New Mexico GAS COMPANY®
AN EMERA COMPANY
A Natural Choice.

Executive Summary - Certificate of Public Convenience and Necessity
Liquefied Natural Gas Facility

➢ Background

In February 2021, New Mexico and surrounding areas experienced a severe winter storm ("Storm Uri"). During Storm Uri, natural gas utilities were forced to pay extraordinarily high prices for natural gas for the utilities' customers. For example, as a result of this one storm, NMGC paid over $107 million for gas in one week in February – equivalent to what it paid for natural gas in all of 2020. Although typically gas costs would be recovered in a shorter time period, these extraordinarily high gas costs were passed on to NMGC's customers, in the form of monthly charges in place through December 2023, by an Order of the New Mexico Public Regulation Commission ("NMPRC"). In that same Order, the NMPRC requested NMGC "evaluate and assess potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, which may be adopted to prevent a reoccurrence of the effects of Storm Uri, and the potential for extraordinary gas expenses and curtailments to customers".

In March 2022, NMGC filed with the NMPRC an evaluation by an outside engineering firm of options available to NMGC. Based on this evaluation, and its own analysis, NMGC stated it was proposing to build a liquefied natural gas ("LNG") production and storage facility ("LNG Facility") in New Mexico. Since March 2022, NMGC has been finalizing preliminary engineering for such an LNG Facility and has prepared this request for a Certificate of Public Convenience and Necessity ("CCN"), seeking authorization to proceed with construction of the LNG Facility.

The proposed LNG Facility offers significant operational advantages to NMGC and its customers that will enhance two critical reasons for having storage gas: helping ensure a reliable gas supply to customers of NMGC and helping control the impacts of price volatility on our customers.

➢ Brief Summary of the Proposed LNG Facility

As designed, the LNG Facility will take up approximately 25 acres of a 160-acre parcel located in the outskirts of Rio Rancho and will be connected directly to NMGC's system. It will have an LNG storage tank, the ability to liquefy natural gas directly into LNG from the Company's system for storage, and the ability to vaporize LNG back into natural gas for use on NMGC's system when needed. In contrast to natural gas, LNG is an odorless, colorless, cryogenic liquid stored at minus 260° Fahrenheit. In this form, LNG takes up about 1/600th of its volume in the gaseous state which makes it an ideal method for storing large amounts of natural gas. The storage tank will also be able to be filled from and deliver natural gas to tanker trucks for delivery as needed throughout the state for NMGC's normal and emergency operational needs. The LNG Facility will have redundant safety features, be staffed 24/7, and be an environmentally conscious closed system.

➢ Operational Benefits of the proposed LNG Facility

The LNG Facility offers the following operational benefits to help NMGC continue to provide safe, reliable, and resilient service to its customers.

- Location - The LNG Facility will be located directly on NMGC's system and thus is not dependent on interstate pipelines to move gas from the LNG Facility to NMGC customers.
- Control - The LNG Facility will be operated by NMGC, and NMGC will not need to rely on or schedule with third parties to obtain access to stored gas. NMGC will have the ability to control weatherization, maintenance scheduling, upgrades and expansions rather than rely on others to do this. As a utility, NMGC has an interest in ensuring weatherization and up-to-date maintenance to ensure performance in cold weather events that non-utility third parties do not have.
- System-Wide Benefit - NMGC will be able to direct stored gas from the LNG Facility to anywhere in its northern system and will be able to direct more gas from the interstate pipelines to other parts of NMGC's system.
- Price Stability - Unlike leased underground storage, which is subject to contract and price negotiations with the storage operator, and market forces of supply and demand, the cost of operating an LNG storage facility will not fluctuate significantly, providing greater long-term control.
- Speed - NMGC can receive natural gas from the LNG Facility within one hour of deciding it needs natural gas from the LNG Facility. This contrasts with NMGC's current storage arrangement, which can involve significant delays between nomination and delivery of natural gas.
- Flexibility - Given the increased speed and control afforded by the LNG Facility, NMGC gains greater flexibility when making decisions about when and how to use storage gas.
- Reliability - The key aspect of the LNG Facility for delivering storage gas into the NMGC system when needed is the reliability of the LNG Facility's vaporization system to quickly provide storage gas to NMGC.
- Confidence - With increased control, speed and reliability, NMGC obtains a higher degree of confidence that natural gas will be delivered quickly when called for. This confidence allows NMGC flexibility in making natural gas buying decisions, allowing these decisions to be based on more real-time information.

➢ Proposed Operating Plan for the LNG Facility

NMGC plans to construct the LNG Facility with the intent that it will be filled in the summer and fall of 2026 and become operational and used and useful prior to or during the 2026-2027 winter heating season.

- The Company will have the LNG Facility filled to operating capacity (approximately 90%) by November 1st of each year, having filled the storage tank over the spring, summer, and fall with typically lower cost natural gas.
- Between November and March, the LNG Facility will be used to routinely supply small amounts of gas when needed to level out supply interruptions or price variations, and to meet

morning demands of customers. The Company will also use the stored LNG, along with day-ahead and same-day gas purchases, to provide swing gas cover for weekends, weather forecasting variations, or supply cuts as needed. The Company will choose between these swing gas options with an eye toward retaining a level of gas in the LNG Facility sufficient to handle cold weather events as they arise. The LNG Facility will be replenished throughout the winter by liquefying additional LNG into the tank when desired or required.

- The key purpose for and use of the LNG Facility will be to provide storage gas before and during storms. To this end, the LNG Facility will provide at least three (3) days and up to more than a week of vaporization capacity during storms, depending on how full the tank is and the vaporization rate used.

➢ **Anticipated Financial Impact on NMGC's Customers**

As planned, the current cost of construction of the LNG Facility is estimated to be approximately $180 million with contingency. Annual operation and maintenance costs are estimated to be about $3.4 million. These costs should be considered in the following context and subject to the following offsets:

- Recovery of the cost of construction will be sought in a future rate case application timed for rate recovery starting at or shortly after the LNG Facility becomes used and useful. Actual rate impact is difficult to quantify at this time; however, as proposed, the rate impact for residential sales customers in the first full year of the LNG Facility's operations, using the rate design from NMGC's most recent rate case filing, is anticipated to be about $3.13 per month or approximately 3.2% on an average bill, based on current rates. The customer impacts in future years will decrease as the LNG Facility depreciates.
- The Company anticipates continuing to use its current leased storage facility as NMGC fully transitions all storage operations to the new LNG Facility. This is expected to be a one-to-three-year transition period after construction of the LNG Facility. At the completion of this transition, the lease with the storage facility in Texas will cease, to the benefit of NMGC customers.
- As requested by the NMPRC, NMGC has determined that the proposed LNG Facility will deliver a signification reduction in its customers' exposure to price volatility during storms such as Storm Uri. The amount saved in the future is impossible to quantify since it depends on supply conditions and prices at the time of future events, but it should be significant, to the benefit of NMGC customers. Additionally, since the LNG Facility offers a more reliable source of stored gas, right on the Company's system, the potential for service interruption and related costs as experienced in 2011 is reduced.
- NMGC will have reliable access to significant amounts of Company-controlled low-cost stored-gas that is placed in the LNG Facility in the summer, and which can be used throughout the following winter on an as needed basis.

➢ **Schedule**

NMGC anticipates constructing the LNG Facility with the intent that the LNG Facility be filled in the summer and fall of 2026 and become operational prior to or during the 2026-2027 winter heating season.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-00309-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

APPLICATION FOR ISSUANCE OF A
CERTIFICATE OF CONVENIENCE AND NECESSITY

Pursuant to NMSA 1978, Sections 62-9-1 and 62-9-6 and 17.1.2.9 NMAC, New Mexico Gas Company, Inc, ("NMGC" or the "Company") files this Application requesting the New Mexico Public Regulation Commission ("NMPRC" or the "Commission") issue a Certificate of Public Convenience and Necessity ("CCN") to NMGC authorizing the construction and operation of a liquefied natural gas ("LNG") storage facility (the "LNG Facility") to be located in Rio Rancho, New Mexico. In support of this Application, NMGC states as follows:

INTRODUCTION

1. NMGC is a public utility, subject to the Commission's jurisdiction and is headquartered in Albuquerque, New Mexico. The Company provides natural gas sales and transportation services to approximately 540,000 customers throughout the state of New Mexico.

2. A certified copy of NMGC's articles of incorporation and authority to do business in New Mexico are on file with the NMPRC.

3. NMGC's principal and corporate office is located at 7120 Wyoming Boulevard NE, Suite 20, Albuquerque, New Mexico 87109.

4. NMGC is proposing to construct the LNG Facility within the city limits of Rio Rancho, New Mexico to enhance utility service reliability by having gas storage tied directly to NMGC's system near its largest customer load centers.

5. NMGC currently contracts with a gas storage facility in Texas, the Keystone Storage Facility (the "Keystone Facility" or "Keystone Storage"), for gas storage services and pays to lease storage space at the Keystone Facility.

6. The Keystone Facility is not tied directly to NMGC's system and is hundreds of miles from NMGC's largest customer load centers.

7. The LNG Facility will ultimately replace the Keystone Facility as NMGC's source for gas storage.

8. If this Application for a CCN is approved, NMGC will construct the LNG Facility with the intent that it will be filled in the summer and fall of 2026 and become operational and used and useful prior to or during the 2026-2027 winter heating season. Thereafter, the Company will continue to use Keystone Storage as it transitions all storage operations to the LNG Facility over a one-to-three-year period.

9. There are three primary reasons for this proposal by the Company:

a. Over the last several years, the Company developed concerns with the performance of the Keystone Facility and, in 2020, began to investigate alternatives, including LNG storage.

b. Following the occurrence of Winter Storm Uri in February 2021, the Commission Ordered the Company in Case No. 21-00095-UT to evaluate and assess potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, that may be adopted to prevent a reoccurrence of the effects of Storm Uri, and the potential for extraordinary gas expenses and curtailments to customers.

c. An on-system LNG storage facility owned and operated by NMGC offers significant advantages over Keystone Storage and will result in improved reliability and a greater ability to moderate price volatility to NMGC customers.

BACKGROUND AND SUPPORT

10. NMGC is primarily a heating-load utility, which means the majority of our customers use gas to heat their homes and businesses throughout the state. Thus, colder winter temperatures result in greater demand for gas. Accordingly, NMGC primarily uses Keystone Storage as a seasonal peaking facility, and withdraws gas in the winter months to help with increased demand by customers.

11. Since 2011 NMGC has leased at least 2.7 billion cubic feet of storage space at the Keystone Facility. At this level of storage space, NMGC has the right to withdraw up to 190,000 thousand cubic feet ("Mcf") per day from Keystone Storage. Significantly, per the lease, NMGC's withdrawal rights vary with storage inventory levels: as NMGC's inventory levels drop, its withdrawal right decline. Since withdrawal rights from Keystone Storage are more important to NMGC's business operations than its inventory level at Keystone Facility, NMGC retains its storage level primarily to maintain its withdrawal rights at Keystone Storage.

12. NMGC primarily uses the Keystone Facility as a seasonal peaking facility, and withdraws gas in the winter months to help with increased demand by customers. To facilitate winter withdrawals from Keystone Storage, NMGC injects gas during the warmer months of spring and summer. NMGC can also inject excess gas into Keystone Storage during the winter in the event that weather forecasts are incorrect and NMGC has more gas than it needs to serve customers.

13. Storage is a critical component of ensuring reliable gas supply and NMGC has experienced several issues with the Keystone Facility.

14. During the week of January 31, 2011, a massive winter storm in the southwestern United States caused freeze-offs on natural gas wells, gathering lines and processing plants in the Permian Basin and the San Juan Basin. The freeze-offs interfered with the delivery of processed natural gas into the interstate pipelines, which severely limited the supply of gas to customers throughout the western United States, including New Mexico. Natural gas producers failed to deliver gas to interstate pipelines, and as a result pressures on the interstate pipelines fell to levels NMGC had never experienced. Keystone Storage declared a *force majeure* event during the storm and was not able to deliver natural gas to the interstate pipelines at its normal rates. As a result of all these supply disruptions, NMGC was forced to curtail natural gas utility service to approximately 31,000 customers in Northern New Mexico. Utilities in Arizona and California were also forced to curtail customers due to lack of natural gas supplies.

15. In 2012, the Company considered construction of an LNG storage tank to help improve reliability of gas supply.

16. In 2020, the Company's engineering department evaluated and updated the Company's earlier investigation into a possible LNG storage facility for several reasons. First, NMGC cannot always withdraw its maximum 190,000 Mcf per day from Keystone Storage. By contract, NMGC's withdrawal capability ratchets down as inventory at Keystone Storage decreases, and during various months of the year. Second, NMGC must plan in advance for its storage withdrawals because there is a lag between the time it decides to withdraw gas from Keystone Storage, and when gas starts flowing into NMGC's system. Gas withdrawn from Keystone Storage is delivered to the Company via the interstate pipelines, and as a result, delivery is tied to North American Energy Standards Board ("NAESB") scheduling cycles. NAESB has created set schedules for nomination and delivery for day-ahead and same-day gas. These schedules affect and control all gas deliveries on interstate pipelines, including those used to deliver gas to NMGC from Keystone Storage. Third, costs for storing gas at Keystone Storage, are increasing. Since 2018 the cost of storage at Keystone Storage has increased 6.2% annually, and this increase is set by contract to continue at least through mid-2027.

17. In February 2021, New Mexico and much of the southwest again experienced a winter storm of unusual severity and duration, which would come to be known as Winter Storm Uri. Winter Storm Uri caused gas production fields in Texas and the surrounding regions to again freeze-off, which limited gas supplies in the region. At the same time, demand throughout the region was increasing significantly due to the cold temperatures caused by Winter Storm Uri. Both natural gas heating loads, and natural gas fired electric generation, mainly in Texas, surged as customers heated their homes and businesses. NMGC's leased storage in West Texas again declared a force majeure and only allowed reduced withdrawals from the facility. This surge in

demand, coupled with restricted supply, caused prices for natural gas in the southwest to surge to record highs, far exceeding all prior observed prices.

18. While NMGC was successful in obtaining enough gas in February 2021 to meet the needs of its customers, over the span of six days NMGC had to pay over $100 million for gas supplies. That amount was almost equal to the amount NMGC spent on the entire 2020-2021 winter heating season, other than February 2021.

19. NMGC applied to the Commission for approval to recover these extraordinary gas costs. The Commission heard the case *en banc*, and assigned it Case Number 21-00095-UT. In its Final Order in Case Number 21-00095-UT, the Commission ordered that "[w]ithin twelve months of the date of this Order, NMGC shall make a filing with the Commission, consistent with the format of its "fresh look" filing in Case 16-00097-UT, evaluating and assessing potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, that may be adopted to prevent a reoccurrence of this event and the potential for extraordinary gas expenses and curtailments to customers." June 15, 2021 Final Order, Decretal Paragraph N.

20. On March 31, 2022, NMGC filed its Compliance Filing and Supporting Testimony Filed Pursuant to Decretal Paragraph N of the NMPRC's June 2021 Final Order Relating to the 2021 Winter Event ("Compliance Filing"). In the Compliance Filing, NMGC outlined multiple options it investigated relating to increased access to stored gas, including possible NMGC-owned or controlled storage facilities that could prevent a reoccurrence of the extraordinary gas prices.

21. A NMGC-owned LNG Facility is the best option for a long-term supply reliability solution to address supply shortfalls and potential price volatility mitigation protection.

22. Supply interruptions and extraordinary price spikes in gas costs have demonstrated that NMGC and its customers are vulnerable to the gas market, and reasonable and prudent steps are necessary to increase reliability of the utility system to risks that have arisen in recent years.

23. NMGC seeks approval of a CCN to construct an LNG Facility in Rio Rancho, New Mexico on undeveloped land in an area zoned for future industrial development.

24. LNG is a purified form of natural gas which has been cooled to the point that it becomes a liquid, approximately negative 260 degrees Fahrenheit. LNG is an extraordinarily efficient way to store natural gas, as one gallon of LNG has the same energy as 600 cubic feet of natural gas. LNG in the United States has a good safety record. There are currently over 100 LNG storage facilities operating in the United States. Many of the LNG storage facilities are located in metropolitan areas, and have been operating for fifty years or more without any incidents.

25. NMGC proposes to own and operate the LNG Facility and utilize it as its primary source of stored gas for customers. The proposed site sits on existing NMGC high pressure transmission pipelines, is close to high voltage electric lines needed to power the facility, and is situated near NMGC's Santa Fe Junction, which will allow NMGC to send re-gasified LNG to any part of NMGC's Northern System (which includes Albuquerque, Rio Rancho, Santa Fe, Espanola, and Taos).

26. The proposed LNG Facility will have a capacity of 1 Bcf of natural gas, which is approximately 12 million gallons of liquefied natural gas. The LNG Facility will be able to

liquefy gas right off of NMGC's transmission system, store the LNG for months, and then vaporize it back into NMGC's transmission system for use by customers. The LNG Facility will have a single specially designed 12 million-gallon LNG storage tank, a liquefaction system, and an LNG vaporizer system. The LNG Facility will also have the ability to receive LNG from and deliver LNG to special tanker-trucks for transport via truck to areas on the Company's system as needed.

27. The LNG Facility will be able to liquefy gas into LNG for storage in the LNG storage tank at the rate of 10,000 Mcf per day. At this rate, it will take approximately 100 days to fill the LNG Facility the first time.

28. The LNG Facility will be able to inject up to 195,000 Mcf per day into NMGC's North System. This injection rate would have prevented the 2011 outage, and will have the ability to mitigate commodity price spikes in the future.

29. The LNG Facility will also be able to assist NMGC's South System and Remote System through displacement. Displacement means that NMGC can use the LNG Facility to carry more load on the North System. That allows NMGC to re-direct gas purchased from the Permian Basin and not yet on the interstate pipelines to the South and Remote Systems instead of going to the North System.

30. The LNG Facility is a superior option when it comes to operating NMGC's system. Currently, NMGC must make many of its gas supply decisions hours in advance, and at times up to a day beforehand. NMGC must also anticipate that some percentage of its out-of-state leased storage will not be delivered, and thus purchase extra gas. With the LNG Facility, NMGC will

be able to react in real-time to developing situations and only use the gas that it needs. The LNG Facility will allow NMGC to operate more efficiently.

31. Because NMGC will own and operate the LNG Facility, NMGC can ensure that the LNG Facility is fully winterized, and able to operate during winter storms. This is a superior option to the current out-of-state leased storage, as it has experienced problems delivering gas to NMGC during winter storms.

32. Total project cost to purchase the real property and construct and install the storage tank, liquifying equipment, vaporization system, and piping to connect the LNG Facility to NMGC's system is estimated to be approximately $180 million, subject to true-up as the project proceeds.

33. NMGC estimates that it will take approximately two years to construct and commission the LNG Facility. If the Commission grants NMGC's requested CCN, NMGC anticipates the LNG Facility will be used and useful in the second-half of 2026.

34. NMGC has received consent from the City of Rio Rancho to construct and operate the LNG Facility and has a current franchise from the City to allow for the construction and rights-of-way to allow for operation of the LNG Facility.

35. NMGC discussed gas storage at Keystone Storage in its most recent Integrated Resource Plan filing in 2020, including rising gas storage lease costs. While NMGC did not foresee filing for permission to construct the LNG Facility in 2020, as a key trigger was the extraordinary gas costs experienced in February 2021 during Winter Storm Uri, NMGC discussed the continued need for gas storage.

36. NMGC's request for the Commission's approvals and authorizations of the LNG Facility in this case is consistent with the Company's 2020 Integrated Resource Plan filed with the NMPRC.

37. The direct testimonies of Tom C. Bullard, John J. Reed, Michael A. Barclay, Edward Jones, Jimmie L. Blotter, and Daniel P. Yardley are attached in support of this filing.

38. NMGC's corporate representatives and attorneys who should receive all notices, pleadings, discovery requests and response, and other documents related to this case are:

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39. NMGC is serving a copy of this filing on the Commission Staff, the Attorney General, and all parties in NMGC's most recent rate case (NMPRC Case No. 21-00267-UT). NMGC will publish notice of this filing of the Application in accordance with 17.1.2.9(D) NMAC. NMGC's proposed Form of Notice is attached to the Application as Exhibit A.

WHEREFORE, NMGC respectfully requests that the Commission enter a final order granting NMGC a CCN to construct and operate the LNG Facility to serve New Mexico customers, and for other and further relief as is necessary or appropriate.

Respectfully submitted this 16th day of December, 2022.

NEW MEXICO GAS COMPANY, INC.

By: */s/Nicole V. Strauser*

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EXHIBIT A

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'S APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

PROPOSED FORM OF NOTICE TO CUSTOMERS

To customers of New Mexico Gas Company, Inc. ("NMGC"): this document is required by the New Mexico Public Regulation Commission ("NMPRC" or the "Commission"). The purpose of this document is to provide you with notice of NMGC's request that the NMPRC allow NMGC to build and operate a liquified natural gas storage facility. This notice:

- Describes the NMPRC process for considering NMGC's request; and
- Describes how you can participate in this process if you wish to do so.

If you would like to participate in this process, the information below details how you may participate. **IF YOU DO NOT WANT TO PARTICIPATE IN THIS PROCESS, NO ACTION IS REQUIRED ON YOUR PART.**

NOTICE is hereby given by the NMPRC of the following:

On December 16, 2022, NMGC filed an Application with the NMPRC requesting the NMPRC issue a Certificate of Public Convenience and Necessity ("CCN"). NMGC is providing the following information concerning the Application:

1. NMGC is requesting approval to construct and operate a liquefied natural gas ("LNG") storage facility (the "LNG Facility").

EXHIBIT A

2. The LNG Facility, if approved, will be built within the city limits of the City of Rio Rancho, on the west side of Bernalillo County.

3. In support of this Application, the Company states as follows:

a. In February 2021, New Mexico and surrounding areas experienced a severe winter storm ("Storm Uri"). During Storm Uri, natural gas utilities were forced to pay extraordinarily high prices for natural gas for their customers. For example, as a result of this one storm, NMGC paid over $107 million for gas in one week in February – equivalent to what it paid for natural gas in all of 2020. These costs were passed on to NMGC's customers, in the form of monthly charges in place through December 2023, by an Order of the Commission. In that same Order, the NMPRC requested NMGC "evaluate and assess potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, which may be adopted to prevent a reoccurrence of the effects of Storm Uri, and the potential for extraordinary gas expenses and curtailments to customers."

b. In response, NMGC is proposing to build an LNG production and storage facility in New Mexico. NMGC has finalized preliminary engineering for such an LNG Facility and has prepared this request for a CCN, seeking authorization to proceed with construction of the LNG Facility. The Company contends that the proposed LNG Facility offers significant operational advantages to NMGC and its customers that will enhance two critical reasons for having storage gas: (1) helping ensure a reliable gas supply to customers of NMGC; and (2) helping control the impacts of price volatility on our customers.

4. As proposed, the LNG Facility will utilize approximately 25 acres of a 160 acre parcel the outskirts of Rio Rancho and be connected directly to NMGC's system. It will have an LNG storage tank, the ability to liquefy natural gas directly into LNG from the Company's system for

storage, and the ability to vaporize LNG back into natural gas for use on NMGC's system when needed. In contrast to natural gas, LNG is an odorless, colorless, cryogenic liquid stored at minus 260° Fahrenheit. In this form, LNG takes up about 1/600th of its volume in the gaseous state which makes it an ideal method for storing large amounts of natural gas. The storage tank will also be able to be filled from and deliver natural gas to tanker trucks for delivery as needed throughout the state for NMGC's normal and emergency operational needs.

5. NMGC anticipates constructing the LNG Facility to become operational prior to or during the 2026-2027 winter heating season.

6. The total cost for constructing the liquefaction system, storage tank, vaporizer system and piping to connect the LNG Facility to the current NMGC system is estimated to be approximately $181 million. The cost of the LNG Facility may affect all customer classes.

7. In this case, NMGC is not asking to change the rates you pay for gas utility service. NMGC anticipates seeking recovery of the costs of the LNG Facility, and change the rates for gas utility service, in a future rate case filing when the LNG Facility becomes operational.

8. The Commission has assigned Case No. 22-________-UT to this proceeding and all inquiries or written comments concerning this proceeding should refer to that case number.

9. The NMPRC has assigned a Hearing Examiner to consider this proceeding, and the Hearing Examiner has established the following schedule for this case:

a. Any person desiring to intervene in the proceeding must file a motion to intervene by ___________, pursuant to 1.2.2.23 NMAC. All motions for leave to intervene shall be served on all existing parties and prospective intervenors of record.

b. The Commission Utility Division Staff shall, and Interveners may, file Direct Testimony by ___________________________.

c. Rebuttal Testimony may be filed by ____________________________.

d. A public hearing will begin at ________ A.M. on ____________, ________________, and shall continue as necessary through ____________________. Due to the COVID-19 pandemic, the evidentiary hearing shall be conducted via the Zoom videoconference platform. Access to and participation in the evidentiary hearing shall be limited to party-participants (i.e. counsel and witnesses), the Commissioners and other essential Commission personnel. Interested persons may view the evidentiary hearing via a live stream on YouTube provided on the Commission's website at https://www.nm-prc.org.

e. The procedural dates and requirements provided herein are subject to further Order of the Commission or the Hearing Examiner. Interested persons should contact the Commission at (505) 690-4191 or Ana.Kippenbrock@state.nm.us for confirmation of the hearing date, time and place, since hearings are occasionally rescheduled.

f. The Commission's procedures, 1.2.2 NMAC, shall apply to this case except as modified by Order of the Commission or Hearing Examiner.

g. Interested persons, who are not affiliated with a party may make oral or written comment pursuant to Rule 1.2.2.23(F) NMAC. Oral comment shall be taken at the beginning of the public hearing in this matter on ________________ and shall be limited to three (3) minutes per commenter. As part of the public hearing, public comment will be taken via the Zoom platform. Therefore, persons wishing to make an oral comment must register in advance, not later than 8:30 a.m. MT on ____________________, by emailing Ana Kippenbrock at Ana.Kippenbrock@state.nm.us.

EXHIBIT A

Written Comments may be submitted before the Commission takes final action by sending the comment, which shall reference NMPRC Case No. 22-_______-UT, to prc.records@state.nm.us. Public comments, whether oral or written, shall not be considered as evidence in this proceeding.

h. Any person with a disability requiring special assistance to participate in this proceeding should contact Ana Kippenbrock at either Ana.Kippenbrock@state.nm.us or (505) 690-4191 as soon as possible before the start of the public hearing. Requests for summaries or other types of accessible forms also should be addressed to the Utility Division at (888) 427-5772.

i. Any person may examine NMGC's filing in this case together with any exhibits and related papers that may be filed in this case at NMGC's office, 7120 Wyoming Blvd. NE, Suite 20, Albuquerque, New Mexico 87109, telephone: (505) 697-3832, or at the Commission's website https://www.nm-prc.org, Case Lookup E-Docket. You can obtain further information regarding this case at NMGC's website, www.nmgco.com/regulatory_filings.

j. Any person filing pleadings or testimony shall serve copies via e-mail on all parties, Commission Staff and the Hearing Examiner. Any person whose testimony has been pre-filed shall attend the hearing and submit to examination under oath. Anyone filing pleadings, testimony, and other documents must follow the Commission's filing policy. Pleadings, testimony, and other documents must be served on all parties of record and Staff in the way or ways specified in the most recent certificate of service issued by the Hearing Examiner. Copies of all filings shall also be emailed on the date of filing and service to the Hearing Examiner at _____________________. All documents emailed to the Hearing Examiner shall also include versions created in Microsoft Word.

EXHIBIT A

ISSUED at Santa Fe, New Mexico this ___ day of _______2023.

NEW MEXICO PUBLIC REGULATION COMMISSION

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Hearing Examiner

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	**)**	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	**)**	
APPLICANT.	**)**	

DIRECT TESTIMONY AND EXHIBITS

OF

TOM C. BULLARD

December 16, 2022

DIRECT TESTIMONY OF
TOM C. BULLARD
NMPRC CASE NO. 22-_____-UT

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Tom C. Bullard. My business address is 7120 Wyoming Boulevard, NE, Suite 20, Albuquerque, New Mexico 87109.

Q. BY WHOM AND IN WHAT CAPACITY ARE YOU EMPLOYED?

A. I am the Vice President of Engineering, Gas Management, and Technical Services for New Mexico Gas Company, Inc. ("NMGC" or the "Company").

Q. PLEASE DESCRIBE YOUR DUTIES AND RESPONSIBILITIES AS VICE PRESIDENT OF ENGINEERING AND GAS MANAGEMENT FOR NMGC.

A. Among other duties, and as relevant for this filing, I am responsible for the engineering and design of the NMGC natural gas distribution and transmission systems that serve the Company's residential, commercial, and industrial customers throughout the State of New Mexico. I am also responsible for the gas acquisitions, gas supply, system planning, and the gas control and compression functions of the Company.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE AND STATE WHETHER YOU HAVE PREVIOUSLY TESTIFIED BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION ("NMPRC" OR THE "COMMISSION").

A. My educational background, professional experience, and previous instances of filing written testimony and testifying before the Commission are summarized in NMGC Exhibit TCB-1.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?

A. The purpose of my Direct Testimony is to support the Company's Application for the issuance of a Certificate of Public Convenience and Necessity ("CCN") authorizing the Company to construct and operate a liquefied natural gas ("LNG") storage facility ("LNG Facility") in Rio Rancho, New Mexico. More specifically:

- In Section I, I introduce this Application, provide an outline of the reasons for this filing, and introduce the other witnesses that will testify in support of this filing. Their Direct Testimonies, together with my testimony, provide sufficient testimony and evidence to satisfy the requirements of New Mexico Statutes Annotated ("NMSA") Section 62-9-6 for approval of this Application for a CCN for the proposed LNG Facility.
- In Section II, I provide background on NMGC'S current gas supply strategy and storage arrangement and describe the role storage currently plays in NMGC's strategy as well as limitations the Company has experienced over the last 11 years.
- In Section III, I discuss this Application in the context of responding to Decretal Paragraph N Of the Commission's June 2021 Final Order Relating to the 2021 Winter Event.
- In Section IV, I discuss the Company's analysis of available storage options, including the LNG Facility.

- In Section V, I discuss NMGC's proposed LNG Facility including why NMGC believes that the LNG Facility provides the best reliability, price protection, and flexibility for NMGC's customers compared to other gas storage options.
- In Section VI, I discuss the Company's proposed plan for use of the LNG Facility.

I. <u>INTRODUCTION TO THIS APPLICATION</u>

Q. WHAT IS NMGC PROPOSING?

A. NMGC is proposing to construct an LNG storage facility within the city limits of Rio Rancho, New Mexico to eventually replace the Company's current storage of gas in the Keystone Storage Facility in West Texas ("Keystone Facility" or "Keystone Storage"). For reference, attached as NMGC Exhibit TCB-2 is a simplified map of NMGC's system showing the major transmission lines and the location of the current Keystone Facility and the proposed LNG Facility.

If this Application for a CCN is approved, NMGC would construct the LNG Facility with the intent that it will be filled in the summer and fall of 2026 and become operational and used and useful prior to or during the 2026-2027 winter heating season. Thereafter, the Company would continue to use the Keystone Facility as it transitions all storage operations to the LNG Facility over a one-to-three year period.

Q. WHY IS NMGC PROPOSING THIS CHANGE TO ITS GAS SUPPLY PORTFOLIO?

A. There are three primary reasons for this proposal by the Company:

1. Over the last several years, the Company developed concerns with the performance of Keystone Storage and, in 2020, began to investigate alternatives, including LNG storage.
2. Following the occurrence of Winter Storm Uri in February 2021, the Commission Ordered the Company in Case No. 21-00095-UT to evaluate and assess potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, that may be adopted to prevent a reoccurrence of the effects of Storm Uri, and the potential for extraordinary gas expenses and curtailments to customers.
3. The Company has concluded that on-system LNG storage owned and operated by NMGC offers significant advantages over Keystone Storage and will result in improved reliability and a greater ability to moderate price volatility to NMGC customers.

This conclusion is based on an overall comparison of the feasibility of continuing with Keystone Storage or shifting to alternative storage options. Factors considered in this analysis include both cost related factors and operational and business-related factors, all addressed at considering which alternative offers the Company the best option to increase reliability of service to customers and to mitigate the impact on customers of price volatility in the future. As you will see in this and the other Direct Testimonies filed by the Company in this case, the all-in cost or opportunity of each alternative requires a consideration of all cost factors including construction, leasehold, and annual operating and maintenance costs.

Equally important, it requires consideration of less quantifiable factors such as projected impact of the options on reliability and price volatility and on gas supply decisions including swing gas purchases and storage gas usage, the costs and consequences of storage interruption or enhanced storage reliability, costs and consequences of supply availability and prices into the future, NMGC's place and role in the market for gas purchases and storage gas, weather volatility, the future of natural gas, and other factors.

Q. WHO WILL BE TESTIFYING ON BEHALF OF THE COMPANY IN THIS MATTER?

A. In addition to myself, the following witnesses will testify on behalf of the Company:

- John J. Reed is Chairman and Chief Executive Officer of Concentric Energy Advisors, Inc. ("Concentric"). Concentric is a management consulting firm specializing in financial and economic services to the energy industry. Mr. Reed will present Concentric's evaluation of the benefits of the LNG Facility, an analysis of the economics of the LNG Facility relative to alternatives, and consideration of the LNG Facility in light of the current energy transition.
- Michael A. Barclay is the Technical Director for The Lisbon Group LLC ("Lisbon") responsible for the quality and content of the work product generated by Lisbon, which focuses on developing front-end engineering, project execution, and facility operations of LNG peak shaving and similar gas processing facilities. Lisbon was engaged to provide Owner's Engineer ("OE") services in the development of a proposed LNG peak shaving plant. Mr. Barclay will discuss the

work that went into the preliminary front-end engineering design ("pre-FEED") report prepared by Lisbon which I have introduced in this matter as NMGC Exhibit TCB-3.

- Edward Jones is the founder and President of JEI Engineering, Inc. Mr. Jones will provide a third-party engineering review and analysis of NMGC's proposed LNG Facility.
- Jimmie L. Blotter is Vice President of Finance and Vice President, Safety and Business Support at NMGC and will testify about the financial impacts of the LNG Facility, the depreciation rate for the LNG Facility, NMGC's proposal for allowance for funds used during construction ("AFUDC"), and the Company's method of accounting for LNG inventory.
- Daniel P. Yardley is Principal of Yardley Associates, a consulting firm specializing in rate and regulatory matters in the natural gas utility industry. Mr. Yardley will provide an opinion concerning the appropriate means of recovering the future costs of the Company's proposed LNG Facility.

In this Application, NMGC provides through NMGC Witness Yardley a theory of how the estimated cost of construction of this LNG Facility will be spread between NMGC's customers and an estimated projection of the anticipated rate impact in the first full year of the LNG Facility's operations on NMGC's customers. However, beyond this theory of allocation, given that this LNG Facility will not go on-line until approximately four years from this filing, the Company is not requesting the Commission determine in this proceeding the ratemaking principles and treatment that will be applicable for the LNG Facility that is the subject of this CCN Application. This is better reserved for consideration in the context of a rate case.

II. BACKGROUND ON NMGC'S CURRENT GAS SUPPLY PORTFOLIO

A. NMGC'S CURRENT GAS STRATEGY

Q. PLEASE BRIEFLY EXPLAIN HOW NMGC OBTAINS GAS FOR ITS CUSTOMERS.

A. NMGC is a gas transmission and distribution utility and does not own or operate any gas production facilities. NMGC therefore must purchase the gas it provides to its sales customers. New Mexico contains two significant natural gas production basins which NMGC primarily relies on for its gas: 1) the San Juan Basin in the northwest, and 2) the Permian Basin in the southeast. NMGC purchases the vast majority of its gas from producers in these two basins. Approximately two-thirds of the Company's baseload gas supply is procured from the San Juan Basin. Additionally, NMGC is a part owner in the Blanco Hub in the northwest part of the state, which allows NMGC to purchase gas from Colorado and Wyoming, where gas fields tend to be winterized. Specifically, NMGC accesses gas in the Piceance and Green River Basins in Colorado and Wyoming via the Blanco Hub to allow for supply diversity and flexibility in sourcing gas from multiple basins, which allows NMGC to increase supplies from one basin should one of the other basins become constrained.

Q. PLEASE DESCRIBE THE COMPANY'S MAIN CATEGORIES OF GAS.

A. For purposes of this discussion, NMGC has two primary categories of gas: 1) baseload gas and 2) swing gas.

Baseload Gas: Baseload gas is the minimum gas demand expected for sales customers. Before each winter heating season NMGC contracts well in advance of for approximately 70% of the average daily throughput in the winter months, based on NMGC's analysis of the Company's average monthly demand over the past 10 years, by entering into long-term and short-term contracts to satisfy this baseload demand based on baseload targets. This is called baseload gas. Baseload gas is the same quantity each day of the month, and the majority of NMGC's baseload gas is priced just before the beginning of each month and locked into place for the entire month.

Swing Gas: When daily customer demand exceeds the volume of baseload gas purchased by the Company, NMGC relies on "swing gas" to make up the difference. The need for swing gas is highly variable, and is largely influenced by changes in weather, or supply cuts from suppliers. Swing gas is obtained from three sources: withdrawal from storage, purchases of gas in day-ahead markets, or purchases of gas in same-day markets.

- Storage Gas: NMGC currently stores gas in the Keystone Facility in southwest Texas, which is a large underground salt dome storage facility owned and operated by Kinder Morgan, Inc. NMGC leases space for storage in this facility. Typically, NMGC purchases gas during the summer, when natural gas prices are generally lower, and injects this gas into Keystone Storage for use during the winter months. The gas in storage has a fixed and known price. NMGC generally plans for and uses storage gas during cold winter months at times when customer demand for gas is greater than the baseload amount of gas scheduled to be delivered on any given day.

- Day-Ahead Purchases: NMGC enters into peaking contracts each year, wherein NMGC has the right, but not the obligation, to call upon sellers to deliver certain volumes of gas any day during the heating season. NMGC generally must arrange for this gas at least one day before it will be delivered (referred to as "day-ahead gas"), and the price is linked to a daily market gas index, the Gas Daily Index. Because the price is tied to a daily index that changes based on daily market conditions, the price volatility for this gas can be high, especially during significant weather events.
- Intraday Purchases: NMGC also obtains swing gas through the intraday gas contracts (also referred to as "same-day gas"). Intraday gas purchases are made the same day delivery is requested. The price of same-day gas is based on the market forces at the time NMGC purchases the gas, which can vary significantly from the daily index prices, and same-day gas is generally priced higher when demand is higher.

Q. PLEASE BRIEFLY DESCRIBE NMGC'S PRIORITY IN SECURING A RELIABLE GAS SUPPLY FOR ITS CUSTOMERS.

A. First, NMGC relies on baseload gas as described above. After having established its baseload levels for the upcoming heating season and ensuring it has contracts in place to provide the baseload needs of the Company for each month during the winter heating season, NMGC, secondly, relies on "swing gas" through use of storage gas, or purchases in the day-ahead or same-day markets, to make up any shortfalls in gas on a daily basis.

Q. HOW DOES NMGC USE STORAGE AS PART OF ITS GAS SUPPLY STRATEGY?

A. NMGC currently uses the Keystone Facility as a source of swing gas, and to temporarily store over-purchases of gas which can occur when weather forecasts are off, and the Company has bought too much day-ahead or same-day gas.

Q. WHAT IS LINE PACK AND HOW DOES THE COMPANY USE LINE PACK AS PART OF ITS GAS SUPPLY STRATEGY?

A. Line pack is a term used to describe gas held in the Company's pipes that is available to meet customer demand during peak consumption hours. Line pack is sometimes described as "horizontal storage" since it is essentially gas "stored" in the Company's pipes for later use. Typically, line pack can be increased throughout the day for use in meeting the evening demand as people return home from work and can be increased at night to help meet the morning demand as people wake up and turn up their thermostats. Planning ahead to use line pack in this fashion allows the Company to effectively store gas in its existing pipes in anticipation of increased demand the following day and minimize same-day gas purchases to the extent possible. Line pack can also be used to make gas available to shippers until gas cuts to shippers are replaced by the shipper. Equally as important, the Company also uses available line pack capacity to manage overbuys as will be discussed below. Available line pack capacity exists when the Company's pipes are not full.

B. NMGC'S CURRENT STORAGE ARRANGEMENT

Q. PLEASE DESCRIBE THE HISTORY OF NMGC'S RELIANCE ON STORAGE.

A. NMGC has used natural gas storage since the Company's inception, and natural gas storage was used by Public Service Company of New Mexico's ("PNM") gas utility division prior to NMGC's inception. I understand that Southern Union Gas Company, which owned the gas utility assets before PNM, also used gas storage facilities going back to the 1970s. Thus, gas storage in one form or another, has been an integral part of utility gas supply strategy for New Mexico customers for at least five decades.

Q. PLEASE EXPLAIN WHY NMGC CURRENTLY USES THE KEYSTONE STORAGE.

A. Initially, NMGC took over the Keystone Storage lease from PNM as part of its purchase of PNM's gas assets in 2009. NMGC has continued utilizing Keystone Storage since 2009. There are limited commercial gas storage facilities in the Southwest. Keystone Storage is one of the only commercial gas storage facilities in the Permian Basin, and there are no commercial gas storage facilities operating in the San Juan Basin. Moreover, the Keystone Facility is also connected to multiple interstate pipelines, including the Transwestern and El Paso Natural Gas Company pipelines that interconnect with NMGC's system and on which NMGC has transportation rights.

Q. PLEASE DESCRIBE THE KEYSTONE FACILITY.

A. The Keystone Facility is a salt dome storage facility that is comprised of seven caverns. The total gas storage capacity is 8.5 Bcf, with a working capacity of 6.38 Bcf. It has injection and withdrawal capabilities.

Q. PLEASE DESCRIBE NMGC'S LEASEHOLD INTEREST IN THE KEYSTONE FACILITY.

A. Since the 2011 winter event when NMGC was forced to curtail customers, NMGC has leased at least 2.7 Bcf[1] of storage space at the Keystone Facility. At this level of storage space, NMGC has the right to withdraw up to 190,000 Mcf/d from the Keystone Facility. Significantly, per the lease, NMGC's withdrawal rights vary with storage inventory levels: as NMGC's inventory levels drop, its withdrawal right decline. Since withdrawal rights from Keystone Storge are more important to NMGC's business operations than its inventory level at the Keystone Facility, NMGC retains its storage level at the Keystone Facility primarily to maintain its withdrawal rights. In short, NMGC maintains 2.7 Bcf of storage rights to safeguard its withdrawal rights at 190,000 Mcf/d. Because NMGC does not typically need the entire 2.7 Bcf of gas storage to service its sales customers, NMGC has been able to sublease 1.0 Bcf of its capacity at the Keystone Facility to third parties while preserving its withdrawal rights. Specifically, while NMGC subleases 1.0

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[1] For ease of reference, in this Direct Testimony the use of the acronyms Bcf (billion cubic feet), Mcf (thousand cubic feet), and Mcf/d (thousand cubic feet per day), are measures of volume. For example, the proposed LNG tank will hold 1 billion cubic feet ("1 Bcf") of LNG. This is equivalent to 1,000,000 thousand cubic feet ("1,000,000 Mcf") of LNG. 195,000 Mcf is a volume of LNG approximately 1/5th the size of the proposed LNG tank. Movement of gas is described in this Direct Testimony in relation to a period of time such as 100,000 Mcf/d means moving 1/10th of the LNG in the LNG Facility during a day.

Bcf of its capacity, it retains all of its withdrawal rights. This means on days when NMGC needs its full withdrawal rights, the sublessee is not allowed to withdraw gas from Keystone Storage.

While these are the rights provided NMGC under its lease, as described below, NMGC's withdrawal rights from the Keystone Facility have been reduced by the operator during severe winter weather events. This is discussed in detail below.

Q. WHAT IS THE COST OF NMGC'S LEASE FOR THE KEYSTONE FACILITY?

A. NMGC currently pays $6,804,000 Kinder Morgan, Inc. for storage at the Keystone Facility each year. This price is fixed through the middle 2023. The cost will increase in mid-2023 to $7,452,000 and again in mid-2024 to $8,748,000 for the final two years of NMGC's current storage lease. Historically, NMGC has experienced increases in lease cost and has never experienced a price decrease for gas storage services. Therefore, NMGC has estimated that that its next storage lease at the Keystone Facility will cost at least $8,748,000 per year and escalate through the term of that lease. Leases have typically been for at least three and up to five years.

As discussed earlier, NMGC is currently able to offset some of this cost through annual subleases of some of its space at Keystone Storage. For August 1, 2022, through September 30, 2023, NMGC will receive $3,240,000 from the sublease. This subleased income can change significantly based on gas markets. NMGC provides a credit of 70% of this amount to customers through its Purchase Gas Adjustment Clause ("PGAC"), as the Commission approved in NMGC's most recent PGAC continuation filing, NMPRC Case No. 20-00130-UT. The revenues derived from these subleases arose only in the last five years because of economic conditions relating to the price differential of natural gas in the Permian Basin compared to other basins, and the continuation of these revenues into the future is uncertain. As I understand it, these economic conditions are related to supply and demand forces which can arise when the Permian Basin produces more gas than can be moved on the interstate pipelines to other markets. These conditions can cause gas produced in the Permian Basin to be less expensive than gas produced in other basins in the Western United States. This results in pricing differentials that marketers try to take advantage of by purchasing gas in the Permian Basin, storing it, and then selling it in markets in the West Coast where gas can attract a higher price.

NMGC will continue to explore the opportunity to sublease a portion of its storage in the Keystone Facility for as long as the Company leases space in the Keystone Facility but cannot with reasonable certainty state that this sublease revenue will continue. Four new pipeline projects were announced this summer, all with the intent to alleviate capacity constraints in the Permian Basin. Of these projects, three will expand capacity of existing pipelines and one will be a new pipeline. A fifth project is already under construction and is expected to be completed by the end of 2022. If completed as planned, these projects together will increase takeaway capacity out of the Permian Basin by an additional 4.18 Bcf/d over the next two years. It is possible that the effect of the additional takeaway capacity out of the Permian Basin will be an increase in Permian Basin prices - bringing them closer to the San Juan Basin and Henry Hub prices.

Q. ARE THE COSTS NMGC INCURS IN LEASING THE KEYSTONE FACILITY CURRENTLY IN CUSTOMER BASE RATES?

A. No. The cost of the lease is not in NMGC's rate base. NMGC recovers the annual cost of the lease for the Keystone Facility through NMGC's PGAC.

Q. HOW DOES NMGC CURRENTLY USE THE KEYSTONE FACILITY?

A. Because NMGC is primarily a heating-load utility, and the majority of our customers use gas to heat their homes and businesses throughout the state, colder winter temperatures result in greater demand for gas. Accordingly, NMGC primarily uses the Keystone Facility as a seasonal peaking facility. By that I mean that NMGC mainly utilizes its withdrawal rights at Keystone Storage in the winter months during abnormally cold weather and winter storms. To facilitate winter withdrawals from the Keystone Facility, NMGC typically injects gas into the Keystone Facility during the summer months. NMGC, however, does have the ability to inject excess gas into Keystone Storage during the winter in the event that weather forecasts are incorrect and NMGC has more gas than it needs to serve customers. Additionally, NMGC uses the gas stored at the Keystone Facility as swing gas to supplement NMGC's baseload purchases.

C. EVALUATION OF KEYSTONE STORAGE BEFORE STORM URI

Q. PLEASE EXPLAIN WHAT NMGC WAS DOING TO EVALUATE STORAGE OPTIONS IN 2020.

A. In 2020, the Company's engineering department had begun to evaluate and update the Company's 2014 prior investigation into an LNG facility. The Company had begun to analyze cost estimates for such an undertaking.

Q WHY WAS THE COMPANY UNDERTAKING THIS REVIEW AND ANALYSIS?

A. Being able to purchase gas, whether baseload gas, or swing gas, is only part of the process of getting gas to customers. Storage is a critical component of ensuring reliable gas supply and NMGC has experienced several issues with Keystone Storage, which prompted it to consider alternatives prior to Storm Uri.

First, NMGC cannot always withdraw its maximum 190,000 Mcf/d from the Keystone Facility. By contract, NMGC's withdrawal capability ratchets down as inventory in the Keystone Facility decreases, and during various months of the year. For example, NMGC's withdrawal capability in the shoulder months of October, November, and March when NMGC's inventory is less than or equal to 1,525,000 Mcf, is limited to 110,000 Mcf/d. In addition to force majeure events, the Keystone Facility has periodically reduced NMGC's ability to withdraw gas through declarations of pro rata reduced withdrawals. The contractual limitations and the operational limitations both diminish the ability of NMGC to use the Keystone Facility for which it has contracted to positively impact NMGC's system.

Second, NMGC must plan in advance for its storage withdrawals because there is a lag between the time it decides to withdraw gas from the Keystone Facility, and when gas starts flowing into NMGC's system. Gas withdrawn from Keystone Storge is delivered to the Company via the interstate pipelines, and as a result, delivery is tied to North American Energy Standards Board ("NAESB") scheduling cycles. NAESB has created set schedules for nomination and delivery for day-ahead and same-day gas. These schedules affect and control all gas deliveries on interstate pipelines, including those used to deliver gas to NMGC from the Keystone Facility.

The NAESB schedules are as follows:

Cycle	Nomination Due	Schedule Issued	Nomination Effective and Gas Flows
Timely	12:00 PM Day 0	4:00 PM Day 0	8:00 AM Day 1
Evening	5:00 PM Day 0	8:00 PM Day 0	8:00 AM Day 1
ID 1	9:00 AM Day 1	12:00 PM Day 1	1:00 PM Day 1
ID 2	1:30 PM Day 1	4:30 PM Day 1	5:00 PM Day 1
ID 3	6:00 PM Day 1	9:00 PM Day 1	9:00 PM Day 1

Because of the NAESB schedules, there can be up to a 20-hour lag between nominating day-ahead gas and when gas begins to flow. Similarly, same-day gas can lag up to four hours from nomination to flow. By way of example, as reflected in the fourth column above, all day-ahead gas starts flowing at 8 am on the day following nomination, and day-ahead nomination times are 12:00 pm or 5:00 pm on the day ahead. As a result, if you order day-ahead gas at noon on Monday it will start to flow at 8 am on Tuesday, a delay of 20 hours. Same-day gas starts flowing anywhere between three to four hours after nomination. Same-day gas has a lower delivery priority than timely day-ahead gas. Therefore, NMGC often tries to nominate day-ahead gas out of Keystone Storage. As a result, NMGC must anticipate what conditions will be like when gas starts to flow, which is long after it is nominated. As described below, this delay can contribute to inefficiencies in NMGC operations.

Third, costs for storing gas at the Keystone Facility, are increasing. Since 2018 the cost of storage at the Keystone Facility has increased 6.2% annually, and this increase is set by contract to continue at least through mid-2027. NMGC does not know what prices Kinder Morgan, Inc. will demand for storage at Keystone Facility at the next renewal of these storage contracts.

Q. DID THE COMPANY HAVE OTHER CONCERNS THAT CAUSED IT TO EVALUATE NEW STORAGE OPTIONS BEFORE STORM URI?

A. Yes. In addition to Keystone Storage-specific concerns, the Company was also concerned about other issues. First, the San Juan Basin has been experiencing declining production for years, and there are fewer sources to obtain pipeline-quality gas from that area. Thirty years ago, there were three large gas processing plants in the San Juan Basin, and NMGC (and its predecessors) was directly connected to two of those plants. Both of these gas processing plants have closed, and no new plants have been built, leaving only one commercial processing facility in the San Juan Basin. If there were to be a problem at this plant, NMGC might not receive the gas it purchased, and the Company's storage arrangements are important in such an event.

Second, NMGC is dependent on the interstate pipelines to transport the gas it purchases and gas it receives from the Keystone Facility. In February 2011 and at other times, the interstate pipelines were unable to deliver the gas to NMGC's receipt points for various reasons. The Company has been looking for an on-system storage alternative to reduce NMGC's reliance on interstate pipeline deliveries.

For all these reasons, even before Winter Storm Uri in February 2021, NMGC was considering a Company controlled on-system storage facility for which NMGC makes decisions as to equipment procurement, equipment maintenance, winterization, staffing and utilization. NMGC would have a different interest in a storage facility than a third-party who is selling storage space to many customers for different purposes. NMGC would prioritize customer reliability and redundancy in operating the LNG Facility.

When Storm Uri hit in February 2021 it presented another issue – price volatility – for the Company to consider as discussed below.

III. RESPONSE TO THE COMMISSION'S JUNE 2021 FINAL ORDER IN NMGC'S EXTRAORDINARY GAS COST RECOVERY CASE, CASE 21-00095-UT RESULTING FROM STORM URI.

Q. PLEASE PROVIDE BACKGROUND REGARDING THE EVENTS BEFORE AND DURING STORM URI IN FEBRUARY 2021.

A. In February 2021, New Mexico and the surrounding region experienced a storm of unusual severity and duration. When NMGC learned that this storm was approaching it took steps to arrange for natural gas supplies during the storm. However, during the storm, gas supply failures throughout the region, combined with significant increases in demand for natural gas throughout the region, caused natural gas prices to spike to levels never before experienced (the "2021 Winter Event"). During the storm, NMGC ensured continuous gas supply for its customers, but was unable to access portions of its Keystone Storage gas and was subject to the dynamics of the exceptionally volatile natural gas markets. The Company ultimately incurred approximately $107 million in extraordinary gas costs over a period of six days.

Q. PLEASE EXPLAIN THE ROLE THE KEYSTONE FACILITY PLAYED IN THE COMPANY INCURRING THESE COSTS IN 2021.

A. As discussed in the Extraordinary Cost Recovery Case filed in April 2021, *force majeure* was declared at the Keystone Facility during Winter Storm Uri in February 2021 and was unable to deliver gas to NMGC at the rate NMGC contracted for. The declaration of a *force majeure* forced NMGC to purchase additional gas in the day-ahead and same-day markets during the February 2021 Winter Event, and this significantly contributed to the extraordinary gas cost incurred by the Company in February 2021.

As described in detail in that filing, but summarized here for your convenience, in February 2021, NMGC had established a baseload demand of 116,600 MMBtu/day, and this gas was priced according to the Platts index at $2.67 per MMBtu. During the 2021 Winter Event, NMGC fully utilized its firm supply of baseload gas. In addition to its Monthly Index Priced baseload gas, NMGC also had one contract for baseload gas for 10,000 MMBtu/day priced at the Gas Daily average index which averaged $93.47 over the 2021 Winter Event. NMGC contracted for this small amount of baseload gas priced at the Gas Daily index in order to maintain supplier diversity.

As the 2021 Winter Event approached, NMGC anticipated using up to 165,000 MMBtu/day of gas from the Keystone Facility. This number reflects NMGC's contractual allotment given inventory levels. Accordingly, during the 2021 Winter Event, NMGC began requesting its gas from the Keystone Facility. NMGC first requested delivery of gas from the Keystone Facility for delivery on Saturday, February 13, 2021, in order to increase line pack in preparation for the storm. This gas was delivered to the Company. NMGC again sought to withdraw gas from the Keystone Facility on Sunday, February 14, 2021, however, a force majeure event was declared at the Keystone Facility on Sunday, and cut the amount of gas it delivered to NMGC, stating that the facility was "experiencing a mechanical failure and low field pressure". This prevented NMGC from accessing the full amount of gas it had contracted for from the Keystone Facility.

Thereafter, throughout the remainder of the 2021 Winter Event, NMGC was able to obtain some gas from storage, but at amounts far less than it had contracted for. Because of the Keystone Facility's failure to provide NMGC with the full amount NMGC should have been able to withdraw from storage, NMGC was forced to purchase more swing gas than it had anticipated purchasing in order to meet demand and this swing gas was at extraordinarily inflated prices.

Q. DESCRIBE THE FINAL ORDER ISSUED BY THE COMMISSION IN THE EXTRAORDINARY GAS COST RECOVERY CASE FILED BY THE COMPANY FOLLOWING STORM URI?

A. Following Storm Uri, the Company in Case No. 21-00095-UT, sought relief in the form of a variance approving its plan for recovery of the 2021 Winter Event gas costs under the extraordinary circumstances provision of 17.10.640.14 NMAC. On June 15, 2021, the Commission entered a Final Order ("June 15 Order") granting the cost recovery relief sought by the Company, and the Company began to recover the extraordinary gas costs.

In addition to authorizing recovery of the extraordinary gas costs, in its June 15 Order, the Commission ordered the Company to make a filing as follows:

> N. Within twelve months of the date of this Order, NMGC shall make a filing with the Commission, consistent with the format of its "fresh look" filing in Case 16-00097-UT, evaluating and assessing potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, that may be adopted to prevent a reoccurrence of this event [the 2021 Winter Event] and the potential for extraordinary gas expenses and curtailments to customers.

Q. DID NMGC MAKE A COMPLIANCE FILING EVALUATING ADDITIONAL STORAGE OPTIONS CONSISTENT WITH THE ORDER'S REQUIREMENTS?

A. Yes. On March 31, 2022, the Company submitted its compliance filing in Case No. 21-00095-UT in which the Company discussed multiple possible storage options, and included a report from an expert engineering firm, Campos EPC ("CEPC"). While NMGC had already been evaluating options to increase storage reliability, following Storm Uri and the Commission's June 15 Order, the Company began to study storage options that could also help the Company deal with storm-related price volatility. In its compliance filing, NMGC stated that it had conducted an internal review of its procedures and business operations, had consulted with outside consultants and experts, and had spoken with suppliers and storage facilities. It also stated that it was the Company's determination that an LNG facility was the best option and that the Company would proceed to file an application for a CCN for approval of an LNG storage facility. This Application follows from the Company's compliance filing and from the Company's ongoing evaluation of its storage options.

Q. PLEASE DESCRIBE YOUR PERSONAL INVOLVEMENT IN THE MARCH 31, 2022, COMPLIANCE FILING AND THIS FILING.

A. As the Vice President of Engineering, Gas Management, and Technical Services for NMGC I am primarily responsible for analyzing the Company's gas supply needs, including storage needs, and as such, I was involved in the investigation of the storage alternatives available to the Company. I was responsible for supervising the Company's gas supply plan and execution during the February 2021 event, and the further investigation after February 2021 into the storage options available to the Company. I testified in the Company's Compliance filing on March 31, 2022. I am responsible for reviewing and analyzing the Company's evaluation of alternatives for storage options, and I am responsible for supervising the design and eventual construction of the proposed LNG Facility.

Q. WHAT ARE THE MAJOR SOURCES OF PRICE VOLATILITY THAT THE COMPANY AND ITS CUSTOMERS FACED DURING AND SINCE STORM URI?

A. First, price volatility results from supply disruptions and demand increases during storms such as Uri. As detailed extensively by the Company in its filing for cost recovery in Case 21-00095-UT, Winter Storm Uri disrupted gas supply and delivery throughout the United States and resulted in extraordinary price spikes. As detailed in the testimony in that case, gas prices increased from approximately $4.00 per MMBtu just prior to the storm to as much as $252.00 per MMBtu during the storm.

Second, recently, the demand for natural gas is increasing world-wide and the world is experiencing price volatility in the natural gas markets related to world-wide economic conditions. These global economic pressures are affecting Permian and San Juan prices of natural gas and thereby directly affecting NMGC and its customers. Demand for Permian Basin gas is rising for LNG exports and NMGC is feeling the resulting price fluctuations. These conditions are exacerbated in a storm situation and therefore applicable to responding to the Commission's June 15 Order to address price volatility issues.

My conclusion is that storm-related price spikes are unpredictable and somewhat short lived, whereas price spikes tied to world-wide economic conditions are unpredictable but potentially long-term. Both types of price spikes are beyond the control of NMGC to eliminate, but as described below, the Company has considered price volatility in its analysis of storage options.

IV. THE COMPANY'S ANALYSIS OF AVAILABLE STORAGE OPTIONS AS CONTAINED IN THE COMPANY'S MARCH 31, 2022, COMPLIANCE FILING

Q. PLEASE DESCRIBE THE ANALYSIS THAT NMGC PERFORMED IN RESPONDING TO THE COMMISSION'S JUNE 15 ORDER IN CASE 21-00095-UT.

A. In responding to the Commissions June 15 Order, NMGC focused its analysis of available storage options on two primary objectives: finding a storage option that best preserves or increases access to gas supplies to ensure reliable gas utility service and mitigates price volatility. The response to the June 15 Order encompasses a full review of options and included the work the Company had been doing prior to February 2021 to study possible storage options given the concern in the June 15 Order regarding curtailments.

Q. PLEASE DESCRIBE HOW NMGC WENT ABOUT PERFORMING ITS EVALUATION OF STORAGE OPTIONS OR ALTERNATIVES AVAILABLE TO THE COMPANY.

A. In 2021, the Company issued a request for proposal ("RFP") for assistance in evaluating all gas storage options available to it. As a result of that RFP, NMGC contracted with CEPC, to prepare an engineering evaluation of options open to NMGC. The Company then independently evaluated the work the engineering firm did, conducted its own operational and business review of the various options, and finally formed a conclusory opinion as to the operational viability of each of the options considered. This is all detailed extensively in the Company's March 31, 2022, Compliance filing in Case No. 21-00095-UT and will not be repeated here.

In its original RFP submitted to CEPC, NMGC asked for CEPC to include a high-level analysis of the possible range of costs for each of the options. Of the seven options evaluated in its report, CEPC determined that it was not in a position to provide a reasonably derived comparable cost estimate of four of the options considered: namely, the expansion of est Texas Storage, the acquisition or development of gas wells, development of underground storage, and gaining access to alternative supply sources. CEPC did determine that the compressed natural gas ("CNG") option was prohibitively expensive due to the amount of infrastructure and property required to meet the capacity needed. As to the first two options discussed in the report – LNG and Propane Air – as discussed in the report, CEPC's cost estimates for these two options were at such a high level that CEPC was not able to differentiate between the two on cost alone but left it to the Company to evaluate these two options from a business and operations perspective.

Q. HAS THE COST COMPARISON OUTLINED AND BEGUN IN THE COMPANY'S MARCH 31, 2022 COMPLIANCE FILING BEEN UPDATED FOR THIS FILING?

A. Yes, NMGC Witness Reed has updated the cost comparison and will testify in this case about the updated cost comparison made.

Q. PLEASE BRIEFLY DESCRIBE THE WORK THE COMPANY PERFORMED TO COMPARE STORAGE OPTIONS BEFORE CONCLUDING THAT AN LNG FACILITY PRESENTS THE MOST VIABLE OPERATIONAL OPTION TO SECURE REASONABLE AND RELIABLE NATURAL GAS STORAGE.

A. I described this work in detail in my testimony presented to the Commission as part of the Company's March 31 Compliance filing. On pages 10 - 17 of that testimony, I discussed how as part its examination of options open to the Company after the February 2021 Pricing event, the Company initially reviewed its current baseload and swing gas acquisition policies and hedging programs. On pages 17 – 40 of that testimony I discussed what the Company did to evaluate all options to enhance storage options open to the Company. On pages 40 - 41 of my testimony I detailed the Company's conclusion to proceed with the LNG Facility. In subsections A and B of this section of my Direct Testimony below I will summarize and update that March 31, 2022, Direct Testimony.

A. EXAMINATION OF BASELOAD AND SWING GAS ACQUISITION POLICIES AND HEDGING PROGRAMS

Q. PLEASE SUMMARIZE AND UPDATE YOUR MARCH 31, 2022, DIRECT TESTIMONY IN THE COMPLIANCE FILING REGARDING BASELOAD AND SWING GAS ACQUISITION POLICIES AND HEDGING PROGRAMS.

A. The Company currently engages in two programs to mitigate the effect of price spikes on the Company's baseload gas. These can be referred to as NMGC's baseload gas acquisition program and its financial hedging program. Following the February 2021 storm and as part of this examination, NMGC reviewed the Company's baseload gas acquisition and hedging programs to determine if changes could be made in these programs to reduce the impact of extreme daily market pricing resulting from winter events.

Q. PLEASE DESCRIBE NMGC'S BASELOAD GAS ACQUISITION PROGRAM.

A. As described above, NMGC contracts well in advance of the upcoming winter season for approximately 70% of the average throughput in the winter months by entering into long-term and short-term contracts. This is called our baseload gas. This gas is subject to price volatility/spikes which could affect the price of gas each day for the entire month, and therefore NMGC developed a hedging program to protect customers from the potential of price spikes affecting this baseload gas. NMGC has focused this hedging program primarily on December, January, and February, the months that have the most throughput (customer demand) in which a price spike could have a significant impact on customer bills. In its hedging program, NMGC provides price protection for 100% of its baseload gas, or approximately 70% of the average throughput in these months. By having this baseload gas contracted for, the Company reduces the amount of gas NMGC needs to purchase in the swing gas market – the shorter-term market – to meet customer gas demand at potentially higher prices.

The Company did not casually come to this 70% protection determination. Rather, the Company has analyzed and considered baseload percentages above and below this level and settled on this percentage of average throughput for baseload gas, as the best balance of the level of gas on the system, the system's need, the cost of hedging the baseload, the availability and cost of swing (daily) gas in normal winter, and the availability and cost of swing gas in an extreme winter event to cost effectively protect the customer.

Q. WHAT DID NMGC CONCLUDE FROM ITS EVALUATION OF THE BASELOAD GAS ACQUISITION PROGRAM?

A. While the Company is always evaluating its baseload gas acquisition strategy, and will continue to adjust the percentage of baseload gas it carries on the system, at this time, and based upon this review, NMGC considers that it currently arranges for an appropriate level of baseload purchases to balance cost with business operations, and that contracting for more baseload gas on an annual basis will not efficiently allow the Company to mitigate the effects of periodic and unpredictable extraordinary winter events.

Q. PLEASE DESCRIBE NMGC'S FINANCIAL HEDGING PROGRAM.

A. The second aspect of the Company's ongoing hedging program that was evaluated following the 2021 Winter Event was its gas price hedging program. In this program, NMGC uses financial call options to provide price protection for baseload gas by paying a premium to a financial institution/producer. These call option premiums are based on the current risk in the market, the underlying market price, interest rates, and the time to expiration. By paying these premiums, NMGC sets a ceiling on pricing for its baseload gas, essentially protecting customers from price spikes should they occur. These hedges only protect baseload gas supply for customers and do not insulate our customers from daily market price spikes when NMGC enters the daily market to meet customer demands above baseload levels during winter.

Q. WHAT DID NMGC CONCLUDE FROM ITS EVALUATION OF THE FINANCIAL HEDGING PROGRAM?

A. In this review, NMGC contacted a significant swing gas provider to see if it was possible to purchase financial hedges on swing gas to provide additional price protection for the Company. It is possible, however, the Company learned that the price for such protection is extremely high and it would need to be put in place on an ongoing basis. Accordingly, as in the baseload discussion above, the potential for protection exists but there are countervailing arguments against engaging in swing price financial hedging. These countervailing arguments are as follows:

- Cost – Like baseload gas, NMGC contracts in advance of each winter for the majority of its swing gas needs to serve customers in anticipation of severe winter events. The cost to hedge this contracted for swing gas volume would be over $100 million a year given the current market.
- The infrequency and unpredictability of extraordinary weather events means that the incurrence of the extraordinary costs discussed above would pay off infrequently and is not a prudent cost for the customer to bear regularly.

Q. PLEASE SUMMARIZE THE COMPANY'S CONCLUSIONS AFTER REVIEW OF THE BASELOAD AND SWING GAS ACQUISITION POLICIES AND HEDGING PROGRAMS.

A. The Company determined that it is best and most prudent to maintain its current baseload acquisition program, with annual adjustments, and that given the infrequency of extraordinary events and the cost of hedging all or most of the Company's swing gas, it is not reasonable for the Company to enter into a program to hedge its swing gas at this time.

Q. ARE THESE STILL THE COMPANY'S CONCLUSIONS?

A. Yes.

B. EVALUATION OF OPTIONS AVAILABLE TO THE COMPANY TO ENHANCE STORAGE

Q. PLEASE SUMMARIZE AND UPDATE YOUR MARCH 31, 2022, DIRECT TESTIMONY MADE IN THE COMPLIANCE FILING REGARDING WHAT THE COMPANY LOOKED AT WHEN EVALUATING ALL OPTIONS AVAILABLE TO THE COMPANY TO ENHANCE STORAGE.

A. Prior to March 31, 2022, NMGC and CEPC evaluated seven possible "storage" options: liquified natural gas, propane/air blending, expanding existing West Texas storage, acquisition and drilling of production wells with necessary facilities, development of underground storage in the service area, new supply points (sources), and CNG facilities throughout the system.

Q. WITHOUT REPEATING ALL THE TESTIMONY IN THE COMPLIANCE FILING PLEASE IDENTIFY THE CONCLUSIONS THE COMPANY REACHED WITH REGARD TO ALL THESE ALTERNATIVES.

A. Taking each of the seven options in order, in my testimony in the Compliance filing, I summarized the engineering review performed by CEPC and the Company, discussed the business and operational aspects of each option, provided an overall evaluation of each and option, and stated the Company's ultimate conclusion. Here I will restate and update that testimony and the ultimate conclusion by the Company reached after comparing all options.

1. As to LNG storage, my March 31, 2022, testimony in the Compliance filing concluded on pages 20 - 21:

> "Overall Evaluation: Overall, NMGC considered LNG to be the most viable option for providing adequate storage on-demand and thereby help mitigate the effects of a reoccurrence of the 2021 Winter Event and the potential for extraordinary gas expenses and/or possible curtailments to customers. In addition to the advantages identified by CEPC, NMGC greatly values the ability to liquefy and inject gas directly from and to an NMGC-owned pipeline and consider this a key reliability factor as well as a way to control costs to our customers. LNG is a proven industry technology, with LNG plants successfully owned and operated by LDCs throughout the country. The LNG storage tank that NMGC would contemplate constructing would be similar to others already constructed throughout the country and would be built and operated based on the expertise gained by others' experience."

> "Finally, an added benefit of owning and operating an LNG plant is the ability to fill semi-trailers and self-support Company projects where NMGC

> would typically rely on commercial LNG vendors to supply gas for pipeline projects or in the event of an isolated outage."
>
> "Construction of a large LNG storage tank and vaporization and liquefaction facility eliminates the Company's reliance on interstate pipelines for delivery of stored gas from West Texas. The proposed NMGC LNG Storage Facility would be located directly on NMGC's system in the Rio Rancho area and can provide storage protection for most NMGC customers through backhauling and balancing measures across the interstate pipeline systems."

This is still true, and I would add that the anticipated primary method for filling the LNG tank and using LNG from the tank will be directly on and off the Company's system through its system pipelines. This is the most reliable and feasible method of operation. At the same time, a trucking terminal will allow the Company to fill the LNG Facility, as needed, or desired, from tanker trucks. The trucking terminal would also allow the Company to truck gas throughout the system, if needed or desired, with tanker trucks.

2. As to <u>Propane/Air Blending Facility with Propane Storage</u> my testimony in the Compliance filing concluded at page 26:

> "<u>Overall Evaluation</u>: Although a propane/air system has merit and NMGC understands it has been used in other locations and will continue to evaluate whether it could be used to supplement other storage options site-specific

> situations, it is not a preferred option because of the operational challenges it poses."

This remains true today and I would add that given that a Propane Air Blending Facility with propane storage would necessitate several propane air facilities throughout the Company's distribution system, and essentially serves as a last resort to avoid curtailment of service, it is unable to provide the system-wide, proactive supply capability that is afforded by the proposed LNG Facility. Additionally using a propane air system leaves the Company reliant on propane suppliers – typically a more costly fuel source – and requires the positioning of very large propane tanks throughout the state, and typically in towns and cities, and this creates potentially significant siting issues for which outcomes are difficult to predict.

3. As to <u>Expanding Existing West Texas Storage</u>, my testimony in the Compliance filing concluded at pages 28 - 30:

> "<u>Overall Evaluation</u>: While these West Texas Storage facilities are already in existence and available for use by NMGC, and while NMGC intends to utilize them until an alternative can be developed (NMGC has contractually secured rights to storage at step- up prices through 2026) expanding West Texas Storage means NGMC continues to rely on a facility that the Company does not have absolute confidence in despite its best effort to contract for further security.

"It should be noted that the same West Texas facility [Keystone Facility] which presented problems in 2011and 2021 again presented performance problems in the most recent storm in February 2022, although the Company was able to mitigate the impact to customers by over nominating supply and market conditions did not result in price spikes."

"In February 2022, the region, including New Mexico, experienced a severe cold weather event. In anticipation of the storm, NMGC took action ahead of time to increase its line pack, to purchase excess gas supplies, and to inject gas into storage in order to elevate inventory. Additionally, the Company's supply was diversified to originate supply from four different basins to minimize reductions due to freeze-offs, and volumes to the Company's independent systems were increased in case gas from the interstates was interrupted. All this was done to avoid needing to go into the intraday market during the storm to purchase additional gas."

"Going into the February 2022 storm, storage supplies to NMGC from the West Texas Storage facility [Keystone Facility] was considered to be part of the Company's supply strategy for that storm. To avoid issues, and in preparation for the approaching storm, NMGC contacted the facility [Keystone Facility] operator to discuss expectations prior to the storm. NMGC advised the operator that a maximum withdrawal would be nominated on each day of the storm. On February 3, 2022, the first day of the storm, NMGC received a notice from Transwestern Pipeline ("TW") advising NMGC that the storage facility operator was underperforming. The operator then in turn advised NMGC that they were having issues making the full delivery to TW and would be capping their volume of deliveries. This cut by the operator to TW, would mean a cut to NMGC. Shortly after this initial conversation, a notice came out from the operator that a Force Majeure was being declared."

"Throughout the 2022 storm, NMGC maintained line pack and received minimal production cuts[2]. The NMGC system was able to absorb the storage reductions because cuts were anticipated, and excess supplies had been purchased in preparation. As planned, NMGC was able to reduce withdrawal volumes during the day to sustain line pack targets as well as meet demand."

"In summary, when viewed from an operational and reliability perspective, NMGC does not judge expanded West Texas storage as highly as CEPC does. To the Company, considering all factors, doubling down on the West Texas storage facility [Keystone Facility] does not solve the problems NMGC is trying to solve, but instead only makes NMGC more reliant on

[2] Gas purchased in the spot market, typically intraday gas, is sometimes referred to as replacement gas when it is purchased to replace gas cut by suppliers.

> these storage facilities in the future, and NMGC does not think this makes sense from a reliability or balancing perspective."

> "Despite its best efforts to negotiate better terms, and because the Company is one of many tenants in the facility, NMGC is unable to negotiate better and more reliable terms for use of the West-Texas Storage. Additionally, the storage facility is somewhat remote from NMGC's primary load centers, and this remoteness, is becoming more problematic because of the need to use interstate pipelines to transport the storage gas to NMGC's load centers."

> "Based on past performance, uncertain supply reliability during high demand, and uncertain future costs, NMGC does not think expanded reliance on the West Texas Storage facility provides the best option to prevent a reoccurrence of the 2021 Winter Event and the potential for extraordinary gas expenses and curtailments to customers."

This is still true. As noted in my testimony from the Compliance filing quoted above, in February 2022 there was another winter weather event, unnamed this time, which was less severe than Winter Storm Uri in February 2021, but which caused a smaller, but equally troubling cut in deliveries from the Keystone Facility and a further erosion in the confidence NMGC has in the reliability of the Keystone Facility. As will be detailed below, confidence in the availability and deliverability of storage gas when requested is critical to the viability of the storage facility to the Company. As discussed below, this is the key characteristic of the proposed LNG Facility which makes it more valuable to NMGC and its customers than the Keystone Facility.

4. As to the Acquisition and Drilling of Production Wells with Necessary Facilities, my testimony in that case on pages 32 – 33 concluded:

> "Overall Evaluation: This possibility of NMGC's owning in whole or in part an interest in gas producing wells operating wells, or completely producing natural gas can be done, and probably should be done, in conjunction with utilization of one of the other storage options discussed. Owning an interest in gas producing wells would give the Company access to natural gas at a price and rate of production that the Company can control, or greatly influence, and give the Company the ability to better control the pricing influences that it and its customers were exposed to in 2021. Ownership or operating control can be increased as the Company becomes more adept and knowledgeable about the production, gathering, and processing of natural gas."

> "Importantly, the San Juan Basin is in close proximity to the Company's loads and system. Whether it be one or multiple wells, the Company can assess and proceed in a methodical and thoughtful fashion and in concert with the regulation of the NMPRC and others. The option of obtaining an interest in production wells in the San Juan Basin is one of the activities that

the Company can envision as having merit to help mitigate the cost effects of natural gas supply as seen in 2021. This option presents a non-traditional way of providing "storage" in an effort to prevent a reoccurrence of the 2021 Winter Event and the potential for extraordinary gas expenses and curtailments to customers."

"NMGC is just beginning its consideration of this option. NMGC does not have any hands-on experience in the drilling for or gathering and processing of natural gas and therefore would not enter into this line of business without the advice and consultation with experts in the field who could advise the Company on the feasibility of entering into an endeavor such as this. Going forward, the Company anticipates retaining a consultant to assist it in evaluating the option of NMGC obtaining, in whole or in part, an interest in production wells in a gas producing field to determine if such interest, in concert with another one of these storage options, could help mitigate the risks of higher costs or supply disruption due to severe weather events."

"Clearly, any movement in this regard is subject to consideration and review by the NMPRC including review and evaluation of the limitation imposed on NMGC's predecessor in the Order in NNPRC Case No. 1891/1892. Given the different risks and opportunities such a business would present, the NMPRC would be engaged in consideration of the Company's engagement in the production, gathering and processing of natural gas should this be the intention of the Company."

5. As to Underground Storage in the Service Area, my testimony in the Compliance filing at page 36 concluded:

"Overall Evaluation: NMGC believes that enhanced underground storage connected to the Northwest transmission system could be an effective means of improving service reliability and reducing potential gas cost spikes. However, based on the Company's experience with the San Ysidro Storage facility, and the aforementioned uncertainties, NMGC does not consider this the highest-ranked option available to the Company."

6. As to New Supply Sources and Points, my testimony in the March 31, 2022, Compliance filing at pages 38 – 39 concluded:

"Overall Evaluation: As stated above, the Company, in performing this review does not believe additional sources of gas, in addition to those already arranged as mentioned above, will provide the type of "storage" the Commission is asking the Company to consider, and given market price increases observed in February 2021, does not think additional supply sources will be beneficial to prevent a reoccurrence of the 2021 Winter Event and the potential for extraordinary gas expenses and curtailments to customers."

7. As to possible <u>CNG Facilities</u>, my testimony in the Compliance filing in March at page 40 concluded:

> "<u>Overall Evaluation</u>: The Company does not believe CNG will provide the type of "storage" the Commission is asking the Company to consider, and given market price increases observed in February 2021, does not think CNG will be beneficial. For this reason, NMGC does not think CNG will economically prevent a reoccurrence of the 2021 Winter Event and the potential for extraordinary gas expenses and curtailments to customers."

Q. WHAT WAS THE ULTIMATE CONCLUSION YOU REACHED IN YOUR COMPLIANCE FILING TESTIMONY WITH REGARD TO ALL THESE ALTERNATIVES?

A. My conclusion in the March 31, 2021 Compliance filing testimony at page 41 was as follows:

"… NMGC intends to file for approval of a CCN to build an LNG facility near the Company's load centers. Despite all the actions taken by the Company before and after the events of 2011, and before and during the solutions case, and prior to and after the events of 2021; and given the evolving gas supply options available to NMGC, and the increasing costs and uncertainty to companies like NMGC as evidenced during the February 2021 Winter Event; and given the concern expressed by all parties involved in the February weather event, and the prospect of further uncertainty in the natural gas industry; NMGC has, upon further examination, determined that the time has now come to propose and build an LNG facility for

NMGC and its customers. NMGC is not asking for approval of the CCN at this time, but instead will be making its case for such a CCN when it files for approval of a CCN later this year. Here, NMGC is reporting that as requested by the NMPRC, this is the Company's conclusion after considering all storage options available to the Company."

Q. IS THIS STILL THE COMPANY'S CONCLUSION?

A. Yes. Additionally, NMGC has worked with Concentric to update the March 2022 cost comparison analysis for all the options and has worked with Lisbon to prepare a pre-FEED study of the viability of the anticipated design for the proposed LNG Facility. For the reasons set forth in the Compliance filing and in the testimony in support of this Application, the Company is filing this application for a CCN to proceed with an LNG Facility.

VII. NMGC'S PROPOSED LNG STORAGE FACILITY

Q. PLEASE BRIEFLY DESCRIBE THE PROPOSED NMGC LNG FACILITY.

A. NMGC's LNG Facility will be capable of storing one Bcf of gas, in liquefied form, for NMGC to use as needed for its customers. The LNG Facility will be comprised of three main components: 1) a large tank, constructed of a combination of steel and nickel, which will hold the LNG, 2) a liquification unit that will take pipeline grade natural gas and cool it to a temperature of -260 F, at which point it becomes a liquid, and 3) a vaporization unit that can take the LNG stored in the LNG Facility and warm it until it returns to a gaseous state and can be reinjected into NMGC's system.

Q. IS NMGC DESIGNING THE LNG FACILITY?

A. No. Lisbon is acting as the Company's OE to advise NMGC on the project, and to develop a pre-FEED for use by NMGC in filing this CCN. NMGC Exhibit TCB-3. A pre-FEED study is best defined as a preliminary engineering report directed at ensuring project parameters are defined, including developing a detailed project scope, identifying appropriate technologies and plant configuration, and verifying location feasibility, project schedule, and cost estimates. NMGC, with Lisbon's support, will ultimately hire an engineering, procurement and construction ("EPC") firm to finalize the design and construct the facility. The EPC company has not yet been chosen. By agreement, the EPC firm will not be Lisbon.

Q. HOW WAS LISBON SELECTED TO PERFORM THE PRE-FEED?

A. NMGC issued an RFP for an experienced LNG design and engineering firm to act as its agent. Lisbon was chosen as a result of this RFP process and is acting on NMGC's behalf.

Q. PLEASE DESCRIBE MORE FULLY THE WORK THAT LISBON ENGINEERING HAS DONE FOR NMGC.

A. In order to prepare the pre-FEED, Lisbon, working with NMGC, developed the basis of design, did a site assessment and validation, made recommendations and specifications for appropriate process technologies, and developed LNG containment options, preliminary site layout, and cost estimates. Additionally, Lisbon, working with NMGC, developed facility operating parameters by analyzing available flows and gas quality to identify appropriate LNG processes and technologies, and defined the plant scheme.

Lisbon then prepared and submitted datasheet-based enquiries to suppliers for a range of equipment and subsystems to allow key decision making including the LNG storage tank, assessment of pretreatment arrangements and liquefaction process, assessment of LNG pumps, LNG vaporization type, boil-off gas compressor and send-out destination, and other components of the LNG Facility. As part of this work, Lisbon analyzed vendor and supplier responses to develop and understand project capital and operating costs. NMGC Witness Barclay, Lisbon's chief engineer on this project, will testify in detail about all aspects of their work on this project and the pre-FEED.

I will first introduce the concept and characteristics of the LNG Facility from the Company's perspective.

A. THE LNG FACILITY DESIGN CHARACTERISTICS

Q. PLEASE BRIEFLY OUTLINE AND DISCUSS THE MAJOR CHARACTERISTICS OF THE PROPOSED LNG FACILITY.

A An LNG storage facility stores natural gas as a liquid. LNG is natural gas that has been liquefied to reduce the specific volume and allow it to be more easily transported or stored. Approximately six-hundred (600) standard cubic feet of natural gas occupies 1 cubic foot in the liquid form. The LNG Facility will take gas off the NMGC system, pretreat the gas and cool it to a liquid form in a process called liquefaction. It will be stored as a liquid in the LNG tank until it is needed for customers. When needed, the liquid natural gas will be warmed to a gaseous state through a process called vaporization and reintroduced into the Company's system for delivery to customers.

These three processes – liquefaction, storage, and vaporization – make up the main characteristics of an LNG facility. I will discuss them below, NMGC Witness Barclay will discuss them in his Direct Testimony, and they are described in detail in the pre-FEED, NMGC Exhibit TCB-3.

Liquefaction: The liquefaction equipment at the LNG Facility will take natural gas from NMGC's system and run that gas through pre-treatment and cooling equipment until the gas cools to -260 degrees Fahrenheit and changes into a liquid. The liquefaction equipment will be able to liquefy 10,000 Mcf/d of gas and inject the resulting LNG directly into the storage tank. Additionally, the LNG Facility will contain a single bay with a scale for loading or unloading LNG trailers which can be used to deliver LNG to the LNG Facility to supplement the 10,000 Mcf/d liquefaction rate if necessary or used to take LNG from the LNG Facility for pipeline maintenance and inspection, or outage management.

Storage: Once liquefied, the LNG will be stored at near atmospheric pressure in a 1 Bcf (12 million net gallons) double-walled and insulated storage system designed to hold the LNG. The LNG tank is comprised of a self-supporting inner tank, comprised of 9% nickel steel, and surrounded by an outer tank made of either carbon steel or pre-stressed concrete (to be determined later by the EPC). The space between the inner and outer tank walls is filled with insulation to help maintain the internal temperature necessary to hold the LNG. NMGC anticipates the outside of the tank will be painted a light color, possibly white, to reflect solar heat gain. The tank itself will be no more than 100 feet high, with a diameter of between 186 and 204 feet.

Vaporization: When called for, the vaporization equipment at the LNG Facility will pump LNG out of the storage tank to be warmed to a gaseous state for reintroduction into the NMGC system. As proposed, there will three vaporization pumps, each of which will be able to pump a maximum of 65,000 Mcf/d into the vaporizers for vaporization. The maximum vaporization rate if all three pumps are working at the same time will be 195,000 Mcf/d, although NMGC anticipates that for the vast majority of the time all three pumps will not run at maximum capacity but instead only two pumps will operate, with a third in reserve, allowing vaporization at a rate of 130,000 Mcf/d.

At a maximum vaporization rate of 195,000 Mcf/d, the LNG Facility will have a slightly higher maximum delivery rate than what NMGC contracts for at the Keystone Facility. Given the size of the tank, this will allow for approximately five days of full capacity vaporization. This is longer than any previous supply disruption that NMGC has experienced. At 130,000 Mcf/d delivery, NMGC can provide more than seven continuous days of gas. NMGC can operate just one pump if needed or can run the pumps at less than full speed. This would allow for multiple variations of vaporization for various periods of time.

Q. HOW DID THE COMPANY SETTLE ON THE OPERATIONAL CHARACTERISTICS DESCRIBED ABOVE?

A. As described below, NMGC worked closely with Lisbon on all these determinations.

Liquefaction: NMGC and Lisbon evaluated pretreatment and liquefaction capacities of 10,000, 20,000, and 30,000 MCF/d before deciding on a liquefaction rate of 10,000 Mcf/d and determined its pretreatment option in part based on the determination.

- The teams evaluated two alternative pretreatment technologies for removal of carbon dioxide and water from the liquefaction gas stream, based on available flow rates and qualities of feed, tail, and blending gas streams. The pretreatment option chosen for the LNG Facility is well suited for liquefaction at a rate of 10,000 Mcf/d and is considered a closed system where impurities removed for the liquefaction process are injected back into the pipeline and blended with flowing gas to produce a gas stream of acceptable quality. This option for pretreatment is also the less costly alternative.
- After exploring the possibility of a faster or larger liquefaction equipment design, NMGC did not believe the greater liquefaction capability justified the approximately $30 million incremental cost. More importantly, liquefaction at a rate of 10,000 Mcf/d of gas will meet NMGC's needs and is similar to facilities owned and operated by other utilities.

NMGC Witnesses Barclay and Jones will testify further on these points.

Storage: At the suggestion of NMGC, Lisbon considered multiple configurations for the LNG storage tank including tank size and tank construction methodology. In considering these options, three industry-leading tank contractors responded with proposals and budgetary estimates based on typical industry design standards and available site geotechnical data. Construction methods vary, with options including traditional 9% nickel inner tanks with either carbon steel or concrete outer shell, and prestressed concrete inner tank with either carbon steel or concrete outer shell. The Company and its engineer settled on a 1 Bcf single containment tank since such a tank is well-suited to the location selected for this facility, is safe and reliable, is a well-recognized construction type, and is significantly more affordable than a full-containment tank. NMGC Witnesses Barclay and Jones will testify further on this point.

An important factor in the design of the tank is consideration of treatment of boil-off gas ("BOG") during storage. Daily BOG results from heat leak into the LNG storage tank and is impacted by operational mode, barometric pressure, and other physical processes. This gas must be recovered during normal operations without unnecessary discretionary venting. As designed, the LNG Facility will capture BOG, compress and odorize it, and inject it into the NMGC distribution system.

<u>Vaporization:</u> As described above, the LNG Facility would have three LNG send-out pumps with each pump being capable of sending up to 65,000 Mcf/d to heat exchangers which vaporize LNG to a gaseous state. Thus, the total vaporization capacity of the LNG Facility is 195,000 Mcf/d if all three pumps are being operated at full capacity. Depending on need, any of the pumps can be operated at full or turned down capacity. Typically, given historical requirements of NMGC for stored gas, the LNG Facility would be able to fulfill its functional requirements on a daily basis operating one or two pumps, meaning the third would normally be held in reserve on any given day and be available as needed. All three pumps would be rotated into service on different days to ensure reliability of operation. The Company discussed with Lisbon installing three 95,000 Mcf/d pumps but determined, based on historical needs, such large pumps were not necessary.

Q. IS THE COMPANY SATISFIED THAT THE FACILITY AS DESCRIBED IN THE PRE-FEED WILL MEET THE COMPANY'S NEEDS?

A. Yes. NMGC is confident that the integrated design of the liquefaction system, the storage tank, and the vaporization system and all component parts will be able to provide operational advantages to the Company on a daily basis and provide reliable LNG gas to NMGC for multiple days when needed during a storm or supply disruption. As described in the next section of this Direct Testimony, NMGC believes this design will be sufficient to ensure reliability and assist the Company's efforts to limit the impacts of price volatility. As discussed in more detail in the pre-FEED, and by NMGC Witness Barclay, all gas lines and components in the LNG Facility are designed and engineered and described in the pre-FEED to accommodate the level of liquefaction and vaporization discussed here. While the Company was consulted on all these details, these design details are better discussed by NMGC Witness Barclay regarding the pre-FEED

B. SITE DETAILS

Q. WHERE WILL THE NMGC LNG STORAGE FACILITY BE LOCATED?

A. The LNG Facility will be located within the city limits of the City of Rio Rancho, on a 160-acre parcel of land that is currently not near any developed property, but which already has established roads. The developed site will be approximately 20 to 25 acres, and the remaining area will be a buffer zone to prevent encroachments and to ensure community safety in the event of an accident at the LNG Facility.

Q. WHY DID NMGC CHOOSE THIS LOCATION?

A. First, this location is perfectly situated on the Company's system and near the Company's gas transmission lines and significant load centers. From an operational perspective, this location offers the ability for the LNG Facility to have a significant impact on the Company's operations that was not available with the Company's current leased storage facility. These impacts include an opportunity to provide LNG directly onto the system, quickly and reliably, provide pressure support and reduce future investment in other facilities necessary to provide distribution service throughout the system and to all customers, and to help ensure reliable service to all the Company's customers.

Second, this location checked all the boxes on NMGC's list of specific attributes for a location upon which to construct the LNG Facility. From a technical perspective, the LNG Facility had to be near NMGC's large gas transmission lines, had to be near an electric power source, had to have access to good roads, had to have soil conditions that would be able to support storage tank holding 12 million gallons of liquid gas, and needed to be large enough to accommodate this design. This location meets all NMGC's requirements.

Q. DOES NMGC ALREADY OWN THIS LAND?

A. No. NMGC has an option to purchase which will be exercised upon Commission approval of the requested CCN.

Q. HAS NMGC BEEN WORKING WITH GOVERNMENTAL AUTHORITIES REGARDING PERMITS AND APPROVALS NEEDED FOR THIS PROJECT.

A. Yes. NMGC has begun engaging with all necessary governmental agencies and authorities. NMGC received a Resolution of Support from Rio Rancho Governing Body on June 23, 2022. NMGC presented the project to Bernalillo County Staff, including Economic Development, Fire Marshal, and Emergency Management departments on June 28, 2022, and none expressed any opposition to the project.

NMGC has been working with PNM on provision of power, utility easements, and budgetary cost estimates for electricity.

NMGC has submitted an Obstruction Evaluation Request to Federal Aviation Administration ("FAA") due to proximity of the Double Eagle II Airport. That determination is pending, and NMGC does not anticipate this being a problem. The Company expects to have this request acted on during the pendency of this Application with the Commission. Important for this approval, the LNG Facility will be less than 100 feet tall and located approximately two miles northwest of the end of the runway, there by exceeding minimum Federal Regulations found in 49 Code of Federal Regulations ("CFR") Part 193 – Liquefied Natural Gas Facilities: Federal Safety Standards regarding location in relation to an airport or runway.

NMGC has communicated with the City of Albuquerque Aviation Department regarding access to the site from Atrisco Vista Boulevard., which runs along the southern border of property.

Lastly, NMGC has had preliminary discussions with the New Mexico Pipeline Safety Bureau ("PSB") regarding this proposed LNG Facility and the Company's anticipated engagement with PSB regarding the LNG Facility if it is approved.

C. OPERATIONAL AND SECURITY DETAILS

Q. DO NMGC'S EMPLOYEES HAVE EXPERIENCE OPERATING AN LNG FACILITY?

A. Not yet. Initially, NMGC plans to hire employees with LNG operations experience. In addition, NMGC will conduct extensive training in LNG facility operation for certain employees during the 24-month construction process. There are experts who specialize in both drafting operating procedures for LNG facilities and training people on how to operate LNG facilities. NMGC is already consulting with experts in these areas in preparation of this Application, and NMGC will retain experts such as these to conduct employee training and continue to consult with the Company. Finally, NMGC will maintain an operations and training program in compliance with 49 CFR Part 193.2713. This written program will include an initial training program along with regular, ongoing, documented refresher training for NMGC employees.

Q. WILL THERE BE NMGC EMPLOYEES AT THE NMGC LNG STORAGE FACILITY AT ALL TIMES?

A. Yes. NMGC intends to have an operating technician on-site 24 hours a day, seven days a week. Any time the LNG Facility is either liquifying or vaporizing, NMGC anticipates also having additional operations technicians and an engineer present as necessary.

Q. PLEASE DESCRIBE THE PLANS FOR PLANT SAFETY AND SECURITY.

A. Facility safety planning and measures are extensive and will be described in more detail in NMGC Witness Barclay's testimony. Among the safety measures built into the plant and as identified in the pre-FEED are typical for LNG peak shaving facilities and include:

- Facility siting that complies with the siting requirements defined in 49 CFR Part 193.2057 and 193.2059 with respect to thermal radiation and dispersion to limit risk beyond the LNG Facility property boundary.
- A layout and impoundment design in compliance with the requirements of 49 CFR Part 193 and National Fire Prevention Association ("NFPA") 59A-2001 that dictates certain arrangements of equipment and facilities and mandates the impoundment of LNG in the event of a spill.
- A hazard detection system capable of continuously monitoring the LNG Facility for and detecting hazards such as flammable gas, fire, smoke, leaks, or other hazards.
- An Emergency Shutdown ("ESD") system that is capable of shutting down the Facility, isolating major hydrocarbon inventories, and de-energizing electrical

devices to prevent equipment damage and bring the LNG Facility to a safer condition when hazards are detected.

- A firefighting water system that includes a water storage tank, firewater pump house, pressurized water ring main, and various monitors and hydrants located in strategic locations around the plant and LNG storage tank. The firewater tank is filled by on-site well.

Security will be provided by fencing around the entire 160-acre site, plus interior high security fencing around the LNG Facility, including barbed wire, intrusion/fence damage detection, and an automated gate with camera, keypad, and communication system. Proposed access improvements include asphalt road extending from Paseo del Norte Boulevard to the site, and additional gravel roads around the processing LNG Facility. 49 CFR Part 193 calls for an operating plan to be prepared which includes security provisions including intrusion protection. This plan is to be submitted to Homeland Security for approval and will be prepared as the Front End Engineering Design is finalized and the construction proceeds. It must be in place and approved prior to commissioning and operation of the plant.

D. ESTIMATED COST OF CONSTRUCTION

Q. WHAT IS THE ESTIMATED COST TO CONSTRUCT THE LNG FACILITY?

A. Lisbon prepared budgetary estimates for key plant components, considering a range of suitable technologies from multiple manufacturers. Pricing was developed for two alternate cases as described here:

Case 1: 1 Bcf single containment 100 feet high storage tank, liquefaction capacity available at 10,000 Mcf/d, and vaporization send out available through three 65,000 Mcf/d pumps capable of very reliably flowing 130,000 Mcf/d to vaporization, and a maximum output of 195,000 Mcf/d as needed with all three pumps operating.

Case 2: Tank and liquefaction as in Case 1, but maximum vaporization and send out capacity of 190,000 Mcf/d through the use of two 95,000 Mcf/d pumps operating and a third in reserve.

Attached as NMGC Exhibit TCB-4, is the current estimate of the Case 1 and Case 2 construction costs. These are estimates only, and the full prudency review and approval will take place when this project is presented to the Commission for cost recovery in a future rate case. The Company has chosen to proceed with the design of the LNG Facility as proposed in Case 1 so that is the relevant cost estimate. The costs contained in NMGC Exhibit TCB-4 are broken down into capital and O&M costs as follows:

- The estimated capital cost for the proposed LNG Facility is approximately $181 million including contingency;
- The estimated annual O&M costs are approximately in the range of $3.4 to $3.9 million/year.

Details of these costs are set forth in NMGC Exhibit TCB-4.

Q. HOW DID NMGC DETERMINE THIS COST?

A. Part of the contracted scope of work with Lisbon was a cost estimate of constructing the LNG Facility. Lisbon has significant experience in the construction of LNG facilities, and has a very good understanding of the time, labor and materials necessary to build this type of LNG facility. I understand that Lisbon also obtained budgetary quotes for key equipment and materials.

Q. PLEASE DISCUSS SOME OF THE ASSUMPTIONS UNDERLYING THE ESTIMATES CONTAINED IN NMGC EXHIBIT TCB-4.

A. As described in NMGC Exhibit TCB-4, these estimates of capital costs include all LNG Facility components, including liquefaction, storage and vaporization equipment, buildings and utilities, and site improvements; and all interconnecting pipelines and reception equipment, emergency shut-down valves, analysis, metering, and odorization. A 20% contingency was applied to the total cost except for the tank for which a 14% contingency was applied due to level of definition and multiple proposals from tank contractors.

The estimates of O&M costs include plant personnel and annual operating costs including electricity power costs, which will vary depending on volumes of gas liquefied and vaporized throughout the year.

Q. COULD THE COST ESTIMATES CHANGE?

A. Yes. This is what is known as an AACE Class 4 cost estimate. AACE is the Association of Cost Engineering which has established a cost estimating and budgeting classification system to be applied to engineering, procurement, and construction projects. A Class 4 AACE cost estimate has an expected accuracy range of accuracy between -15% to +50%, but generally an estimated variation in the middle of these ranges, -25% to +40%, is a good estimation of the error range for such an estimate. NMGC Witness Barclay discusses this in his Direct Testimony.

E. ANTICIPATED CONSTRUCTION PROCESS AND SCHEDULE

Q. PLEASE DESCRIBE THE COMPANY'S PLAN FOR CONTROLLING THE CONSTRUCTION PROCESS AND THE SUBSEQUENT OPERATIONS.

A. The project will be developed in phases, with decision gates and practical offramps to allow the Company to change course if needed. Lisbon will assist in providing a detailed RFP package, complete with a pre-qualified vendor list and equipment specifications, to solicit bids for EPC-FEED phase of the project.

It is anticipated that the FEED will progress the design to sufficient detail to enable NMGC to execute LNG sales contracts, submit long lead regulatory permits, and support the financial investment decision. Contracting requirements will be implemented to ensure vendor resources remain committed throughout project; NMGC will ensure compliance with Company Contracting and Procurement Policies. An option for ensuring competitive process includes commissioning dual EPC-FEEDs to provide value engineering from competing vendors, with award of construction to top performer—this model has been used and recommended by other peer utilities in their LNG projects.

Third-party operations support will be engaged as needed throughout project planning and execution.

Q. HOW LONG WILL IT TAKE TO CONSTRUCT THE LNG FACILITY?

A. NMGC anticipates that the construction process will take approximately 24 months. Commissioning the unit, which includes at least partially filling the tank and testing and running all of the equipment to ensure the LNG Facility is fully operational, should take an additional four months. With timely approval of the Company's CCN, the LNG Facility should be in service for some or all the winter of 2026-2027.

XIII. NMGC'S PLAN FOR USE OF THE LNG FACILITY IN THE CONTEXT OF THE COMPANY'S GAS SUPPLY STRATEGY

Q. HOW WILL THE LNG FACILITY IMPACT NMGC'S GAS SUPPLY PHILOSOPHY?

A. By moving the Company's storage gas onto the Company's system and closer to significant load centers on NMGC's system, the LNG Facility will deliver reliability and reduce the impact of price volatility during storms and throughout the winter heating season. This section of my Direct Testimony details the Company's operating plan for the LNG Facility and contrasts use of the LNG Facility with the current use of the Keystone Facility.

To begin this discussion let me highlight key attributes or benefits of the LNG Facility to gas supply operations by the Company:

1) Location - The LNG Facility will be located directly on NMGC's system on the outskirts of Rio Rancho and is not dependent on interstate pipelines to move gas from the LNG Facility to NMGC's system.

2) Control - The LNG Facility will be operated by the Company. It will typically be filled by the Company in the spring, fall, and summer when economical, with low-cost gas from our system. The gas will be liquefied by the Company and stored until needed. When needed, typically in the winter, this liquefied natural gas will be vaporized by the Company and put directly into the Company's system. Decisions regarding use of the stored gas will be solely at NMGC's direction and there are no third-party pipes between the LNG Facility and the Company's system. When NMGC calls for gas from the LNG Facility, no third party is involved. Unlike the Keystone Facility, NMGC is the only/primary customer for the storage gas at the LNG Facility.

3) System-wide impact - The Company can operate the LNG Facility to provide system-wide benefits by displacing gas throughout NMGC's system. In this situation "displacing gas" simply means using LNG Facility gas on the Company's northern system and leaving more Permian Basin gas to be used on the Company's southern system. In effect, the Company is displacing Permian Basin gas headed to the northern system with LNG Facility gas. Stated differently, when vaporized gas enters the

NMGC system near Rio Rancho, this gas can be used throughout the northern system and gas entering the NMGC system from the Permian Basin can be retained throughout the southern part of NMGC's system. Absent this displacement, for Permian Basin gas to be used in the northern part of NMGC's system, the gas must be moved along the interstate pipelines. This ability to displace gas means the LNG Facility near Rio Rancho is essentially a system-wide facility that impacts and benefits all NMGC customers.

Finally, operational control offers the Company the ability to control weatherization, maintenance scheduling, upgrades and expansions...

4) Speed - NMGC can receive gas from the LNG Facility within one hour of deciding it needs gas. This contrasts with the NAESB proscribed schedule for delivery from the Keystone Facility which can result in a delay of three or more hours between nomination and delivery of gas. By displacing gas throughout the NMGC system as just described above, the LNG storage gas on NMGC's system can be an integral part of the Company's daily gas strategy throughout the state.

5) Flexibility – Given the increased speed and control afforded the Company, the Company gains greater flexibility and speed when making decisions about when and how to use storage gas.

6) Reliability. As described above, the key aspect of the LNG Facility for delivering storage gas into the NMGC system when needed is the reliability of the LNG Facility's vaporization system. The design of this LNG Facility calls for redundancy through the availability of three LNG send-out pumps with each pump being capable of sending up to 65,000 Mcf/d to heat exchangers which vaporize LNG to a gaseous state. The three pumps offer high reliability of vaporization at the rate of 195,000 Mcf/d when needed and the ability to vaporize at the rate of 130,000 Mcf/d even with any one LNG, pump vaporizer, and water-glycol heater out of service.

7) Confidence – With control and speed and reliability, NMGC obtains a higher degree of confidence that gas will be delivered quickly when called for. This confidence allows the Company greater flexibility in making gas buying decisions since these decisions can be based on more real-time information.

As described throughout the rest of this section, these attributes/benefits, coupled with the other improvements to the Company's system over the last several years, including the looping of several of the Company's mainlines such as the Santa Fe Mainline, Rio Puerco Mainline, and the construction of the Malaga Pipeline, will enable the Company to better shape its gas supply and gas control operations when using LNG as part of its overall gas supply strategy.

Q. PLEASE PROVIDE AN OVERVIEW OF HOW THE COMPANY ANTICIPATES USING THE LNG FACILITY THROUGHOUT THE YEAR.

A. The Company plans to have the LNG Facility filled to operating capacity (approximately 90%) by November 1st of each year. The LNG Facility would be filled primarily during the preceding spring and fall when gas prices and electricity costs are lower. Some filling could take place during the summer depending on gas prices and electricity charges.

Between November and March, the normal winter operations period for NMGC, the LNG Facility would be used to routinely supply small amounts of gas when needed to level out supply interruptions, or price variations and to meet the morning demands of customers. The Company would use the stored LNG, along with day-ahead and same-day gas purchases, to provide swing gas cover for weekends, weather forecasting variations, or supply cuts as needed. The Company would choose between these swing gas options with an eye toward retaining a level of gas in the LNG Facility sufficient to handle storms as they arise. The Facility would be replenished by liquefying additional LNG into the tank throughout the winter when desired or required. In April of each year, depending on gas prices, the Company can, if beneficial to customers, intentionally “turn” any remaining gas in the LNG Facility by vaporizing, and thereby provide NMGC customers with the benefits of the low-cost LNG remaining in the LNG Facility when compared to the existing market price of gas.

Q. PLEASE WALK US THROUGH THE COMPANY'S PLAN FOR HOW IT WOULD USE THE LNG FACILITY IN A TYPICAL YEAR, AND PLEASE ASSUME A SIGNIFICANT STORM DURING THE YEAR.

A. Given the multiple variables the Company faces in the "typical" year, not all of which can be anticipated, answering this question entails making reasonable assumptions. Gas supply and planning requires reacting to multiple inputs and variables on any given day and deciding how to choose among the supply options available to the Company. This is a skill developed over years and includes many real time decisions that are specific to the circumstances that exist on a given day. To this end, NMGC believes that the LNG Facility gives its operators more and better real time information to make the many decisions needed on a daily basis. Instead of deciding how much gas to purchase or withdraw from storage 20 hours before that gas is needed, the operator can make that decision much closer in time to when the gas is actually needed. As set forth below, is an example as to how the Company's gas supply operators could operate the LNG Facility in a winter that includes a severe storm.

To begin with, in a typical year, by November 1st the Company would have the LNG Facility filled to it an operating capacity of between 900,000 Mcf and 925,000 Mcf of gas. This provides headroom in the tank for the Company to use to absorb over- purchases of gas by liquefying excess gas into the LNG Facility.

In November, historically the chances of "severe" storms and storm related price volatility are lower than they will be later in the winter. However, in a shoulder month like

November, weather can vary significantly, and weather forecasting can be off. As a result, throughout November the Company needs to be prepared to cover for weather forecast misses or variations and for supply cuts. However, to protect the inventory of LNG retained in the LNG Facility for use later in the winter, the Company in November will typically rely more on day-ahead purchases and same-day purchases than on LNG storage for these purposes. Late in November, the Thanksgiving holiday and long weekend must be covered by a significant day-ahead ratable[3] buy of gas or LNG withdrawals. The Company's "target" is to come out of November with at least 900,000 to 925,000 Mcf in the LNG Facility. This is a target only, and the level of gas in the LNG Facility could be higher or lower than this at the end of the month depending on weather variations and gas supply issues. This target will be monitored throughout the month.

In the first part of December, the chance of a "severe" storm remains lower than it will be later in the winter, but this increases throughout the month. Late in the month there are long holiday weekends and increasing chances for price volatility and severe storms. Accordingly, assuming price volatility will be lower, and in an effort to preserve LNG storage gas for later winter storms, throughout the first half of December, the Company will attempt to rely more on day-ahead purchases and same-day purchases to cover for weather forecast misses or variations and for supply cuts. Later in the month, the Company will probably begin to rely more heavily on LNG storage to avoid volatility but

[3] A "ratable" buy of gas refers to the situation where according to industry standard a weekend or holiday weekend is considered a single gas day. As a result the Company is required to purchase the same amount of gas on each day as if it were the same day.

again this will depend on price and supply conditions. The Company's target is to come out of December with at least 775,000 to 800,000 Mcf in the LNG Facility.

In January, historically the chances of severe storms and price volatility are higher. Accordingly, the Company anticipates it will need to anticipate relying more heavily on LNG storage to mitigate the effects of price spikes and to cover for weather forecast misses or variations and for supply cuts. When possible, the Company will still rely on day-ahead purchases and same-day purchases when prices are competitive with the price of the gas in LNG Facility to retain as much LNG inventory as possible for use in the event of a severe storm later in the month or in February. The Company's target is to come out of January with at least 625,000 to 650,000 Mcf in the LNG Facility.

In February, historically, the chances of severe storms are high, and the chances of price volatility are also high. Accordingly, the Company anticipates that it will need to rely more heavily on LNG storage to mitigate the effects of price fluctuations. The Company will still rely on day-ahead purchases and same-day purchases to cover for weather forecast misses or variations and for supply cuts when prices are competitive with the price of LNG in the LNG Facility. Without a storm occurring in February, NMGC could come out of February with as much as 450,000 to 500,000 Mcf of gas in the LNG Facility. The Company's target is to come out of February with at least 200,000 Mcf in the LNG Facility.

For purposes of this hypothetical question, we are assuming that a severe storm will occur in January or February and that the Company will vaporize 500,000 to 550,000 Mcf of LNG from the LNG Facility over a four- or five-day period to address storm-related reliability and price volatility issues. Because of the Company's efforts to retain LNG inventory whenever possible by purchasing gas when feasible, the LNG Facility should have sufficient inventory in January and February to handle a serious storm and on February 15th the Company should still have significant LNG in storage. Following the storm, and provided that further vaporization is not needed, the Company can engage in liquefaction if necessary to replenish the LNG inventory in the LNG Facility.

In March, the weather typically begins to moderate, and the chance of a severe storm reduces. However, in March the weather fluctuates, and the Company will rely on day-ahead purchases, same-day purchases, and LNG to cover for weather forecast misses and variations and for supply cuts. Historically, the chances of price volatility can be significant in March, so the Company has LNG inventory to apply to price fluctuations. The target for the Company to come out of March with 200,000 Mcf in the LNG Facility since March will likely afford the Company many opportunities to liquefy gas into the Facility at the rate of 10,000 Mcf/d.

In April the Company will, depending on the price of gas, "turn" the LNG Facility to provide its customers with the benefits of any low-cost gas remaining in the LNG Facility.

Q. HAVE YOU APPLIED THIS GENERAL PLAN TO ACTUAL OPERATING CONDITIONS TO EXAMINE HOW EFFECTIVELY THE LNG FACILTY COULD BE USED IN REAL TIME CONDITIONS?

A. Yes. Attached to this testimony as NMGC Exhibit TCB-5 ("TCB-5"), is a spreadsheet evaluating a scenario of how the LNG Facility could be used when facing the conditions experienced by the Company in the most recent winter: December 2021, January 2022 and February 2022.

Columns A through I of TCB-5 depict in simplified form how the Company's gas supply group operated in December 2021 and January and February 2022. In contrast, columns J through Q reflect one scenario of how the Company could have handled those same days using the LNG Facility instead of the Keystone Facility. I say one scenario, because columns J through Q show only one of many possible combinations of choices the gas supply team could have chosen. These include alternative uses of levels of LNG storage, day-ahead gas purchases or same-day gas purchases. The exact combination of day ahead purchases (Column K), LNG withdrawal (L), LNG injections (M), same-day purchases (N), and market day sales (O) that could be made on any day are numerous. Indeed, when preparing TCB-5, the gas supply department could have presented different choices than those selected, so the exact numbers are not as important as the gas supply strategy . TCB-5 highlights that the attributes of the LNG Facility, namely location, control, speed, and flexibility, give the Company's gas supply group options that enable the Company to effectively use LNG storage as an integral component of an effective gas supply strategy.

Put another way, the factors that will influence and determine which source of gas supply to use, and in what combination, include current and prospective prices and availability of each source of gas, LNG inventory, weather projections, weather accuracy, supplier conduct and numerous other variables and combinations of variables all of which change daily. TCB-5 shows that using the operating plan and philosophy outlined above would work in real time conditions and would enable the Company to more effectively meet all daily needs and unanticipated storms.

Q. NOW LOOKING FORWARD, HOW DO YOU ENVISION THE LNG FACILITY AFFECTING THE COMPANY'S APPROACH TO BUYING GAS IN THE SWING MARKET?

A. When to buy gas and how much to buy in the swing markets are among the key daily decisions that must be made by the Company throughout the winter. As discussed above, the Company can choose to purchase swing gas in the day-ahead market or the same-day market, or it can take from its storage facilities. All three options are available and are interrelated. Having a reliable LNG storage facility directly on the Company's system, nearer to the Company's load centers and under the Company's control to quickly supply LNG storage gas, will affect the Company's decisions to purchase swing gas. Stated differently, having the LNG Facility makes choosing LNG a real-time alternative to swing purchases and gives the Company greater flexibility.

First, it must be understood that gas utilities routinely buy swing gas to meet customer needs. And often, NMGC overbuys swing gas in the day ahead market because it isn't exactly sure what conditions will be like the next day. Buying extra gas is the safe bet when faced with uncertainty. There is nothing wrong with this. These day-ahead purchase decisions, or Keystone Storage orders, must be based on information available at the time the decision to buy or withdraw the gas is made. For day-ahead purchases or withdrawals this can be anywhere from 12 to 20 hours between nomination and delivery. Theoretically, if a company can make a more real-time storage withdrawal decision and has confidence that LNG storage gas will be delivered quickly when asked for, (e.g., due to having an on-system LNG facility), it will be less inclined to over-purchase gas in the day- ahead market. It can purchase less day-ahead gas and rely on LNG storage, or even same-day gas. In essence, it can make more precise gas purchase decisions.

Applying this to NMGC operations, with the LNG Facility, in contrast to its operation with the Keystone Facility, NMGC will need to buy less gas in the day-ahead market and can rely more on real time LNG decisions. Or, depending on the price of gas compared to the cost of LNG inventory, make more same-day gas purchases, with LNG storage gas available for quick backup. This is observed by comparing columns E and K in TCB-5. As discussed above, day-ahead purchases are purchases made on day ahead information which is often less accurate real-time information.

As discussed above, delivery of gas from the Keystone Facility to the Company is via the interstate pipelines and tied to NAESB scheduling cycles which results in lags between nominating gas and delivery of that gas. Orders for LNG storage gas from the Keystone Facility are sometimes subject to approval and control of the facility operator, capacity of the interstate pipelines, and other parties' withdrawal rights. The Keystone Facility can take as short as three hours or as long as 15-20 hours to deliver gas to NMGC following nomination. As a result, when ordering gas from Keystone Storage, NMGC must anticipate well ahead of time what conditions will be like when the nominated gas starts to flow. This lag time between nomination and delivery often affects the efficiency of decisions the Company makes regarding purchases of gas in the day-ahead or same-day markets. This in turn affects decisions regarding levels of line-pack to maintain in the Company's pipes, injections into and out of storage, and often leads to the Company making decisions to over-purchase gas or take gas from storage based on stale information. For the gas supply team, even a few hours can significantly affect information and alter decisions. The speed with which the LNG Facility can put vaporized gas into NMGC's system – as little as one hour – allows NMGC to make more accurate decisions based on more real-time data.

With the LNG Facility, both decision lead time and reaction time are reduced. Because with preparation, vaporized LNG can begin to flow onto the Company's system from the LNG Facility within one hour of being requested, the Company can decide as late as 7 a.m. that it will need vaporized LNG at 8 a.m. and it will receive the gas. Additionally, as this LNG Facility is being designed, the Company can decide daily that it needs no vaporized LNG, or as little as 20,000 Mcf/d or as much 195,000 Mcf/d of vaporized LNG based on real-time data. The Company can also decide to shift from vaporization to liquefaction and introduce 10,000 Mcf of additional LNG into the tank during the same day if need be. This flexibility and control in storge choices in turn allows the Company to have the confidence to reduce overbuys of day-ahead gas.

Q. PLEASE DESCRIBE HOW THE COMPANY WOULD EVALUATE WHAT PRICES WOULD AFFECT THE DECISION TO ENGAGE IN DAY-AHEAD OR SAME DAY PURCHASES OF GAS.

A. The Company does not believe a rigid formula can be employed, as there are numerous factors that should be analyzed before determining the best option for customers. The choices would be between the purchase of day-ahead gas, same-day gas, and cost of using LNG. The prices of purchased gas would be determined from the market, and the cost of LNG would be based on the weighted average cost of gas ("WACOG") for the gas in the LNG Facility plus variable expenses. Automatically purchasing the lowest cost gas would not always be the best strategy since variables such as availability, conservation of LNG inventory, or supplier reliability, among other things could lead to purchasing gas that is not the lowest cost alternative. Clearly the price comparison is important, but not the only consideration. The goal would be to make the best decision considering all factors, including price.

Q. PLEASE DESCRIBE WHAT IMPACT THE LNG FACILITY WOULD HAVE ON THE COMPANY'S APPROACH TO MAINTAINING LINE PACK IN THE COMPANY'S MAIN LINES.

A. As discussed above, with the LNG Facility, the Company anticipates making fewer over-purchases of gas in the day-ahead market because it will be able to rely on more real time data in deciding whether to take gas from the LNG Facility and or buy same-day gas. Nevertheless, the Company will still be faced with the prospect of handling volumes of overbought gas, and after a few years will not have the option of moving this excess gas into the Keystone Facility as it often does now. In lieu of the Keystone Facility, the Company can either move excess gas into unused capacity in the LNG Facility, into unused line pack space, or sell it on the market. Given the speed with which vaporized LNG can be brought into the system if needed, the Company will be afforded the opportunity to routinely operate with less line pack in its pipes and to more frequently move over-purchases of gas into line pack capacity. Additionally, the Company intends to retain some unused capacity in the LNG Facility and as described above, will have the ability to liquefy up to 10,000 Mcf/d of excess gas into the LNG Facility, provided the plant is not being called upon to send out gas. With the LNG Facility in place, the Company will be making fewer over-buys of gas, and given the speed and variability of the LNG Facility, will be able to operate with less line pack and move excess gas into unused line pack capacity or into unused LNG tank space.

An example of this is reflected in comparing columns C and J in TCB-5. Again, the exact numbers in J are not as significant as is the trend they illustrate. With LNG, line pack levels can trend lower, yet adjust quickly, and this again reflects the flexibility the LNG Facility affords the Company. Excess gas from day-ahead purchases (which are fewer and smaller as described above) can be moved directly into this line pack headroom, instead of into out-of-state storage, and this is more efficient for day-to-day operations.

Of course, reliability is still the key factor, and with the approach of any significant winter storm the Company can quickly build line pack by purchasing gas or vaporizing LNG storage gas into the system.

Q. PLEASE DESCRIBE WHAT IMPACT THE LNG FACILITY WOULD HAVE ON THE COMPANY'S APPROACH TO USING LNG THROUGHOUT THE WINTER ON NON-STORM DAYS.

A. As detailed throughout this Direct Testimony, the primary purposes of NMGC-owned on-system LNG storage is to have gas on hand, when needed, to provide reliability when gas supplies are interrupted or constrained and to mitigate the effects of price spikes on customers of NMGC. This typically happens during storms but can also happen in non-storm situations. As detailed in the operating plan above, and reflected in TCB-5, the Company intends to retain sufficient volumes of inventory in the LNG Facility to provide the Company with the ability to use vaporized LNG to satisfy these two primary purposes during storms (Column Q). This does not mean the Company cannot use the LNG Facility at other times in the winter. With vaporized LNG available on short notice, the Company will be able to choose between day-ahead purchases (K), same-day purchases (N), and LNG storage (L) to address weather forecasting variations and or gas cuts. Depending on prices, and month, the Company will choose between these three options. Early in the winter season (November and December), and when spot prices are in line with LNG storage prices, the Company will rely more heavily on purchases to obtain daily gas in order to preserve LNG storage gas for later in the season. As the winter season progresses

(January and February), and when spot prices are higher, the Company will have the option of relying more heavily on gas from the LNG Facility as opposed to purchases.

Another example of how the LNG Facility will facilitate daily operation is to consider LNG's ability to act as a peak shaver plant to address morning demand. NMGC is primarily a residential heating load utility. People wake up in the morning, turn on their heat and take their morning shower, and as a result the highest demand on NMGC's system is typically in the morning. A peak shaver storage facility allows a company, such as NMGC, to use storage gas to address these limited hours of peak demand. The amount of line pack in the system and the weather greatly dictates whether the Company has enough gas in the system to handle this load, or whether the Company needs swing gas to meet this demand. Logically, the best time to make this determination is in that morning period, and not the day before. LNG allows the Company to move this decision closer to the morning load demand periods since the Company has the ability to quickly access LNG storage. In this fashion the LNG storage, and line pack, together can be used to meet this morning demand profile. This is a fundamental difference afforded to the Company because of the LNG Facility. Examples of this can be observed in several instances in Column L in TCB-5.

Q. PLEASE DESCRIBE WHAT IMPACT THE LNG FACILITY WOULD HAVE ON THE COMPANY'S APPROACH TO USING LNG STORAGE WHEN FACING A SEVERE STORM.

A. The LNG Facility provides quick, Company-controlled access to LNG storage gas in the event of a severe storm approaching or affecting NMGC's service territory, or the sources of supply to the Company. The Company is designing its gas supply plan to ensure that it has sufficient gas in its LNG Facility throughout the winter to mitigate the impact of storms. The best way to accomplish this is to orchestrate the use of LNG Storage, day-ahead purchases, and same-day purchases to maintain LNG inventory at target levels. This means that depending on market prices, the Company early in the winter season may rely more heavily on day-ahead or same day purchases to obtain supply even if the Company has LNG inventory. To do otherwise would deplete the LNG inventory below target levels. This also means that the Company will inject liquefied gas into the LNG tank throughout the winter to replenish LNG inventory levels in anticipation of future storms. As described above, and shown throughout TCB-5, LNG inventory will vary depending on weather conditions, weather forecasts, prices of gas, and current and projected availability of gas supply (Q). The Company's intent is to manage the LNG levels such that the Company will be able to ensure supply and reduce the impact of price spikes related to storms throughout the winter. Yet, at the same time, there is room in this plan for the Company to still be able to use LNG and either day-ahead or same-day purchases during a storm. As detailed in TCB-5 the target levels in the plan are achievable under normal operation conditions (Column Q). Under the scenario depicted in TCB-5, the Company enters January with 691,000 Mcf and enters February with 688,000 Mcf. These amounts are able to handle severe storms.

Q. PLEASE DESCRIBE WHAT IMPACT THE LNG FACILITY WILL HAVE ON THE COMPANY'S APPROACH TO PURCHASING GAS TO COVER A SUPPLY CUT.

A. Gas cuts frequently happen for a variety of reasons. The LNG Facility gives the Company the ability to address all or part of a cut in delivery of contracted gas without needing to quickly enter into same-day gas market to cover the cut. As discussed previously, withdrawals from the LNG Facility would not be heavily relied on early in the winter season in order to preserve LNG inventory, but throughout the winter it does give the Company some additional measure of control over supply and price when facing a gas cut.

Q. PLEASE DESCRIBE WHAT IMPACT THE LNG FACILITY WILL HAVE ON THE COMPANY'S ABILITY TO HANDLE UNDER BUYS OR UNDER DELIVERIES FROM TRANSPORTATION CUSTOMERS.

A. Transportation customers are obligated by contract and rule to be in balance and to have purchased and received sufficient gas for shipping on the NMGC system to meet their needs. Sometimes this obligation is not met, either through the fault of the transportation customer or their supplier, and the transportation customer looks to NMGC as the last resort for gas to make up a negative imbalance. In these instances, NMGC's line pack or storage – either the Keystone Facility or the LNG Facility, can be used to make up this shortfall as has been done in the past.

Q. PLEASE IDENTIFY HOW MUCH GAS THE COMPANY COULD LIQUEFY AND PUT INTO THE LNG FACILITY DURING THE WINTER AND WHAT THIS WOULD MEAN TO THE AMOUNT OF LNG INVENTORY THE COMPANY ACTUALLY HAS AVAILABLE IN A TYPICAL WINTER.

A. The LNG Facility will be engineered to switch from vaporization to liquefaction within an 8-hour shift. Typically, the Company will be able to liquefy 6,500 Mcf to 10,000 Mcf into the LNG Facility on any given day as necessary. The Company anticipates that in an average winter month it will likely be in a position to liquefy on 12 -18 days of that month, meaning the Company might liquefy between 78,000 and 180,000 Mcf/month into the LNG Facility during each winter month. Assuming the Company starts with 900,000 Mcf in the LNG Facility on November 1st and liquefies an average of 120,000 Mcf each month between November and March inclusive, the Company could have access to approximately 1.5 Bcf of LNG throughout the winter.

TCB-5 itself does not reflect this level of liquefaction into the Tank (Column M), but it is possible to liquefy at this level given the operability of the LNG Facility. Also, it is important to note that at any time LNG inventory decreases, including use of the LNG Facility to address a severe storm, the Company can increase the days of liquefaction to refill the tank. For example, if a storm were to occur in the middle of January and reduce the LNG inventory, the Company could liquefy for a number of days in late January to help replenish the LNG inventory available for a potential February storm.

Q. PLEASE DESCRIBE WHAT IMPACT THE LNG FACILITY WOULD HAVE ON THE COMPANY'S APPROACH TO "TURNING" THE INVENTORY OF GAS IN THE LNG FACILITY AT THE END OF THE WINTER SEASON.

A. Historically in the spring, before the end of the PGAC year, the Company "turns" the gas in the Keystone Facility to provide the customers with the benefits of any low-cost gas in storage. This policy would continue in the future with the LNG Facility, assuming that the WACOG in the tank is such that customers would benefit and not be harmed by the activity. This depends on the economics of the market year to year and will only be done if it benefits the customers. There is no engineering need to "turn" the gas in the spring.

Q. PLEASE DISCUSS THE SIGNIFICANCE OF WITHDRAWAL OR VAPORIZATION RATES TO THE COMPANY'S OPERATING PLANS WITH THE LNG FACILITY.

A. The Company has up to 190,000 Mcf/d of withdrawal rights at the Keystone Facility and up to 195,000 Mcf/d of vaporization capacity at the LNG Facility.[4] Both Facilities offer withdrawals and vaporization at reduced volumes as necessary. Based on historical usage, the Company believes that the vaporization rate coupled with the size of this LNG Facility, and the operating plan, provides the Company the storage it needs to handle weather events it faces in a typical year.

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[4] As used here, gas is "withdrawn" from the Keystone Facility, while gas is "vaporized" into a gaseous state from the LNG Facility. The effect is the same. Withdrawn or vaporized gas is pipeline quality gas that is available to the Company for all uses.

Q. WILL GAS LIQUEFIED AND PLACED INTO THE LNG TANK IN THE WINTER LIKELY BE MORE COSTLY THAN GAS LIQUEFIED AND PLACED INTO THE TANK IN THE SPRING AND FALL?

A. Yes, this is probably true but hard to quantify. The Company can be somewhat selective in when it liquefies in the winter and can attempt to liquefy when winter gas prices are probably higher than shoulder season gas prices, but likely significantly less expensive than gas price spikes that can be experienced during storms. It is most important to have the tank as full as possible throughout the year so it can be ready to perform during a storm. This is achieved by using the LNG Facility wisely and liquefying LNG into the LNG Facility when feasible. It is equally as important to use the LNG Facility throughout the year to enhance reliability, mitigate the effects of price spikes, ensure operability, and enhance the Company's gas balancing activities. This LNG Facility is not intended to sit there as a silent sentinel until needed, but instead to be an integral part of the Company's gas supply and gas control activities to help ensure reliability and price stability. Additionally, even if the WACOG in the LNG Facility rises during winter, it will still almost certainly be less than the cost of gas available from suppliers during a severe winter event and would still help mitigate the effects of price spikes in such an event.

Q. DOES THE COMPANY FORESEE ANY ADDITIONAL PROPOSED USES OF THE LNG IN THE LNG FACILITY?

A. Yes, the Company anticipates being able to use a small portion of the LNG in the LNG Facility to supply backup gas to the isolated Brazos pipeline in north central New Mexico. As shown on NMGC Exhibit TCB-2, the Brazos pipeline is unique in that it is not connected to the remainder of NMGC's system, but provides natural gas to the towns of Dulce, Chama, parts of Tierra Amarilla and some customers in-between. Through the acquisition of two LNG tankers and vaporization units, the Company can backstop the gas supply the Brazos line currently relies on. Additionally, a third LNG tanker can be used to move LNG from the LNG Facility throughout the state as needed in emergencies and during normal construction. This would be an opportunity not available to the Company under its current Keystone Facility storage arrangement.

Q. WILL NMGC BE TERMINATING ITS RELATIONSHIP WITH THE KEYSTONE WEST-TEXAS STORAGE FACILITY?

A. Not immediately. The Company proposes to retain storage capacity at the Keystone Facility for a period. Once the LNG Facility comes online, and when contractual commitments with the Keystone Facility will allow, storage capacity will be ratcheted down. Over time – likely within one to three years from commissioning of the LNG Facility – the Company plans to eliminate its contract with the Keystone Facility. Retaining a portion of the storage capacity at the Keystone Facility will allow the Company to have "redundant" storage options for a brief time as the LNG Facility comes online, and the Company will continue to try to sublease a portion of its storage capacity at the Keystone Facility to minimize the cost impact.

Q. WILL NMGC BE RETAINING ITS CAPACITY ON THE INTERSTATE PIPELINES?

A. Yes. The Company's reliance on gas supply contracts, and the interstate transportation to deliver this gas to the Company is not affected by the LNG Facility. These firm interstate transport rights are valuable to the Company and its customers and will be retained.

Q. IN CONCLUSION, ASSUME HYPOTHETICALLY THAT PRICES SIMILAR TO THOSE WHICH OCCURRED IN FEBRUARY 2021 WERE TO OCCUR AGAIN IN ANOTHER WINTER STORM. PLEASE EXPLAIN WHAT IMPACT THE LNG FACILITY COULD HAVE ON THE OUTCOME OF SUCH AN EVENT.

A. The intent in planning for such a storm is to ensure that no curtailments of customers occur because of supply disruptions, and that the impact of price spikes is mitigated as much as possible.

As the storm approaches, the Company would have control over a significant volume of low-cost gas to address potential storm-related supply disruptions and to use in the event market prices spike. The Company would also have confidence in the deliverability of this gas to its system. NMGC would ensure that the LNG Facility was manned and fully operational to supply vaporized gas on short notice. Depending on the time of year, the Company would have at least, and potentially more than, 650,000 Mcf of LNG inventory available for storm related purposes.

As the storm begins, the Company would buy day-ahead gas and same-day gas as long as it could and as long as that gas was comparable in price to gas stored at the LNG Facility when the purchase is made. If the storm occurred on a weekend or holiday weekend, as occurred in 2021, the Company could be careful entering into ratable multi-day contracts for purchasing day-ahead gas, knowing it has reliable LNG available over the weekend if needed.

As the storm intensifies, and if supplies became constrained or if prices began to rise or spike, the Company could use LNG to supplement supply and in lieu of higher priced gas. The Company could vaporize LNG as necessary, and not necessarily at the full capability of the LNG Facility, knowing that it could quickly increase vaporization if required. Assuming hypothetically that the cost of the gas in the LNG Facility is $10.00/MMBtu, and that the price of gas in the market is comparable to what was seen during Storm Uri, assume $175.00/MMBtu for purposes of this hypothetical, and assuming that the Company uses 400,000 Mcf of vaporized LNG over several days, the LNG Facility could save the customers more than $60,000,000 in this scenario.

The prices used in this hypothetical are relatively conservative considering the prices that were seen in 2021. Obviously, the savings could be higher or lower depending on several factors including the timing, duration, and severity of the storm, and the prices of gas over the period of the storm. This hypothetical shows that the LNG Facility could impact the price volatility and impact on customers. Most importantly, using the LNG Facility in this manner would help reduce the likelihood of customer curtailments by supplementing supply, even if prices remained reasonable.

Q. PLEASE DESCRIBE HOW THIS PROPOSED CCN TIES TO THE COMPANY'S LAST INTEGRATED RESOURCE PLAN "IRP" FILED IN 2020.

A. In its 2020 IRP, NMGC described the Company's then-existing storage arrangement as being contracted-for storage in west Texas which is used "as a swing supply source during higher demand periods, a replacement supply during times of supply disruption, and to provide daily operational balancing." The IRP further stated that NMGC has "rights to withdraw up to 217,500 MMBtu/d" during peak winter months, subject to "contractual force majeure provisions at the discretion of the provider, which may reduce NMGC's access to its gas in storage. In addition, the IRP points out that "If storage is located directly on the NMGC system rather than an interstate pipeline, NMGC can dispatch gas based on need rather than being limited to the national gas scheduling cycles, which could delay gas flow for hours." Finally, the IRP stated that the "the cost for these storage services is expected to increase in the future due to demand from other regional utilities, new gas-fired generation in Mexico, and activity in the Permian Basin."

While the Company when it filed its 2020 IRP could not foresee the events of February 2021, the Company's IRP identified the storage arrangements it had at the time, and identifies factors potentially impinging on that resource. The Company having experienced the February 2021 Winter Event that impacted the Company's storage arrangements, is filing its Application for a CCN for construction of an LNG Facility to help alleviate the pressures identified in the 2020 IRP.

Q. PLEASE SUMMARIZE WHY THE COMPANY BELIEVES THAT THE LNG FACILITY IS THE BEST CHOICE FROM AN OPERATIONAL PERSPECTIVE.

A. The Company believes that the LNG Facility is the best choice from an operational perspective because:

a. The LNG Facility will be located directly on the Company's system and therefore not dependent on the interstate pipelines or any non-Company pipelines for delivery to the Company's customers.

b. The LNG Facility will be located closer to the Company's primary load centers and therefore provide quicker response when activated and allows for the use of displaced gas throughout the Company's system.

c. The LNG Facility will be operated and controlled by NMGC solely for Company needs, as opposed to being a storage facility owned and controlled by a third-party operator with several customers.

d. The LNG Facility will give the Company the opportunity to hedge against price spikes similar to those recently experienced in natural gas markets by allowing the Company to liquify lower-cost gas into the LNG Facility for use when needed. The prices during Storm Uri highlighted the critical problem that price spikes present.

f. The LNG Facility will allow the Company to significantly reduce its dependence on the Keystone Facility and offset the costs associated with this LNG Facility. While the goal is ultimately to eliminate the Company's reliance on the Keystone Facility, the opening of the LNG Facility will immediately lessen the Company's reliance on the Keystone Facility.

g. The LNG Facility allows the Company to develop a valuable asset in New Mexico to serve NMGC customers. The LNG Facility will be in Rio Rancho, New Mexico; pay taxes in New Mexico; hire New Mexicans for operation of the LNG Facility; and typically be stocked with gas from the large producing basins in and near New Mexico.

h. The LNG Facility provides the Company with the opportunity to explore the possibility of utilizing LNG for new business opportunities to offset some of the cost of the LNG Facility. For example, as discussed on page 23 of the Company's 2020 Integrated Resource Plan ("IRP") the Company is evaluating the feasibility of using LNG for use remotely throughout the state to supply natural gas to unserved or underserved areas and communities. To be clear, the primary reason for the LNG Facility is to increase reliability of service to NMGC's customers and to reduce the impacts of price spikes on NMGC customers. This will always be the highest priority for the LNG Facility. However, NMGC may find other beneficial uses for the LNG gas in the LNG Facility, when reliability and price volatility issues are not in play.

Q. DOES THIS CONCLUDE YOUR TESTIMONY.

A. Yes.

EDUCATIONAL AND PROFESSIONAL SUMMARY

Name:	Tom C. Bullard, P.E.
Address:	P.O. Box 97500 Albuquerque, NM 87199
Education:	B.S., Mechanical Engineering, June1984 New Mexico State University, Las Cruces, NM Master of Business Administration, May 1992 University of Phoenix, Phoenix, AZ Registered Professional Engineer (NM, AZ)

Professional Experience:

New Mexico Gas Company, Inc.
Albuquerque, NM

Vice President, Engineering, Gas Management and Technical Services	2017- Present
Director, Engineering Services	2011 - 2017
Manager, Transmission Engineering	2006 – 2011
Professional Engineer	2003 – 2006
Manager, Engineering Support	2001 – 2003
Senior Engineer	2000 - 2001

City of Las Cruces Gas Department
Las Cruces, NM

Gas Director	1997 – 2000

Rio Grande Natural Gas Association
Las Cruces, NM

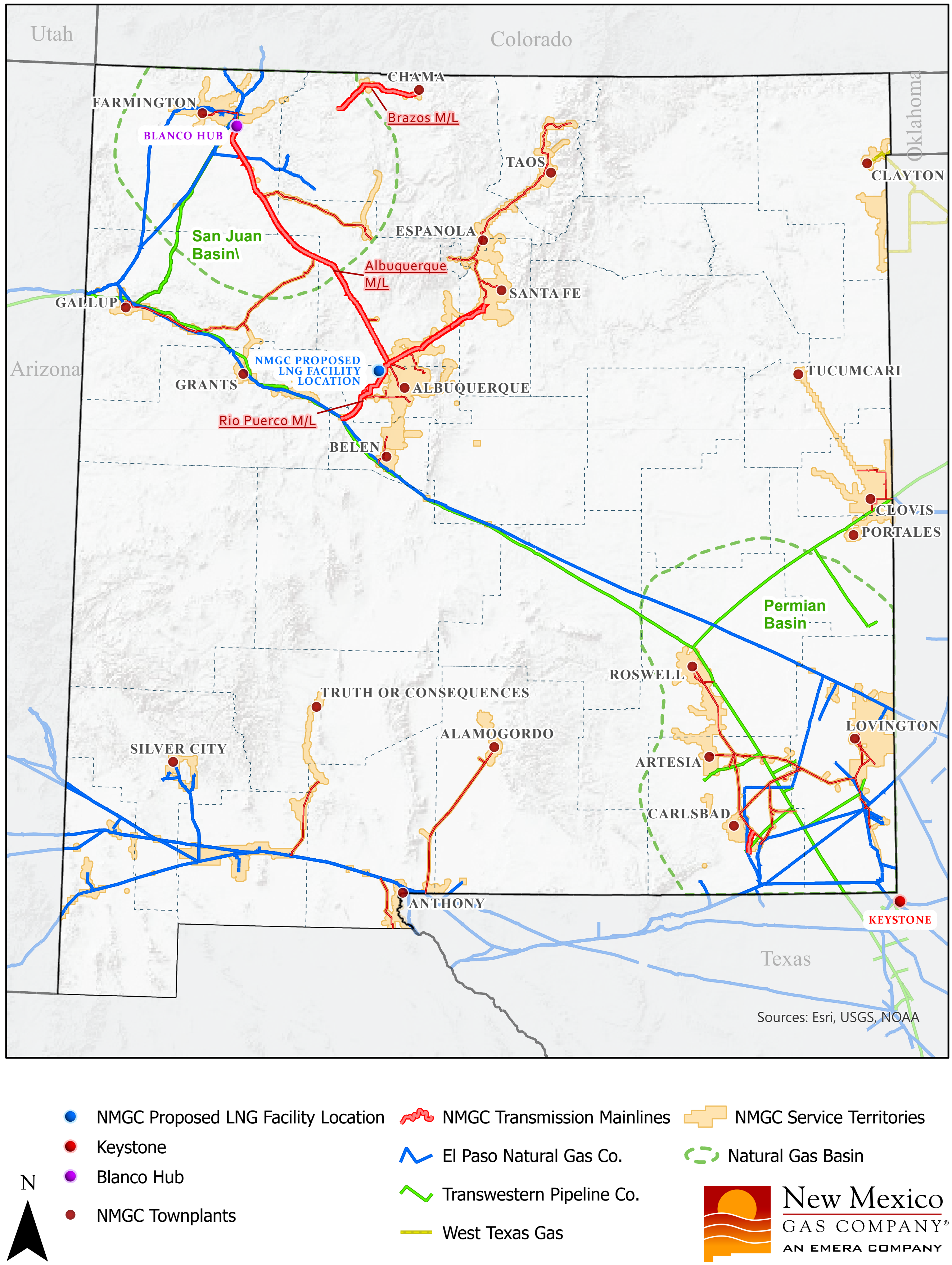
Administrator	1993 – 1997

Allied-Signal Aerospace Company
Phoenix, AZ

Project Engineer	1984 - 1993

Testimony before the New Mexico Public Regulation Commission:

Case No. 19-00317-UT – 2019 Rate Case
Case No. 19-00318-UT – Brazos Mainline Purchase
Case No. 20-00130-UT – 2020 Purchase Gas Adjustment Clause
Case No. 21-00095-UT – 2021 Winter Weather Event (Storage Options Compliance)
Case No. 21-00267-UT – 2021 Rate Case


Utah
Colorado
Oklahoma
Arizona
Texas
CHAMA
FARMINGTON
BLANCO HUB
Brazos M/L
TAOS
CLAYTON
ESPANOLA
San Juan Basin\
Albuquerque M/L
SANTA FE
GALLUP
NMGC PROPOSED LNG FACILITY LOCATION
GRANTS
ALBUQUERQUE
TUCUMCARI
Rio Puerco M/L
BELEN
CLOVIS
PORTALES
Permian Basin
ROSWELL
TRUTH OR CONSEQUENCES
LOVINGTON
ALAMOGORDO
SILVER CITY
ARTESIA
CARLSBAD
ANTHONY
KEYSTONE
Sources: Esri, USGS, NOAA
N
NMGC Proposed LNG Facility Location
Keystone
Blanco Hub
NMGC Townplants
NMGC Transmission Mainlines
El Paso Natural Gas Co.
Transwestern Pipeline Co.
West Texas Gas
NMGC Service Territories
Natural Gas Basin
New Mexico GAS COMPANY®
AN EMERA COMPANY

THE LISBON GROUP, LLC

Preliminary Front-End Engineering Design Report (pre-FEED Report)

prepared for

New Mexico Gas Company, Inc.

October 12, 2022

NEW MEXICO GAS COMPANY
RIO PUERCO LNG PLANT

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RIO PUERCO LNG PLANT

BOOK 1 OF 1

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1. FOUNDATION DOCUMENTS

New Mexico GAS COMPANY

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EXECUTIVE SUMMARY

New Mexico Gas Company (NMGC) is a member of the Emera family of energy companies. NMGC is headquartered in Albuquerque and is the largest natural gas utility in New Mexico. The Company is situated between two large natural gas production basins, the Permian Basin in southeast New Mexico, and the San Juan Basin in northwest New Mexico. NMGC operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout the state.

Currently NMGC uses contracted off network underground gas storage capacity of 2.7 BCF in West Texas (leased capacity from Kinder Morgan) to help ensure gas availability and decrease the gas supply cost during cold weather / high demand periods. This leased capacity is expensive and has been unreliable resulting or contributing to some network outage and expensive spot market gas purchases in recent years.

To improve gas reliability / cost-effectiveness, New Mexico Gas Company is proposing to construct an LNG Facility in Rio Rancho, NM to provide on-network gas storage. The functional requirements of the proposed LNG facility that have been defined based on best industry practice, cost-benefit analysis, federal and state safety and design regulations, and due consideration of industry environmental trends. The planned LNG facility will:

- Store 1 BCF (~12 million gallons) net natural gas in a single containment LNG storage tank.
- Reliably be able to send-out 195 MMscfd natural gas to either of the on-network 16” or 24” transmission pipelines flowing through the eastern edge of the plot. To help achieve high reliability and availability of the vaporization facilities three parallel 65 MMscfd equipment sets (LNG pumps, vaporizers, and heating systems) are installed with interconnects.
- To fill and maintain LNG level in the storage tank, the facility will liquefy 10 MMscfd (net in-tank) of feed gas from either of the two transmission pipelines.

A PreFEED project description was issued in early September 2022 and updated on October 12, 2022, to make some minor corrections and reflect finalization of a decision regarding send-out capacity. The following areas of the Pre-FEED are the primary updates in this October revision:

- Cost and descriptions are updated to reflect a natural gas fired Essential Gas Generator capable of sending-out gas at the full vaporization rate of 195 MMscfd during a grid power outage.
- Terminology explaining the installed vaporizer capacity was refined in several documents to reflect 195 MMscfd send-out capacity and associated reliability of this system.
- Some additional documentation was supplied regarding hazard detection and management, dispersion and thermal radiation exclusion zone analysis, and related subjects.
- Clarification regarding the ability of the facility to operate in LIQUEFACTION mode throughout the year (including winter) and to be able to simultaneously liquefy and conduct LNG trailer unloading operations.

The Project Description includes the documents listed on the following page.

FOUNDATION DOCUMENTS

- N2101-ES-001-1 EXECUTIVE SUMMARY
- N2101-B-001-0 PROJECT DESCRIPTION

PHILOSOPHIES

- N2101-P-001-1 RELIEF AND BLOWDOWN PHILOSOPHY
- N2101-P-002-1 ISOLATION AND MAINTENANCE PHILOSOPHY
- N2101-P-003-1 PLANT SEGREGATION PHILOSOPHY
- N2101-P-004-1 EQUIPMENT SPARING PHILOSOPHY

PROCESS FLOW DIAGRAMS

- N2101-PS-001-1 COVER SHEET
- N2101-PS-002-1 PROCESS DRAWING LIST
- N2101-PS-003-1 PFD LEGEND SHEET
- N2101-PS-004-1 BLOCK FLOW DIAGRAM
- N2101-PS-005-1 RECEPTION AND INTERFACES
- N2101-PS-007-1 MS ADSORPTION PRETREATMENT
- N2101-PS-010-1 LIQUEFACTION
- N2101-PS-015-1 LNG STORAGE TANK AND VAPORIZATION
- N2101-PS-016-1 BOIL-OFF GAS COMPRESSORS
- N2101-PS-020-1 FUEL GAS
- N2101-PS-021-1 HEATING MEDIA
- N2101-PS-022-1 BOG COMPRESSOR GLYCOL COOLING MEDIA
- N2101-PS-023-1 INSTRUMENT AIR AND NITROGEN SYSTEM

UFD HEAT AND MATERIAL BALANCES

- N2101-PS-101-1 CASE 1: LIQUEFACTION
- N2101-PS-102-1 CASE 2: HOLDING
- N2101-PS-103-1 CASE 3: VAPORIZATION

DRAWINGS AND LISTS

- 5.1 N2101-L-402-0 PLOT PLAN
- 5.2 N2101-IR-001-0 EQUIPMENT LIST
- 5.3 N2101-EIR-001-1 ELECTRICAL LOAD LIST

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- N2101-PS-015-1 LNG STORAGE TANK AND VAPORIZATION
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- 5.1 N2101-L-402-0 PLOT PLAN
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- 5.3 N2101-EIR-001-1 ELECTRICAL LOAD LIST

NEW MEXICO GAS COMPANY

Project Name: Rio Puerco LNG Plant

Document Name:	Project Description
Document Number:	N2101-PB-002
Revision:	0
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Holds

No.	Description
1	

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1 ABBREVIATIONS

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BAHX	Brazed Aluminum Heat Exchanger
BOG	Boil-off Gas
DCS	Distributed Control System
EPC	Engineering, Procurement and Construction
ESD	Emergency Shut Down
FEED	Front End Engineering and Design
FGS	Fire & Gas System
HC	Hydrocarbon
HP	High Pressure
LNG	Liquefied Natural Gas
MAOP	Maximum Allowable Operating Pressure
MCC	Motor Control Center
MCR	Main Control Room
MMscfd	Million Standard Cubic Feet per Day
NFPA	National Fire Protection Association
PSV	Pressure Safety Valve

2 PURPOSE

This Project Description is intended to describe the Rio Puerco LNG Facility. It provides an overall description of the facility and associate key philosophical principles considered in its development.

3 PROJECT DESCRIPTION

New Mexico Gas Company (NMGC) is a member of the Emera family of energy companies. NMGC is headquartered in Albuquerque and is the largest natural gas utility in New Mexico. The Company is situated between two large natural gas production basins, the Permian Basin in southeast New Mexico, and the San Juan Basin in northwest New Mexico. NMGC operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout the state.

Currently NMGC uses contracted underground gas storage capacity of 2.7 BCF in West Texas (leased capacity from Kinder Morgan) to help ensure gas availability and decrease the gas supply cost to their rate base during cold weather / high demand in transmission network during winter. This leased capacity is expensive and has been unreliable resulting or contributing to some network outage and expensive spot market gas purchases in recent years.

To improve gas reliability / cost-effectiveness, New Mexico Gas Company is proposing to construct an LNG Facility in Rio Rancho, NM to provide on-network gas storage. The functional requirements of the proposed LNG facility that have been defined based on best industry practice, cost-benefit analysis, federal and state safety and design regulations, and due consideration of industry environmental trends. The planned LNG facility will:

- Store 1 BCF (~12 million gallons) net natural gas in a single containment LNG storage tank.
- Reliably be able to send-out 195 MMscfd natural gas to either of the on-network 16” or 24” transmission pipelines flowing through the eastern edge of the plot. To help achieve high reliability and availability of the vaporization facilities three parallel 65 MMscfd equipment sets (LNG pumps, vaporizers, and heating systems) are installed with interconnects.
- To fill and maintain LNG level in the storage tank, the facility will liquefy 10 MMscfd (net in-tank) of feed gas from either of the two transmission pipelines.

The plant will be located outside Albuquerque with the Rio Puerco Mainline 16-inch and 24-inch parallel transmission pipelines running through the east edge of the plot. Feed gas for liquefaction and regasification shall be supplied by one or both pipelines and vaporized gas will be injected into the NMGC pipeline and distributed via the NMGC transmission system.

3.1 SITE DESCRIPTION

Rio Puerco LNG is proposed to be located at a 160-acre site to the west of Albuquerque, N.M. The property is undeveloped and is part of a larger master-planned area that is zoned for industrial and commercial uses (approximate site coordinates: 35°10'59.16"N, 106°47'50.95"W). This site was selected for a number of reasons that make it technically suitable and cost-effective:

- Proximity to power lines and gas pipelines running through the site.
- Proximity to infrastructure for construction and operations with the eastern edge of the site located roughly 3000' from Paseo Del Norte Blvd. NE, commuting distance to Albuquerque, reasonable proximity to Interstate 40.
- Undeveloped, unpopulated, sufficiency sized plot and appropriately zoned site.

A photo of the proposed site is seen in Figure 1.

Figure 1. Proposed Rio Puerco LNG facility site

A picture showing details of the plot are seen in Figure 2. As can be seen in the site Plot Plan (Drawing N2101-L-402), the LNG facility is located primarily in the center of the plot immediately south of the power lines.

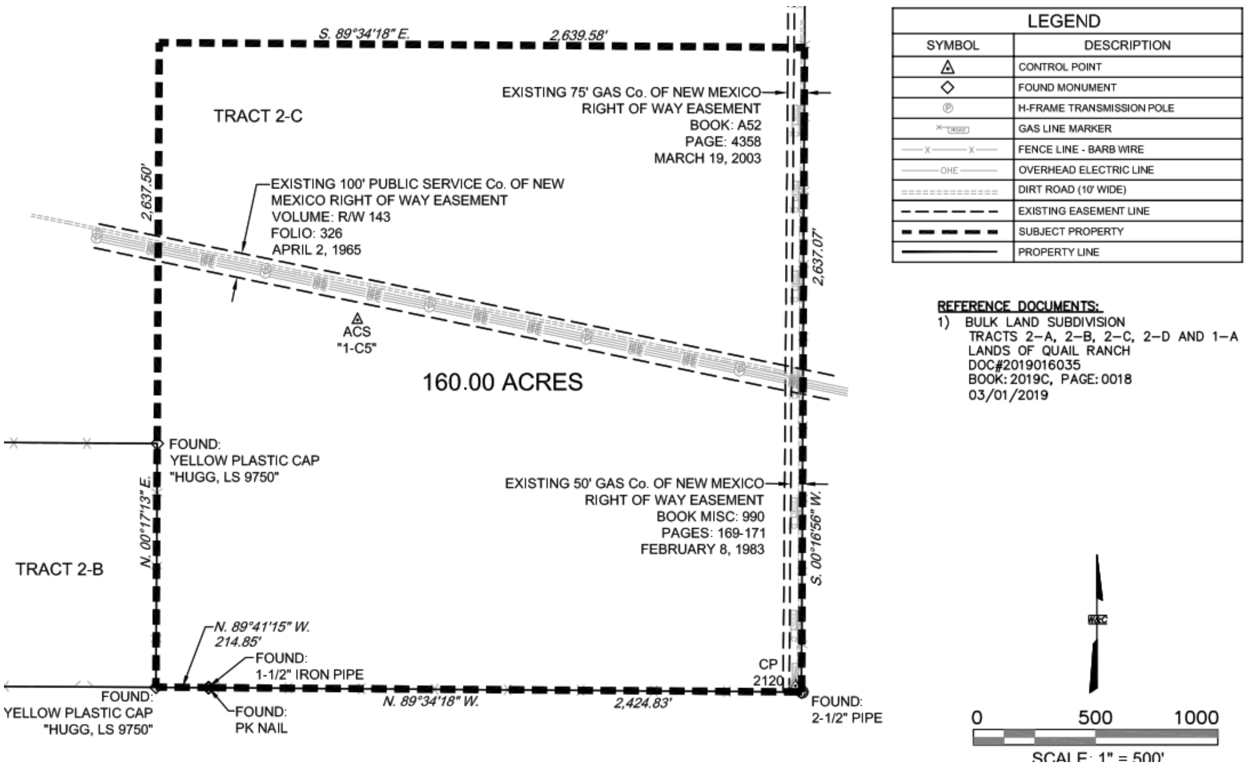

Figure 2. Plot drawing showing location, power lines, and gas pipelines.

3.2 PROCESS DESCRIPTION

Rio Puerco LNG facility is equipped with three operating modes:

> HOLDING – The facility has LNG in the storage tank but is neither adding to gas inventories or withdrawing through Vaporization or Liquefaction activities. During this time Boil-off Gas must be managed and control and safety systems are operational.
>
> VAPORIZATION – The facility is actively vaporizing and sending-out gas. During this time, in addition to HOLDING mode functionality, the LNG pumps and vaporization facility are operational. Reliable performance during this period is critical because it underpins the purpose of the facility.
>
> LIQUEFACTION – The facility is activity liquefying feed gas from the pipeline to rebuild inventories of stored gas. During this time, in addition to HOLDING mode functionality, the pretreatment and refrigeration systems are operational.

Rio Puerco LNG is being designed to build levels in the storage tank when required throughout the year. This means it is possible to operate liquefaction throughout the year including through peak heat of the summer as well as throughout the winter months. It is also possible to operate LNG unloading facilities during liquefaction to assist in tank level recovery if desired.

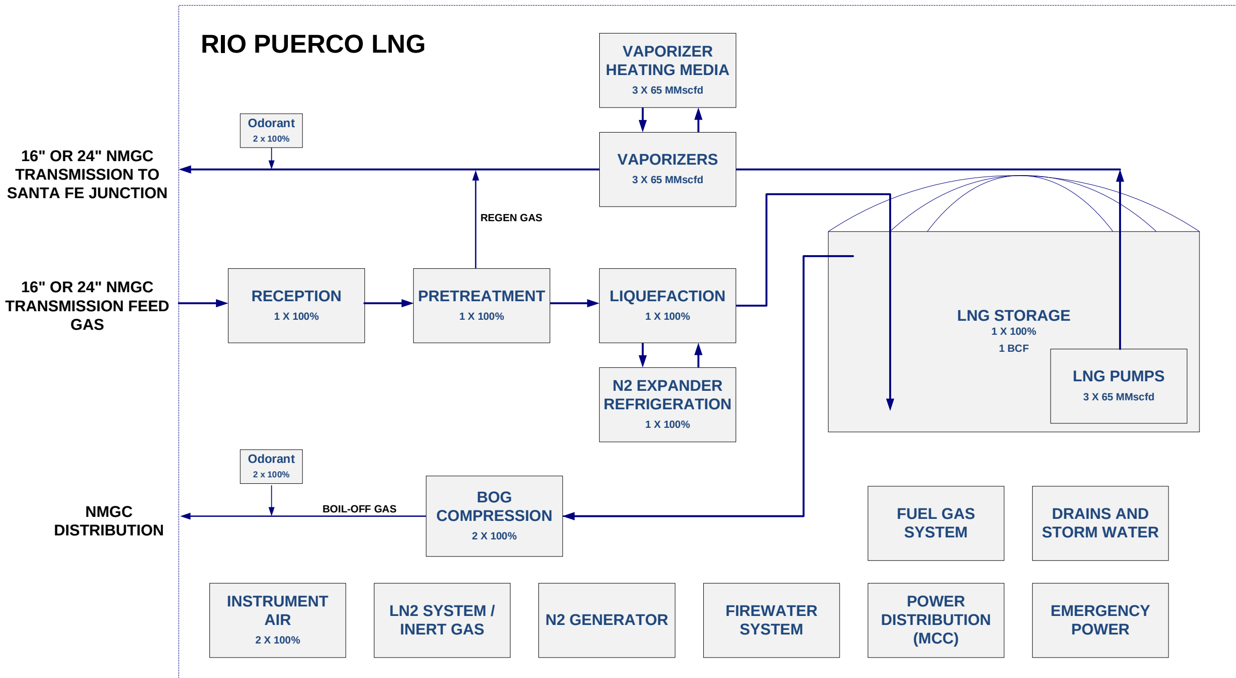

Figure 3. Rio Puerco LNG Block Flow Sketch

Referring to Figure 3 the following unit operations are of particular interest:

- **Reception** is simply the term use for interconnection to one of the NMGC transmission pipelines (pipeline #1). It consists of the valving and instrumentation to measure flow and automatically isolate the LNG facility from the pipeline if required. Reception facilities also include filter separator/ coalescer capable of removing free liquids and 99.0% of entrained liquids greater than 0.3 micron upstream of Pretreatment.

- **Pretreatment** consist of a peak shaver LNG industry standard 3-bed Molecular Sieve system that removed water, CO2 and mercaptan from the feed gas. These components freeze when the gas is cooled and liquefied into LNG. The system normally removes CO_2 down to <50 ppm(v) and water to <0.1 ppm(v). The beds are regenerated with a slip stream of hot treated gas referred to a regeneration or regen gas. This gas heats a bed that has been loaded with impurities and then sweeps them out of the system for return to the other transmission pipeline (#2).

  Molecular sieve pretreatment offers a number of advantages because it is the most cost-effective method of removal CO_2 / water, and it is a closed system meaning there is no venting of concentrated CO_2 through would be required if amine technology we required (the leading alternative).

- **Liquefaction** consists of the separators, heat exchangers, controls and instruments, valving, piping, and ancillary devices required to cool, condense, and otherwise process the treated natural gas stream into an LNG stream suitable for storage in the LNG Storage Tank. It is fully integrated with Refrigeration and typically supplied by the same vendor.

- **Refrigeration** consists of a dual N2 Expander-type refrigeration system that provides the cold required to support liquefaction. It is capable of producing a net of 10 MMscfd equivalent of LNG to the storage tank. Dual N2 expander refrigeration processes have been widely applied at many peak shaving plant. It is very popular in the 10 MMscfd liquefaction range because it is cost-effective and operated with an N2 refrigerant that is inert (non-flammable) and easy to make and store. Additionally, using an N2 refrigerant (derived from air) means that any losses of refrigerant to the air does not pose any environmental concern.

  The Refrigerant Compressor (K-4001) is a multi-stage centrifugal compressor that increases the pressure of the N2 refrigerant so it can circulate around the refrigeration system. This compressor required inter and aftercoolers that cool the gas back to close to ambient temperatures before the high-pressure warm refrigerant is directed to the coldbox that includes an aluminum plate fin heat exchanger. The exchanger the cools the refrigerant stream to either an intermediate or lower temperature before the precooled are isentropically expanded in turboexpanders that drop the temperature as they reduce pressure of the refrigerant. The cold and very cold resultant streams are returned to the exchanger where they precool in the incoming warm refrigerant and cool and condense the natural gas to form LNG. The work extracted from the isentropically expanded refrigerant stream is recovered in single-stage centrifugal compressor stage (recompressor) that compresses the N2 refrigerant in an appropriate area in the process.

- **LNG Pumps** are installed in pump wells from the top of the LNG storage tank and supply head to the LNG to pressurize to above pipeline pressure and transfer LNG to the vaporizers. This industry standard approach to pump installation uses well-proven pumps and avoids LNG tank penetrations below the liquid level in the storage tank to decrease the risk of LNG releases in the storage area.

  The LNG pumps are installed in a 3 x 65 MMscfd arrangement with a vaporization capacity of 195 MMscfd with all three pumps operational. Each pump is driven by an integral submerged electric motor that is cooled by the LNG and is operated by variable speed drive to facility start-up and increase operational flexibility. A fourth 24” pump column is planned on the LNG storage tank dome to facilitate addition of future installed redundancy or capacity increase if beneficial.

- **Vaporizers** are welded Shell & Tube Vaporizers (STV) that are installed in the LNG storage impoundment area. LNG flows tube-side in these vertically installed exchangers and the heating media on the shell-side is a water-glycol mix that offers excellent heat transfer, freeze point suppression (e.g., can work with the cold LNG), good corrosion properties, and is widely used at most peak shavers. The STV-type vaporizers were selected because they are the most cost-effective and can be located in the LNG storage impoundment area minimizing the extent of LNG the plant to enhance safety.

  Matching the arrangement of the LNG pumps, 3 x 65 MMscfd STV are included to support reliable vaporization capacity of 195 MMscfd with all three pumps and vaporizers operational.

- **Vaporizer Heating Media** supplies the warm water-glycol heating media to the STV vaporizers. This consists of a gas fired water-glycol heater (often referred to as a boiler) as well as glycol-water circulation pumps. The Vaporizer Heating Media systems are located in a building remote away from the LNG and hydrocarbon processing areas and the glycol is circulated via insulated carbon steel lines to / from the Vaporizer area.

  The Vaporizer Heating Media pumps and fired heaters match the arrangement of the LNG pumps and STV vaporizers with a 3 x 65 MMscfd arrangement designed for vaporization capacity of 195 MMscfd with all sets of equipment running. Note that any LNG pump can operate with any STV and any water-glycol heater arrangement for operational flexibility and high reliability.

- **LNG Storage** allows the storage of ~1 BCF of liquefied LNG at cryogenic temperatures of approximately -260 ^{o}F and is equipped with a number of features single containment construction with an inner and outer tank. The inner tank is constructed of a material suitable for containing LNG at the very low temperature and is supported by structural insulation above the foundation. There are also foundation heating elements that prevent cold propagation into the group where it can cause problems. The outer tank is constructed of a less expensive material and perlite insulation fills the space between the inner and outer tank so that heat leak results in a boil-off rate of ~0.05% of the tank contents per day.

  The LNG storage tank roof is called the Tank Dome and houses the LNG pump columns, instrumentation, relief valves, and the piping, valving, instrumentation, etc. required to monitor and operate the LNG storage tank.

- **BOG Compression** is required because once there is LNG in the storage tank BOG is produced by heat ingress from the environment, various process operations, and other environmental causes. BOG compression must be highly available / reliable because to allow all the BOG to be recovered and either used as fuel or send-out to the NMGC distribution line depending on operating mode. To accomplish this 2 x 100% BOG compression is provided such that all the design BOG can be compressed with a single compressor while the other is in stand-by or undergoing maintenance or repair.

- **Major Utilities** systems are shown as blocks in Figure 3. Similar to BOG compression and vaporization facilities, critical utilities are required to be very reliable. Full description of the reliability / redundancy of these systems is described in the Equipment Sparing Philosophy (N2101-P-004) and select examples to illustrate the objectives of the Rio Puerco LNG facility are as follows:
  - **Air System:** There redundant (2 x 100%) air compression trains including compressors and driers to help ensure there is always a supply of reliably instrument air for the plant for operating pneumatic valves and other services.
  - **N2 System:** N2 is supplied by two sources to offer redundancy. The primary source is a 1 x 100% N2 generator that supplies high purity, dry N2 using an air compressor, carbon bed, N2 generator, filters and associated piping, valving, controls, etc. This system is backed-up by liquid N2 Dewar and vaporizer.
  - **Power Systems:** The primary power supply for the Rio Puerco LNG facility is grid electrical power. In the event of a power outage an Essential Natural Gas Generator provides sufficient power to run all the essential facility loads including BOG compression and 195 MMscfd of gas vaporization facilities as well as all control and safety systems on a continuous basis. The generator supports black-start capability. All control systems are further backed-up by a UPS to keep systems live through the blackout.

The following sections describes the operating equipment during each of the operating modes.

3.2.1 HOLDING Mode

HOLDING mode is the simplest operating mode for the facility with minimal equipment and subsystems operating. During this mode critical utilities, the LNG storage tank, safety and control systems, and BOG Compression are active. These are all high priority systems and great effort has been paid to ensure they reliable operate. For instance, a full spare BOG Compressor is included in the design. This means that even if one machine is down for maintenance or repair, all the BOG produced in the LNG storage tank can still be compressed and send-out to the NMGC distribution piping connected to the plant.

The equipment operating in HOLDING Mode are highlighted below in Figure 4.

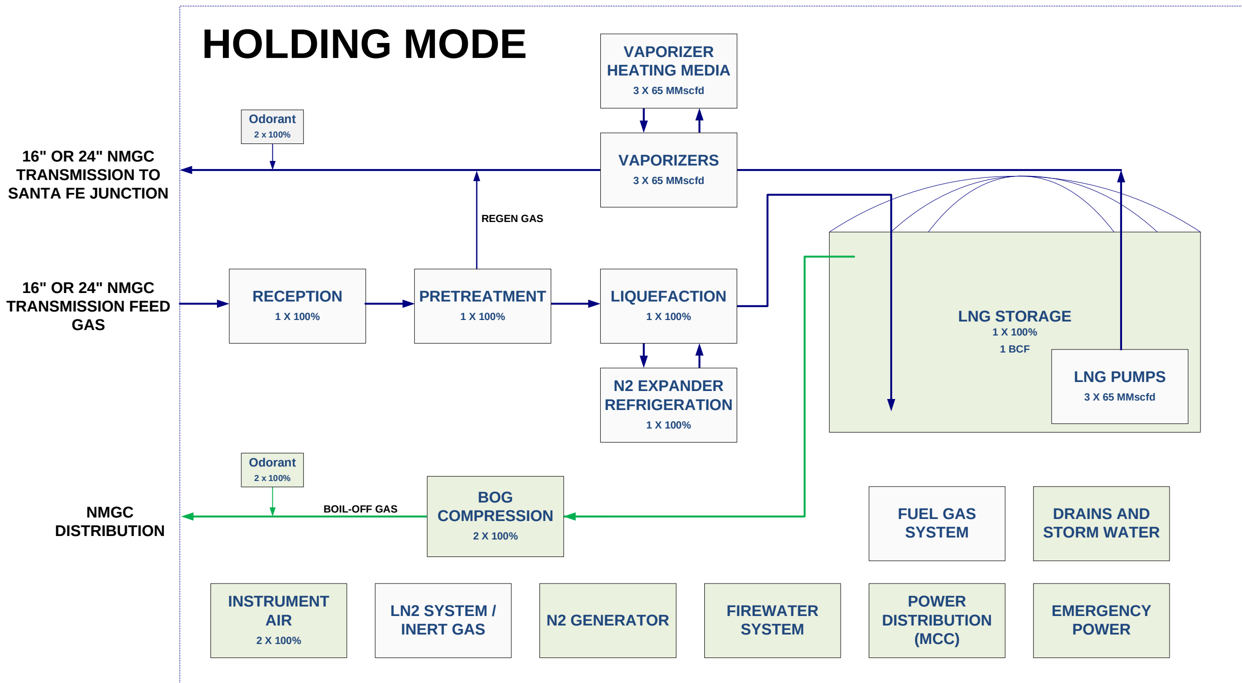

Figure 4. HOLDING Mode - active units highlighted in green.

3.2.2 Vaporization Mode

VAPORIZATION Mode refers to an operational mode of the facility where LNG stored in the storage tank is pumped to transmission line pressures, send through the STV vaporizers, and then directed to NMGC transmission lines to provide reliable on-grid natural gas for their network. This operational mode decreases the level in the storage tank. The active facilities include everything that was functional for HOLDING mode as well as the LNG Pumps, STV Vaporizers, Vaporizer Heating Media, and the send-out pipeline to Transmission.

Extreme cold weather tolerance is a critical functional requirement of the VAPORIZATION Mode equipment because this equipment is more likely to be required to function during cold weather when supply disruptions or shortfalls are more likely to occur. The Rio Puerco LNG facility will form part of critical energy supply infrastructure to New Mexico and vaporization facilities are designed to be able to operate below the coldest low ambient temperature (design = -20 ^{o}F) vs. -17 ^{o}F recorded in January 1971, over 50 years ago.

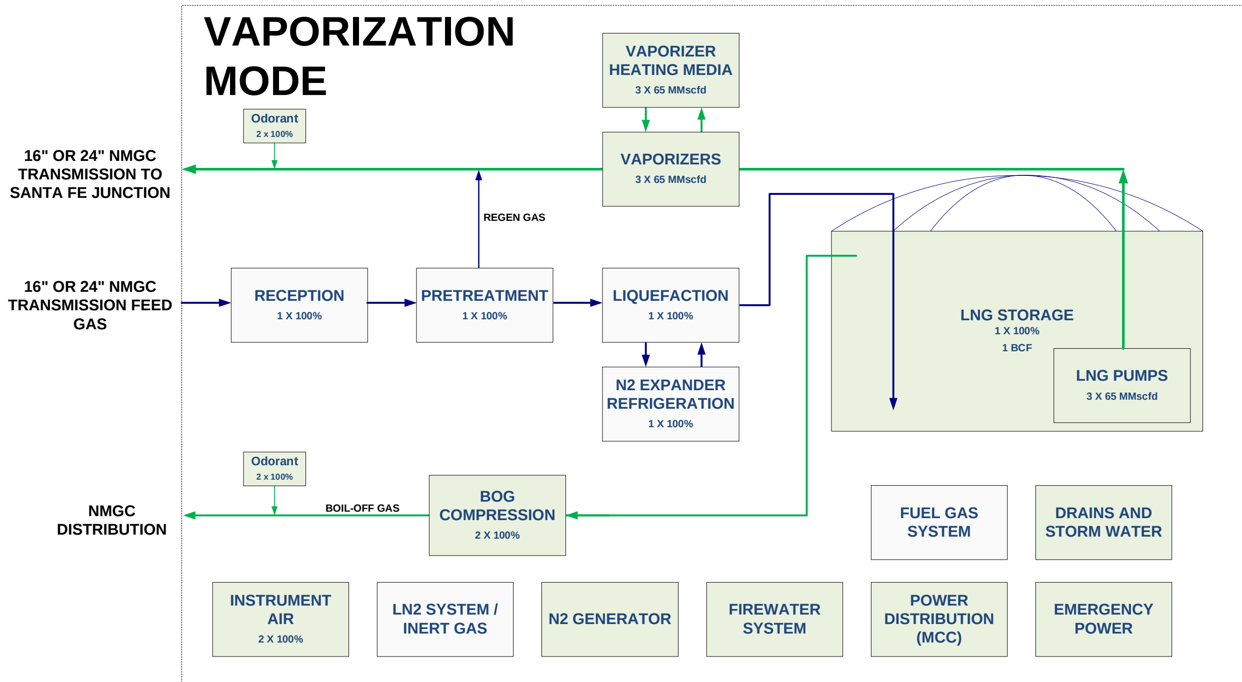

Figure 5. VAPORIZATION Mode - active units highlighted in green

3.2.3 Liquefaction Mode

LIQUEFACTION Mode refers to an operational mode where the facility is building inventory in the LNG storage tank by running the LNG production liquefaction (Reception, Pretreatment, Liquefaction, and Refrigeration).

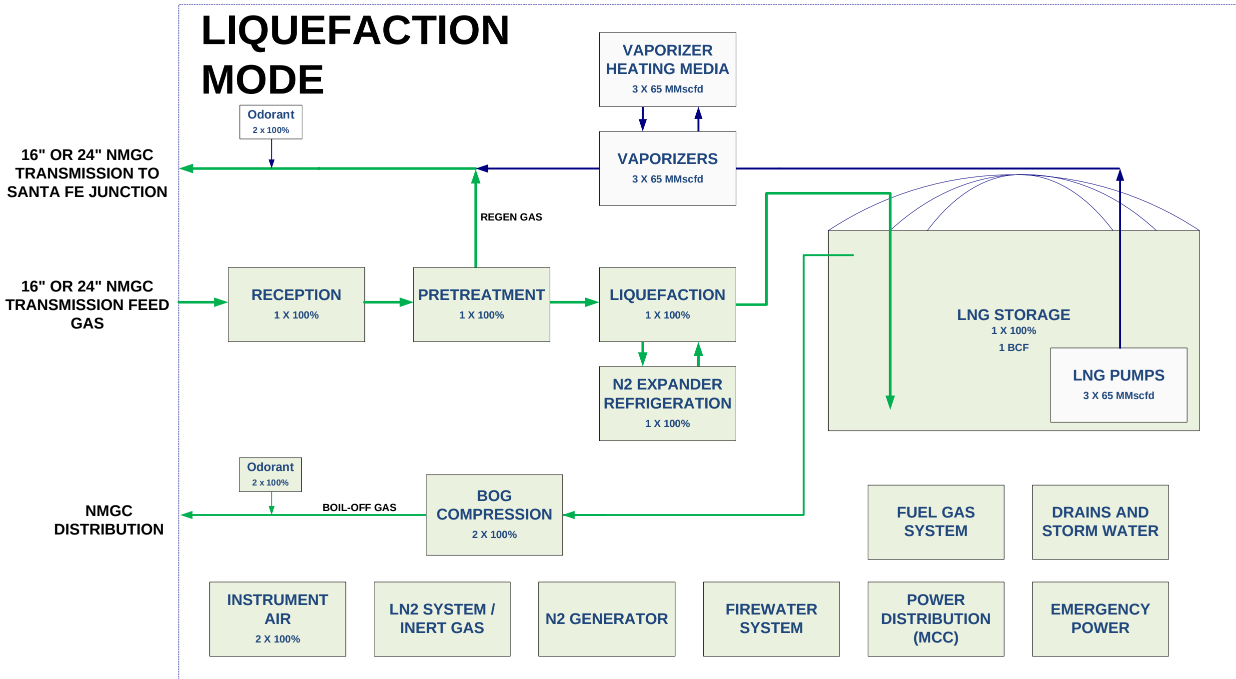

Figure 6. LIQUEFACTION Mode - active units highlighted in green

4 DESIGN CRITERIA AND CONSTRAINTS

4.1 CODES AND STANDARDS

The following codes and standards are applicable to the project. If there is a conflict among different editions of the codes and standards referenced shall have the following prevailing hierarchy:

1) Federal Requirements
    a. **DOT 49 CFR 193**: Liquefied Natural Gas Facilities: Federal Safety Standards
    b. **NFPA 59A:** Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG) – 2001/2006/2013 as referenced in 49 CFR Part 193 American National Standard Institute (ANSI)
2) State Requirements

Any conflicts within 49 CFR Part 193 or any other applicable codes & standards, the requirements in 49 CFR Part 193 shall prevail followed by NFPA 59a, followed by applicable state and local level requirements.

DOT 49 CFR 193 incorporates NFPA 59a into law by reference and this standard, in turn, is an “umbrella standard” that references and incorporates many ASME, API, and other NFPA by reference.

A full list of applicable codes and standards for the facility siting and design are seen in *Codes and Standards (N2101-B-002)*.

4.2 ENVIRONMENTAL DESIGN CRITERIA

The following provides a summary of the site environmental conditions.

Table 1: Environmental and Site Conditions

Elevation above sea level	5,312 ft
Barometric Pressure	12.09 psi
Maximum Ambient Temperature	105 °F
Minimum Design Ambient	-20 °F
Design Cooling Dry Bulb (0.4% DB) • Air-Cooler Design • Power, Instrument Cable, and Panels	95.6 ˚F
Design Cooling Dry Bulb, HVAC (1% DB)	93.4 °F
Design Heating Dry Bulb, HVAC (1% Heating DB)	22.4 °F
HVAC (Indoor design for process/utility/electrical)	35 °F to 100 °F
HVAC (Indoor Design for instrument/control rooms)	69 °F to 84°F

Maximum Relative Humidity	10%
Average Annual Relative Humidity	1%
Min Annual Relative Humidity	0%
Precipitation, Average Annual	13.1”
Precipitation, Highest Monthly Average, July	3.7”
Reference Albuquerque Intl., NM USA 2021 ASHRAE Handbook unless otherwise noted	

1. Rotating equipment power rating shall be specified based on the average ambient temperature.
2. Air cooler discharge temperature approach shall be specified considering the maximum site ambient temperature because it can impact product specification.

The facility is being designed to be able to operate, especially be able to vaporize and send-out natural gas to NMGC’s pipelines through extreme cold weather events. The Minimum Design Ambient temperature above is 3 °F colder than the lowest recorded temperature at site and will ensure facilities include winterization features that are intended keep the facility operational when it is needed.

Wind design criteria is defined in 49 CFR 193.2067 that calls for an assumed sustained wind velocity of not less than 150 miles per hour, unless the Administrator finds a lower velocity is justified by adequate supportive data.

A full list of environmental conditions reflected in the PreFEED are seen in *Site Environmental Conditions (N2101-B-003)*.

4.3 EMISSIONS AND RELEASES TO THE ENVIRONMENT

Gas processing facilities, including LNG facilities, are under increasing scrutiny to minimize uncombusted releases to the environment. To the extent practicable, the facility shall operate as a closed facility with **normally no venting of hydrocarbon releases**. This means:

- The natural gas and LNG containing systems in this processing facility are closed to the atmosphere and do not include a vent (or flare) system releasing uncombusted (or combusted) hydrocarbons respectively during normal operations. For clarity, normal operating scenarios include all operating modes where LNG is intentionally being produced, stored in the storage tank, or vaporized for send-out as well as normal start-up, cool-down, process shutdown, stand-by (shutdown) and truck loading / unloading during HOLDING, PRODUCTION AND VAPORIZATION modes of operation.
- Upset, emergency and other unusual conditions may arise during the life of the facility, and these will be protected against by the relief system described in this document as well as other control and protective measures. Safe, well-considered venting of hydrocarbons may occur outside normal operations.
- Rio Puerco LNG locally routes hydrocarbon releases from relief valves and non-normal operational vents such as the LNG storage tank discretionary vent to atmosphere.
- The facility has been designed with a number of features to minimize the potential for releases to atmosphere:

    - The refrigerant system uses N2 expander refrigeration process that does not contain hydrocarbon refrigerants.
    - Boil-off Gas (BOG) is generated at all LNG facilities as a byproduct of the very cold LNG. Rio Puerco includes a spare BOG compressor so that if one machine is down due to a fault or maintenance, all the facility BOG can still be compressed and sent to NMGC distribution network.
    - Pretreatment has been designed with a mole sieve arrangement that does not require any venting or flaring of a by-product stream.
    - Thermal relief valves may be routed to large closed systems (LNG storage tank, LNG trailer, or BOG compressor suction line) where safe and practicable to minimize releases of hydrocarbons from cryogenic piping systems.
- The facility shall be designed to minimize the natural gas vapors released to the atmosphere from truck loading operations at the plant. The LNG loading system shall be provided with a vapor return line that will be modified to directly take truck vapors back to an LNG storage.
- Relief valves outlets shall be routed to the atmosphere via local tail pipes or integrated vent system provided they are routed to a safe location.

Additional details maybe found in the Rio Puerco LNG Plant Relief System Philosophy, N2101-P-001.

4.4 PROCESS SAFETY DESIGN

Safety is a fundamental aspect of Rio Puerco LNG Facility's siting and design. This section briefly describes some of the features included in the design and more is found in the various philosophies, basis, and technical note.

4.4.1 Facility Siting

Fundamental to LNG facility siting is compliance with two very important federal regulations intended to limit risk to the community:

- *DOT 49 CFR 193.2057* requires LNG facility siting to evaluate thermal radiation to minimize the potential of damaging effects of fire reaching beyond a property boundary.
- *DOT 49 CFR 193.2059* requires LNG facility sites to establishes a dispersion exclusion zone to minimize the potential of flammable gas mixtures and associated hazards from reaching beyond a property line that can be built upon.

These regulations incorporate sections of NFPA 59a-2001 and additional PHMSA written guidance and interpretations to result in a rigorously defined methodology for determining the acceptability of site.

Meeting the dispersion requirements for LNG facilities defined in *49 CFR 193.2059* typically is governing in determining the viability of a site. Preliminary dispersion analysis was completed with the selected 160-acre site, and an alternative that could have offered a lower overall cost development. This screening exercise identified the 160-acre site as acceptable and preferred.

Following site screening, more detailed dispersion and thermal radiation analysis was completed for the selected Rio Puerco LNG Facility site. This analysis included calculation of Single Accidental Leak Scenarios (SALS) for all the LNG containing lines and equipment in the facility as well impoundment dispersion and thermal radiation cases. The analysis findings are summarized below:

- The thermal radiation exclusion distances for Rio Puerco LNG were calculated using the mandated LNGFire3 software in accordance with the environmental conditions, calculation methods and exclusion zone distances required by DOT 49 CFR 193.2057 and associated PHMSA and NFPA59A-2001 guidance. The analysis indicates Rio Puerco LNG site is expected to be suitable with respect to thermal radiation exclusion zones. The governing radiation exclusion zone distances is approximately 800 ft required between the LNG storage tank impoundment berm and the nearest property boundary.
- Dispersion exclusion zone distances were calculated for Rio Puerco LNG using DNV Phast vs. 6.7 software in accordance with the methods, requirements, and exclusion zone distances from DOT 49 CFR 193.2059 along with associated PHMSA guidance and NFPA59A-2001. The results indicated that, given prudent layout and design, the mandated vapor exclusion zones fall within the 160-acre Rio Puerco LNG property boundaries in accordance with requirements.

Based on the analysis completed, site and PreFEED design complies with federal siting requirements that require provisions to minimize the possibility of the damaging effects of fire, or of a flammable mixture of vapors from a design spill, reaching beyond a property line that can be built upon and that would result in a distinct hazard.

4.4.2 Safety-Related Control Systems

The Rio Puerco LNG facility will be equipped with a wide array of hazard detection, emergency response, and active and passive fire protection systems as typical for LNG peak shaving facilities. Descriptions of select key functional requirements are described below.

Rio Puerco LNG shall be provided with a standalone, independent ESD SIS that can segregate the facility components and ensure a safe, reliable shutdown of the facility. The Safety Instrumented System (SIS) emergency shutdown (ESD) system, including an ESD SIS, which is intended to:

- Detect hazardous conditions with high reliability.
- Shut down equipment and brings the facility to a safer state.
- Isolate / segregate hydrocarbon-containing plant areas, including pipeline connections.
- De-energize affected plant areas.

These features shall be described in the *Plant Segregation Philosophy (N2101-P-003)* and associated documentation. This section of this philosophy describes the hierarchy of shutdowns within Rio Puerco LNG facility and associated actions and facility segregation.

4.4.3 Shutdowns and Facility Isolation Systems

The ability to shut down the facility, isolate hydrocarbon containing inventories, and bring the facility to a safety state under conditions that could result in equipment damage, hydrocarbon release, or other undesired consequences if an important part of LNG facility design. Rio Puerco shall be equipped with an ESD system with the following three-level shutdown hierarchy:

Level 1: ESD – Emergency Shutdown. Plant power is de-energized for shutdown and evacuation, all equipment fails to its fail-safe condition / position. A facility ESD is manually initiated only under very serious emergency conditions.

Level 2: PSD - Plant Shutdown. Power is maintained as equipment and systems throughout the plant are shut down and isolated.

Level 3: Area Shutdowns. Area shutdowns which shutdown and isolate a specific process area within the plant where a problem or hazard is occurring. The following area shutdowns are relevant for Rio Puerco:

- LSD – Liquefaction shutdown
- VSD – Vaporization Shutdown
- TSD – Trucking Shutdown

These are intended to shut down their respective areas only and safety isolated equipment during emergency conditions.

4.4.4 Hazards Detection Systems

A robust hazards detection system is an important function of safeguarding the LNG facility because it alerts operators to potential problems and hazards so that appropriate actions can be taken. Rio Puerco LNG will be equipped with a hazards detection system (Fire & Gas System or FGS) that will detect hazardous conditions throughout the facility. Elements of this system include:

1. Flammable gas detectors strategically located in areas subject to flammable gas leaks and releases in the plant.
2. High and low temperature detectors (as required, including low temperature detection in sub-impoundment areas).
3. Smoke detectors (as required in buildings)
4. Flame detectors
5. Manual local shutdown activation push buttons

4.4.5 Fire Water Systems (Fire Protection)

The Rio Puerco LNG Facility will form an important part of gas infrastructure for New Mexico and is equipped with a range of fire protection systems to help safeguard the system and minimize the risk of escalation in the event of a fire or other incident.

4.4.5.1 Active Fire Protection

Rio Puerco LNG Facility is equipped with a firewater system in compliance with NFPA 59A Section 9.4. The system shall be capable of distributing and applying firewater to protect LNG containers, equipment, and other escalation targets from fire exposure and to assist in the control of unignited leaks and spills.

The firewater system shall comply with NFPA standards incorporated by reference into NFPA59A including NFPA 20. The water supply is from an on-site well system and stored onsite in a firewater storage tank sized in accordance with NFPA 59A Section 9.4.2 to provide water supply of fixed fire protection systems, including monitor nozzles, at their design flow and pressure, involved in the maximum single incident expected in the plant plus an allowance of 1000 gpm (63 L/sec) for hand hose streams for not less than 2 hours.

A buried firewater ring main runs around the LNG storage tank impoundment berm and other strategic locations in the plant to provide coverage to all LNG impoundment areas and other sources and escalation targets. Manually operated and controlled hydrants and monitors are distributed around the facility and are each equipped with root valves to allow isolation of the device.

The ring main is a pressurized firewater system with 2 x 100% jockey pumps maintaining water pressure in the firewater system.

A firewater pump room houses the jockey pump as well as the NFPA 20 compliant firewater pumps. Two Firewater pumps are supplied, one diesel-driven and the other electric motor driven. The firewater pump house electrical loads are fed from the facility's essential load buss such that the firewater system remains operational through black-out and emergency conditions. The firewater control system is equipped with its own UPS to remain available during major upsets with the diesel firewater pump operational.

In addition to the firewater system, there are portable wheeled and hand-held fire extinguishers located throughout the facility in accordance with NFPA 10 requirements.

4.4.5.2 Passive Fire Protection

Passive Fire Protection (PFP) shall be applied to key structures and equipment where determined required in detailed design. API RP 2218 *(Fireproofing Practices in Petroleum and Petrochemical Processing Plants)* shall be considered in application of PFP and is anticipated to be relevant in the following areas:

- LNG rundown rack including vertical and horizontal primary members anywhere LNG is conveyed, or trough is provided. Multi-section elevated racks in the LNG storage area / berm area may evaluate running PFP only to the first level.
- The STV vaporizer area on critical steel members.
- Exposed steel coldbox supports foundations.

Any application of PFP shall consider risk of corrosion under PFP and associated inspection and maintenance requirements.

4.4.6 Spill containment and Impoundment Systems

LNG spill impoundment is an important part of LNG facility design. The following is a brief description of the facilities included for Rio Puerco LNG.

All areas subject to LNG releases shall have LNG impoundment in line with guidance and requirements of NFPA 59A, 49 CFR 193 and associated written PHMSA guidance. This results in a number of key facility design features described in the following sections.

4.4.6.1 LNG Rundown Line

A concrete graded (sloped), bunded trough runs under all LNG piping outside the LNG storage impoundment area that is capable of conveying LNG spills to an impoundment area that is shared with truck load.

This shared LNG impoundment area is sized by the larger of the LNG rundown 10-minute design spill or the volume of an LNG trailer. The concrete impoundment includes fencing or rail system to prevent unintended entry and two (2) means of entry / egress. It is equipped with a sump pump capable of automatically pumping out storm water following precipitation. There is a pump run permissive set on low temperature to prevent operation in the event of an LNG release.

4.4.6.2 LNG Truck Load/Unload Station and Line

The LNG rundown line is subject to a 10-minute design spill during truck loading operations. For conservatism, because functionality of all LNG trailers cannot be known, the release size shall be considered a full LNG trailer (12,000 gallons) for truck unload operations.

A graded (sloped), bunded trough runs under all LNG piping outside the LNG storage impoundment area that conveys LNG spills to the shared impoundment area. The trough and impoundment area are concrete. The area at the loading station by the trailer doghouse will be graded towards the trough and bunding shall be applied as needed. The trough at the loading interface point will be covered in steel grating to allow personnel and vehicle access.

This shared LNG impoundment area will be sized by the larger of the LNG rundown 10-minute design spill or the volume of an LNG trailer. The concrete impoundment includes fencing or rail system to prevent unintended entry and two (2) means of entry / egress. It is equipped with a sump pump capable of automatically pumping out storm water following precipitation. There is a pump run permissive set on low temperature to prevent operation in the event of an LNG release. The truck tractor area will be in a separate bunded area to prevent any truck liquids (antifreeze, oil, diesel) from entering the LNG impoundment area.

4.4.6.3 LNG STV Vaporizers

The LNG STV are located inside the main LNG storage tank impoundment area to minimize the extent of LNG piping and equipment in the plant. The LNG rundown line and the LNG between the pumps and STV are subject to various 10-minute design spills conditions during all various operating modes and scenarios.

The STV area includes bunding and trough for conveyance of any LNG releases to a sub-impoundment area located in the main storage tank impoundment area. This sub-impoundment area is designed to contain a 10-minute design spill from any piping inside the LNG storage tank impoundment and is equipped with storm water sump pump with low temperature interlock as described above.

4.4.6.4 LNG Storage Tank Impoundment

The single containment LNG storage tank shall be supplied with impoundment in compliance with NFPA59A-2001.

4.4.6.5 Other Fluids

Bunding, impoundment, and other measures in the facility will comply with normal industry practices. This includes chemical storage areas, glycol storage and process equipment areas, diesel storage for the firewater pump, etc.

The facility does not include any flammable refrigerant storage.

2. PHILOSOPHIES

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Project Name: Rio Puerco LNG Plant

Document Name:	Relief System Philosophy
Document Number:	N2101-P-001
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1 ABBREVIATIONS

ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society for Health, Refrigeration, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
BAHX	Brazed Aluminum Heat Exchanger
BOD	Basis of Design
BOG	Boil-off Gas
EPC	Engineering, Procurement and Construction
ESD	Emergency Shut Down
FEED	Front End Engineering and Design
F&G	Fire & Gas Detection
HC	Hydrocarbon
HMI	Human-Machine Interface
HP	High Pressure
H&MB	Heat and Material Balance
K.O. Drum	Knock Out Drum
LNG	Liquefied Natural Gas
LSHH	Level Switch LowLow (trip)
MAOP	Maximum Allowable Operating Pressure
MMscfd	Million Standard Cubic Feet per Day
NFPA	National Fire Protection Association
NMGC	New Mexico Gas Company
OPP	Overpressure Protection
PAH	Pressure Alarm High
PSV	Pressure Safety Valve
P&ID	Piping & Instrumentation Diagram
SIS	Safety Instrumented System
TRV	Thermal Relief Valve
TSO	Tight Shut Off

2 PURPOSE

This document describes the planned Rio Puerco LNG facility's approach to relief and overpressure protection (OPP) system design and integration. It is intended to specify the minimum project requirements for relief systems, determining relieving rates for Pressure Safety Valves (PSV) that protect the equipment and piping from overpressure, depressurization systems, and routing of tail pipes.

This document should be used in conjunction with other design basis and philosophy documents for the project including:

Table 1 Project Philosophies

N2101-B-002	Project Description
N2101-P-002	Isolation for Maintenance Philosophy
N2101-P-003	Plant Segregation Philosophy
N2101-P-004	Equipment Sparing Philosophy

3 INTRODUCTION

New Mexico Gas Company (NMGC) is a member of the Emera family of energy companies. NMGC is headquartered in Albuquerque and is the largest natural gas utility in New Mexico. The Company is situated between two large natural gas production basins, the Permian Basin in southeast New Mexico, and the San Juan Basin in northwest New Mexico. NMGC operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout the state.

The plant will be located outside Albuquerque adjacent to existing NMGC intrastate 16-inch and 24-inch parallel transmission pipelines, each with an operating pressure of approximately 650 psig. Feed gas for liquefaction and regasification shall be supplied by one or both pipelines and vaporized gas will be injected into the NMGC pipeline and distributed via the NMGC transmission system throughout New Mexico.

All fluid processing facilities, including gas processing ones such as Rio Puerco LNG, consider and implement protections to prevent fluid pressures from exceeding safe operating limits of the processing equipment. This document describes the planned Rio Puerco LNG facility's approach to overpressure protection (OPP) system design and integration in line with sound industry practice and applicable codes and standards. It is intended to specify the minimum project requirements for Pressure Safety Valves (PSV), relief systems, automatic depressurization systems, and safe and environmentally acceptable gas disposal routes.

4 GENERAL REQUIREMENTS

This section describes the general requirements for the relief and disposal system at the Rio Puerco LNG Facility.

4.1 GOVERNING CODES AND STANDARDS

The design and implementation of relief and overpressure protection systems is governed by a range of codes and standards. While a complete list of codes and standards relevant for the facility are found in the Project Description (N2101-B-002), particularly relevant to overpressure protection codes and standards are:

- *49 CFR Part 193, Liquefied Natural Gas Facilities: Federal Safety Standards* set some specific requirements for relief valves and incorporates by reference a number of codes and standards including NFPA 59A-2001.
- *NPFA 59A-2001 Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)* sets a number of requirements for relief devices including requirements for LNG storage tanks in Section 4.7 and requirements for vaporizers in Section 5.4.
- ASME Boiler & Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels.
- ASME B31.3 Process Piping.

Additionally, a number of industry standards are highly relevant to relief and overpressure system design as follows:

- API Standard 520 Part I Sizing, Selection and Installation of Pressure Relief Devices - Sizing and Selection
- API RP 520 Part II Sizing, Selection and Installation of Pressure Relief Devices – Installation
- API Standard 521 Pressure Relieving and Depressurization Systems
- API Standard 526 Flanged Steel Safety Relief Valves

4.2 VENTING AND FLARING PHILOSOPHY

To the extent practicable, the facility shall operate with **normally no venting of hydrocarbon releases**. This means:

- The gas and LNG containing systems in this processing facility are closed to the atmosphere and do not include a vent (or flare) system releasing uncombusted (or combusted) hydrocarbons respectively during normal operations. For clarity, normal operating scenarios include all operating modes where LNG is intentionally being produced, stored in the storage tank, or vaporized for send-out as well as normal start-up, cool-down, process shutdown, stand-by (shutdown) and truck loading / unloading during HOLDING, PRODUCTION AND VAPORIZATION modes of operation.

- Upset, emergency and other unusual conditions may arise during the life of the facility, and these will be protected against by the relief system described in this document as well as other control and protective measures. Safe, well-considered venting of hydrocarbons may occur outside normal operations.
- Rio Puerco LNG locally routes hydrocarbon releases from relief valves and non-normal operational vents such as the LNG storage tank discretionary vent to atmosphere.
- The facility has been designed with a number of features to minimize the potential for releases to atmosphere:
    - The refrigerant system uses N2 expander refrigeration process that does not contain hydrocarbon refrigerants.
    - Boil-off Gas (BOG) is generated at all LNG facilities as a byproduct of the very cold LNG. Rio Puerco includes a spare BOG compressor so that if one machine is down due to a fault or maintenance, all the facility BOG can still be compressed.
    - Pretreatment has been designed with a mole sieve arrangement that does not require any venting or flaring of a by-product stream.
- The facility shall be designed to minimize the natural gas vapors released to the atmosphere from truck loading operations at the plant. The LNG loading system shall be provided with a vapor return line that will be modified to directly take truck vapors back to an LNG storage.
- Relief valves outlets shall be routed to the atmosphere via local tail pipes or integrated vent system provided they are routed to a safe location.

5 REQUIREMENTS FOR RELIEF VALVES

Relief valves in fluid processing facilities are installed to protect equipment and piping from exceeding design conditions due to upset or emergency. They are used throughout industries such as pulp and paper, chemicals, sanitary, petrochemical, and oil and gas processing with similar rules, design practices, and implemental to protect against overpressure condition.

For the Rio Puerco LNG facility relief devices are mandated for use in equipment and piping systems by ASME BPVC Code Section VIII and ASME B13.3 and NFPA 59A lays out a number of requirements for locating and sizing these devices. A relief device is a valve:

1) Designed to open and relieve excess pressure from a system.
2) Reclose and prevent the further flow of fluid after normal conditions have been restored.

In addition to relief device, other terms are used for these devices including pressure-relief valve (PRV), pressure safety valve (PSV), relief valve, safety valve, and safety-relief valve.

As mentioned above, PRVs are protective devices that are installed to prevent equipment from being subjected to pressure conditions that exceed their design pressure (overpressure). Although normally relief valves are passive, to perform this protective measure PRVs must be sized so they can accommodate the worst event the device may need to protect against. This requires consideration of range of events (sizing cases) that, while not expected to occur at the facility, need to be accommodated in design.

This document describes what cases shall be considered to help make sure that any circumstance that reasonably constitutes an overpressure hazard under the prevailing conditions shall be analyzed and evaluated.

This section summarizes the design approach to the sizing and selection of pressure relief devices to protect equipment against overpressure from operating and fire contingencies. API Std. 520 Part 1 shall be applied to determining the PSV type, sizing method, set pressure and allowable overpressure.

5.1 ASSUMPTIONS

The following industry standard assumptions are relevant for the Overpressure Protection Philosophy as associated relief valve sizing:

- **Set pressure.** Relief device set pressure will be set at the system design pressure, even for cases where a higher MAWP has been established by the vessel or equipment manufacturer.

- **Pressure Breaks.** All High-Pressure / Low-Pressure interfaces (HP/LP) shall be rigorously managed. They shall appear as pressure set breaks on the P&IDs and shall be minimized.

- **Trained operators.** Rio Puerco LNG facility will be staffed by trained and competent operators that are present to respond to an emergency.
- **No double jeopardy.** The simultaneous occurrence of two or more conditions which could result in overpressure will not be considered if the causes are unrelated (e.g., no "double jeopardy") provided that no mechanical, electrical or process common failure mode exists between the causes.
- **No credit for instrumented response.** An instrumented response (e.g., the opening and closing action of control valves, automatic start-up of equipment, etc.) will not be considered as a substitute for pressure relieving devices for equipment protection. Final overpressure protection is to be provided by means of a mechanical pressure-relieving device.
- **Limited utility failure.** Equipment which will not be affected by a utility failure will be considered to remain in operation when evaluating the failure of such utility, while control functions and other systems will be assumed to operate as designed.
- **Normal flow case sizing basis.** Flow rate or condition through the equipment during the emergency will be assumed to be at the normal rate or condition, except when the particular primary emergency cause would alter the rate or condition.
- **Operator error considered as cause.** The possibility of an operator inadvertently opening or closing any one valve or taking any incorrect action in the wrong sequence or at the wrong time will be considered (e.g. operator error). Block valves, electric switches, or any other equipment which are locked in the correct position will **NOT** be considered in any scenarios of operator error.
- **LNG Storage Container cases.** The LNG storage tank relief valves shall comply with Section 4.7 of NFPA 59A_2001.
- **LNG Vaporizer cases.** The STV LNG vaporizer relief valves shall comply with Section 5.4 of NFPA 59A_2001.

5.2 CAUSES OF OVERPRESSURE

Note: *The Rio Puerco LNG Facility includes multiple protective measures to prevent overpressure conditions from occurring. However, sizing the PRVs requires consideration of a number of worst-case scenarios in alignment with industry standard practices and API 521 guidelines. Although some of the scenarios described below sound alarming, these are typical for hydrocarbon processing industries to help make sure the facility is as safe as practicable and aligned with sound engineering practice. The planned Rio Puerco facility does not pose any usual causes of overpressure relative to other similar installations.*

This section lists some common principal causes of overpressure, which shall be analyzed to determine the individual relieving flow rates for pressure relieving devices. Also, clarification of the failure and overpressure protection device is provided where applicable.

The list is not intended to be all-inclusive but is intended to serve as a guide.

5.2.1 Electrical Power Failure

Plant wide and individual equipment power failure (i.e., total and partial failure) shall be considered. Total electrical power failure implies plant trip, loss of all motor-based air coolers, and instrument air. It is assumed that uninterruptible power supplies (UPS) and other batteries remain operational. Any emergency generators will be assumed to start and provide backup power to connected systems.

In case of partial failure, equipment that is not affected by the failure will be considered to remain in operation and the controls will be assumed to operate as designed. There can be an equipment electrical failure that can upset the process and be the cause of overpressure.

Note: To further explain the qualification at the start of this section, Rio Puerco will have a number of measures to prevent electrical power failures resulting in overpressure conditions. For instance, the control system is backed-up by a UPS, there is an Essential Diesel Generator (EDG) on-site that can operate and allow regas and essential (include storage tank BOG compressor) operation. Even with the protection of back-up in place relief valves in the facility will conservatively consider, and if needed, be sized considering Electrical Power Failure.

5.2.2 Open External Fire

Equipment shall be protected against high pressure due to fire if the equipment is located in an area where a sustained intense fire could occur, and it is conceivable that the equipment is blocked in without having been emptied when such a fire occurred.

The following assumptions are relevant to fire case:

- All input and output streams to and from the fire affected equipment and all internal heat sources within the process are assumed to have ceased after fire detection and operator intervention.
- Two scenarios shall be evaluated with respect to liquids in process conditions and the worst case shall be applied:
    - Vessel start at LSHH (Level Switch HighHigh). This is based on liquid level in the process vessel based on the normal liquid volume plus liquid draining from upstream piping / system. This can result in a worst credible fire sizing case due to vapor generation.
    - Vessel start at dry condition. In some cases where operating pressure is close to design pressure this results in a worst credible sizing case from vapor expansion.
    - Both the scenarios should start with an initial pressure condition set to the PAH (Pressure Alarm High) for the vessel or maximum operating pressure of the vessel.
- Credit for insulation may be applied provided it meets the requirement of API 521. Initial calculations for most fire case PSVs may typically neglect insulation.

5.2.3 Blocked Outlet

Every control valve and manual valve (that is not designed as locked or car sealed in position on the P&IDs), shall be considered as being subject to inadvertent operation. It is assumed that only one valve will be inadvertently closed at any one time.

5.2.4 Pump Circuits

Pump overpressure protection circuits shall be designed for the highest head and flow conditions that can be developed by the pump.

Generally, pressure relief devices shall be avoided for centrifugal pump discharge shut-off conditions. The pump itself, discharge piping, and discharge equipment shall normally be designed to safely contain the pump shut-off pressure.

High-head pumps may be present (e.g. the expander lube oil pump) and shall be designed with suitable PSVs – typically relieving back to the oil separator.

5.2.5 Instrument Air Failure

All overpressure scenarios that could develop in the event of instrument air system shall be investigated. These cases should include “worst case” valve sequencing if the timing of valve closure cannot be controlled / managed.

In case of total instrument air failure, there is inventory in the instrument air receiver/header to allow a safe shutdown without causing overpressure and subsequent release to the vent header.

5.2.6 Control Valve Failure

Failure mode (air fail to open, close, or last position) on loss of motive power shall be evaluated for each control valve. All control valves shall have their fail-safe characteristics / position properly established to minimize the hazard to plant operation.

Effect of a mechanical failure of the control valve shall always be considered when evaluating the need for protection of systems associated with the valve.

As for the control valve with a manual bypass, provisions for overpressure protection of a system downstream of a control valve station shall consider the full opening of the manual bypass valve, in addition to the full opening of the control valve.

The case of inadvertent JT control valve failure full open during full-capacity turboexpander operations shall be considered. Mechanical stop or other protection on the JT valve as needed.

5.2.7 Inadvertent Valve Opening

Inadvertent opening of any valve from a source of higher pressure shall be considered, unless provisions are made for locking the valve to be closed.

5.2.8 Check Valve Failure

Check valves are industry standard devices that are intended to prevent misdirected or reverse flow in the process piping. Although expected to be reliable, where an unexpected check valve's failure can result in an overpressure condition this scenario will be considered and applied to relief valve sizing.

Check valves shall **NOT** be considered effective for preventing overpressure by reverse flow from a high-pressure source. Overpressure protection shall be provided for check valve failure where the maximum normal operating pressure of downstream system is higher than the design pressure of upstream low pressure system (as if no check valve is present).

Credit for two dissimilar devices in series shall be allowed. For example, two dissimilar back-flow prevention devices installed in series could be used to reduce the reverse flow PSV case to 10% of the orifice size of the larger of the two devices. Consequence of the multiple devices shall be evaluated case-by-case.

5.2.9 Hydraulic Expansion and Boil-Off

Lines or equipment, including all cryogenic ones, that can be left full of liquid under no flow conditions and that can be heated while completely blocked in, must have means of relieving pressure built up by thermal expansion of the contained liquid. Solar radiation, loss of vacuum (if relevant), as well as other heat sources such as heat exchanger or regen gas heater, shall be considered.

The following requirement shall apply:

- ALL isolatable sections of piping that could contain LNG (including in upset conditions) or other similar fluid capable of generating overpressure conditions shall include thermal relief valves (designated as TRV instead of PSVs).
- TRVs protecting hydrocarbon systems shall be routed back to the LNG storage tank or other closed gas sink where practicable.
- Special care shall be taken in consideration of cryogenic ball valves in liquid service with a weephole drilled into the ball to avoid trapping LNG in the ball. Preferential sealing direction shall be indicated on the P&IDs.
- TRVs protecting sections of vacuum jacketed piping shall consider:
    - Any relevant over-pressure risk associated with a leak from the inner piping into the vacuum and high associated heat leak.
    - Heat leak to the inner pipe associated with a total loss of vacuum.

5.2.10 Pressure Transients

Piping and system design shall consider the potential for surge conditions exceeding design conditions in liquid filled systems. Such systems shall avoid the use of slam-shut and quick-closing butterfly valves. Since the pressure transients are caused by rapid closure of valves, overpressure protection requiring a pressure transient analysis will not be required for these systems.

5.2.11 Heat Exchanger Failure

Heat exchangers are industry standard equipment items that exchange heat between two or more process fluids. They are very important in LNG production where very cold temperatures are required. Although expected to be reliable, where an unexpected heat exchanger failure can result in an overpressure condition this scenario will be considered and applied to relief valve sizing.

For all exchangers, the lower pressure side shall be protected by pressure relief devices if the design pressure of the higher-pressure side exceeds either the corrected hydro-test pressure of the low-pressure side or 1.3 times the design pressure.

- Shell and Tube Heat Exchanger: The relief rate shall be defined by the maximum flow through the two open ends resulting from a guillotine cut of a single tube at the tube sheet.
- Aluminum Brazed (Plate-fin) Heat Exchanger. The maximum relief rate shall be based on a complete rupture running longitudinal to a plate. Consultation with Vendor may be required.

5.2.12 Abnormal Process Heat Input

The required relief in systems subject to abnormal heat input (such as regeneration systems for molecular sieve modules or the fuel gas heater) shall consider these cases. For example, when the temperature is controlled by a fired or electrical heater, the heat controls shall be assumed to fail allowing full power input to the gas stream.

5.2.13 Liquid Overfilling

Pressure relief valves are often located in the vapor space of partially liquid filled vessels which could overfill during a plant upset. In all cases, if overfilling can result in an overpressure (pressure above the corrected hydro-test pressure or 1.3 times the design pressure), the PSV must be sized for liquid relief.

Exception for this sizing application will be on a case-by-case basis, e.g., the vessel vapor space above the normal liquid level is equivalent to a 15 minute or longer hold up based on the design liquid inlet rate and a stoppage of the liquid outlet flow (e.g., LNG storage).

6 RELIEF PIPING AND SAFE DISPOSAL

6.1 RELIEF SYSTEM CONFIGURATION

The relief system is expected to include the following considerations:

- The Relief System will be designed in accordance with the current version of API Std. 521 and normal industry practice.
- All relief tail pipes shall be locally routed to safe locations. Stainless, aluminum, or other suitable material rated for low temperatures shall be used for low temperature releases.
- LNG Tank Relief valves shall be routed to atmosphere per NFPA 59A.

6.2 PSV INLET AND OUTLET REQUIREMENTS

PSV inlet piping shall meet the following requirements:

- Distance shall be minimized to the extent practicable and have no process laterals connected.
- Pressure drop through the relief valve inlet piping shall be minimized and the line shall not be pocketed.
- The effect of any component along the inlet piping shall be considered in terms of potential reduction of relief capacity. The inlet piping and any fittings shall have a bore area at least equal to the relief device inlet flange or fitting.
- All block valves must be full bore and locked or interlocked in correct position. A mechanical interlocking system shall be applied where possible.
- Pressure drop in relief valve inlet piping shall be limited to 3% of relief valve set pressure to avoid chattering.

PSV Discharge Piping shall meet the following requirements:

- PSV discharge piping shall be locally routed to safe location.
- The outlet pipe size shall be at least equal to or greater than the PSV outlet flange or fitting size.
- The piping shall not be pocketed and shall include provision to keep liquids collected on the downstream side of the PSV. This arrangement will typically include a 3/8" weephole coupled with a weather cap installed over discharge piping chamfered with a 45-degree angle. Other arrangement may be considered.
- No restriction in PSV tailpipes shall be allowed (such as check valves, flame arresters and block valves.
- Backpressure at rated capacity of the relief valve shall not exceed the requirements of the chosen relief valve type.

7 AUTOMATIC DEPRESSURIZATION SYSTEMS

7.1 AUTOMATIC DEPRESSURIZATION SYSTEMS

Automatic (or Emergency) Depressurization, also referred to as blowdown, refers to the depressurization a portion of the hydrocarbon containing facilities to minimize escalation potential during emergencies conditions, especially under the unlikely event of a fire being exposed to process equipment and piping.

NFPA 59A (2001) mandates that depressurization systems are considered in LNG facilities in Section 9.1.2.

"*Fire protection shall be provided for all LNG facilities. The extent of such protection shall be determined by an evaluation based on sound fire protection engineering principles, analysis of local conditions, hazards within the facility, and exposure to or from other property. The evaluation shall determine the following, as a minimum:*

(6) The equipment and processes to be incorporated within the emergency shutdown (ESD) system, including analysis of subsystems, if any, and the need for depressurizing specific vessels or equipment during a fire emergency."

Most peak shaving LNG facilities do not require emergency depressurization capabilities because their hydrocarbon inventories in pressurized systems are too low. This is particularly true for the planned Rio Puerco LNG facility that includes a number of favorable features with respect to hydrocarbon inventories:

- The refrigeration system is a dual N2 expander cycle that does not require hydrocarbon refrigerants. This means refrigeration hydrocarbon inventories are lower and no refrigerants susceptible to BLEVE (MR Accumulator) are present.
- There is no MR storage required (MR Storage, Propane, Ethylene, or Butane) that typically require deluge and other protective measures.
- Liquefaction capacity is 10 MMscfd and the associated equipment and piping sizes are considerably smaller than those typically requiring automatic depressurization.

Rio Puerco does not include an emergency depressurization system.

7.2 NON-EMERGENCY DEPRESSURIZATION SYSTEMS

Some systems may require manual (i.e. operator-initiated) depressurization systems that are separate from the automatic emergency blowdown system. These have less prescriptive requirements and should be designed to meet application specific conditions. Examples of non-emergency depressurization systems include:

- Fuel gas supply lines may include low pressure back-pressure regulators or creep valves that may vent a small quantity of gas to atmosphere following a burner trip or as part of the start-up sequence. These operate a too low of a pressure to direct to a flare.

- Cryogenic sections that build pressure following a plant shutdown or trip (e.g. the LNG end-flash vessel) shall not be allowed to reach 85% of PSV set pressure. To meet this requirement, such systems shall be equipped with some form of (low integrity) automatic depressurization based either on pressure instrument or timer. These depressurization valves shall be tied into the relief system.

- As a protective measure, in the event that all BOG compressors are down for an extended period of time or other upset condition is occurring, the LNG Storage Tank(s) shall be equipped with a "Discretionary Vent". This is a protective measure because it can be opened before the relief valves lift at their set pressure. The Discretionary Vent valve will automatically open 0.15 psig below set pressure of the LNG tank PSVs. The Discretionary Vent is NOT used for operational purposes – emergencies and upset conditions only.

NEW MEXICO GAS COMPANY

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1 ABBREVIATIONS AND DEFINITIONS

API	American Petroleum Institute
Battery Limit	Plant, unit or train boundary. These form a set of isolations which define the boundaries of a discrete process envelope
BCF	Billion Cubic Feet
BOG	Boil Off Gas
Breaking Containment	The opening up of process/utility systems for any reason, including inspection, repairs or modifications, where there is a risk from egress of toxic, flammable or otherwise dangerous materials
CSU	Commissioning and Start up
Car-sealed	Car-sealed is any corrosion and sunlight resistant method of preventing accidental opening or closing of a manual block valve or pilot sense valve, such as lock and chain, tamper-proof stainless steel banding or multi-strand wire with a lead seal.
ESD	Emergency Shutdown system
DBB	Double block and bleed isolation
FO	Fail Open
FC	Fail Closed
Flammable	Refers to any substance, solid, liquid, gas or vapor, that is easily ignited. The addition of the prefix ‘non’ indicates that the substances are not readily ignited but does not necessarily indicate that they are non-combustible. Synonymous with inflammable.
Gas Free	A tank is considered to be gas free when the concentration of flammable gases is within safe prescribed limits. The term gas free does not imply absence of toxic gases or sufficiency of oxygen for vessel entry
Hazardous Area	An area in which there is, or may exist, a hazardous atmosphere
Isolation	A method of preventing the passage of fluids through connecting pipework in order to allow safe access to vessels or other intrusive equipment maintenance
LO / LC	Locked Open / Locked Closed
Leak Testing	The application of a pressure differential to detect leakage paths or leakage rates. The pressure applied, liquid or gaseous, may be

	much less than the maximum service pressure (e.g. vacuum tests, search gas tests, air tests, and water or service fluid tests)
LNG	Liquefied Natural Gas
LOTO	Log Out Tag Out
MMscfd	Million Standard Cubic Feet
NMGC	New Mexico Gas Company
PLC	Programmable Logic Controller
Positive Isolation	Isolation by means of a fixed barrier, such as a blank flange or spectacle blind, bolted or clamped in place and conforming to the pipework specification, which provides an equivalent standard of containment to the pipework in which it is installed
PSV	Pressure Safety Valve
Process Fluid	Natural gas, LNG, gas, or any other produced fluid containing hydrocarbon gas or liquid, or other chemical compounds.
SDV	Shutdown Valve. A fail closed isolation valve designated as part of the Emergency Shutdown System (ESD)
SBB	Single Block and Bleed isolation
SVI	Single Valve Isolation. Never sufficient to conduct maintenance requiring any breaking of containment

2 PURPOSE

This document describes the high-level project requirements for the isolations strategy and requirements for isolation for maintenance relevant for the Rio Puerco LNG facility.

It should be used in conjunction with other design basis and philosophy documents for the project including:

Table 1 Project Philosophies

N2101-B-002	Project Description
N2101-P-001	Relief System Philosophy
N2101-P-003	Plant Segregation Philosophy
N2101-P-004	Equipment Sparing Philosophy

3 INTRODUCTION

New Mexico Gas Company (NMGC) is a member of the Emera family of energy companies. NMGC is headquartered in Albuquerque and is the largest natural gas utility in New Mexico. The Company is situated between two large natural gas production basins, the Permian Basin in southeast New Mexico, and the San Juan Basin in northwest New Mexico. NMGC operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout the state.

Like all process facilities, equipment, piping, valving, instruments, and other components within the Rio Puerco LNG facility require periodic inspection, maintenance, and repair to help make sure the facility operates in a reliable and safe manner. Some of these activities require closing valves or other measures to isolate the maintenance task area from parts of the facility that may contain natural gas, pressurized N2 refrigerant, or other fluids. This referred to as isolation for maintenance.

This document describes the Rio Puerco LNG facility's isolation strategy and the minimum requirements to safely isolate plant elements prior to conducting maintenance. The following items are addressed:

- Facility Isolation Strategy (i.e., what plant elements can be isolated for maintenance with a live plant).
- Requirements for Isolations to Support Maintenance.
- Isolation Requirements (Positive vs. Valved Isolations and criteria).
- Valving Arrangement Requirements and Details (for clarity).

Doc #	N2101-P-002 Rev. 1
Name	Isolation for Maintenance Philosophy
Date	10/05/2022

4 FACILITY ISOLATION STRATEGY

The facility isolation strategy defines how equipment is isolated for maintenance. It is intended to be used with the requirements for safe isolation to ensure that the means of positive and valves isolation are suitable for the level of isolation required. It is important to apply this strategy avoid adding excessive isolation valves inside process areas to isolate and segregate single train equipment that require maintenance, increase facility cost, and represent leak points while the facility is in service.

The isolation strategy defines where systems are isolatable for maintenance while in service and is described with the assistance of Figure 1 that shows key isolations in the facility that are described in this section.

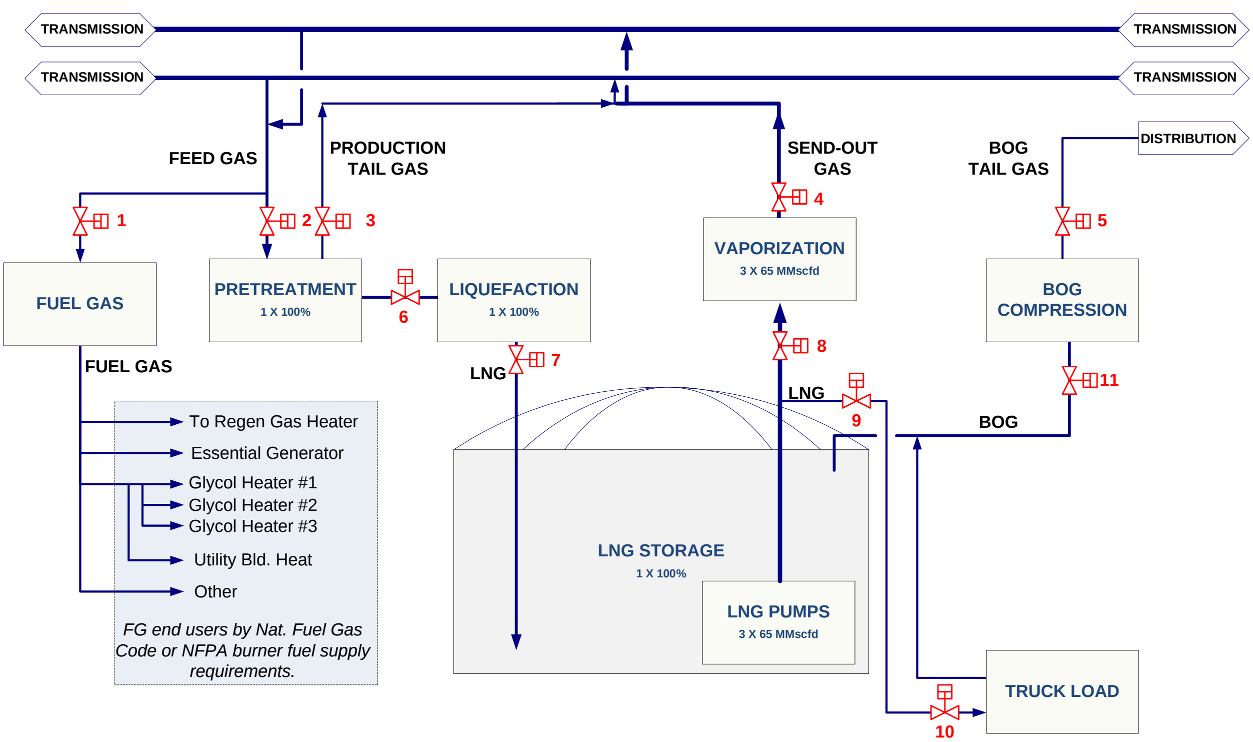

Figure 1. Isolation Strategy and LNG Facilities

Referring to Figure 1, the governing philosophy is summarized as follows:

- **#1: Feed Gas (Reception) positive isolation.** It shall be possible to establish positive isolation from either or both the transmission pipelines with either or both of the pipeline live (**#1** in figure). This is expected to be using Double Block and Bleed (DBB) isolation to a spectacle blind or removeable spool at each connection to the pipeline at the battery limit. Any relevant SDV in this piping may act as one of the isolation valves in the DBB set. During facility initial commissioning and start-up (CSU), the positive isolation removed following pre-commissioning and sign-off of the PSSR to allow hydrocarbons to be introduced to the facility.

- **#2: Tail Gas positive isolation.** It shall be possible to establish positive isolation from either or both the transmission pipelines with either or both of the pipeline live (**#2** in figure). This is expected to be using Double Block and Bleed (DBB) isolation to a spectacle blind or removeable spool at each connection to the pipeline at the battery limit. Any relevant SDV or separated manual isolation valves in vaporization and the train may act as one of the isolation valves in the DBB set. During facility initial commissioning and start-up (CSU), the positive isolation removed following pre-commissioning and sign-off of the Pre-Startup Safety Review (PSSR) to allow hydrocarbons to be introduced to the facility.

- **#3 Cold LNG Storage Tank Positive Isolations.** Some means of positive isolation shall be provided between:

  - The LNG production train and the LNG storage tank.
  - BOG compressor suction and LNG storage tank.
  - Other continuously in-service lines connected to the LNG storage tank. This is required because once the LNG storage tank is placed into service it will remain HC containing for a prolonged (typically at least 20 years) period of time.

  Positive isolation shall made possible by means of a removable spool or flanged valve that may be dropped while minimizing leak points. A spectacle blind shall not be used because it is difficult to insulate and will frost heavily.

  Positive isolation in this system may be installed while warmed-up and depressurized against SVB according to facility isolation for maintenance requirements.

- **#4 Each LNG Pump Positive Isolation.** Similar to #3, there shall be some means of applying positive isolation to each LNG export pump on the LNG storage tank. This is important because the pumps must be extractable and serviceable with the LNG storage tank in service.

  Positive isolation shall be by means of a fully rated, stainless blind of the pump well during the maintenance. These blinds need not be procured until pump extraction is planned. Other connections may be by any accepted means of positive isolation on all systems to be subject to longer-term isolation.

  Installation of the positive isolation shall be in accordance with the isolation requirements set forth in this philosophy where practicable. Exceptions for single valve (SVI) and single valve and bleed (SVB) shall be made were required to allow safe intervention / extraction of the pumps. Such activities will be completed with the pump column penetrations warm and all pumps electrically isolated by LOTO (e.g., no pressurized LNG possible).

- **#5 BOG Compressor Positive Isolation.** Each BOG compressor shall be cable of achieving positive isolation for maintenance that will include breaking containment and other major activities with the adjacent machine (pressurized discharge line and cold / active suction line). The isolations shall fully meet facility isolation requirements.

- **#6 Distribution Line connection positive isolation.** Some means to achieve positive isolation from the distribution pipeline shall be established. This may take advantage of the isolations installed for the discharge line of the BOG compressors but should also consider distance between isolation valves.
- **Limited Valved Isolations** With the exceptions of the robust isolations between continuously live systems such as the LNG storage tank and the pipelines, there shall be limited means to install positive isolation and only single valve isolation between other equipment items. Isolations, breaking containment, and interventions may be taken with the system brought to a suitable hazard level such that working against limited isolations is acceptable as defined in this Philosophy. Such interventions may be planned to occur with non-operating conditions to allow maintenance to be conducted. For instance, replacing a flanged valve on a Mol Sieve bed may be completed with the regen gas heater off, and the system fully or partially depressurized such that single valve and bleed isolation is adequate.
- To the extent relevant, the following isolation requirements not shown in Figure 1 shall be considered:
    - Positive isolations from live closed hydrocarbon drain systems.
    - Positive isolation from fuel gas systems.
    - Valved isolations for non-hazardous utilities and N2 system.

The general requirements for isolations at the facility are as follows:

- Longer shutdowns or major maintenance are conducted with positive isolation established between the facility and the feed gas pipeline.
- Minor maintenance on small-bore piping (3/4" and below) may be done on-line with SBB isolation adjacent to the area of interest with the plant live (e.g., pressure instrument replacement).
- Minor maintenance such as relief valve replacement and control valve maintenance should be feasible with the plant online, either partly or fully depressurized. Therefore, the appropriate valved isolation must be provided to enable maintenance such as replacement of PSV's, filter elements and control valves.

5 ISOLATIONS TO SUPPORT MAINTENANCE

Regular maintenance in LNG and other gas processing facilities is a fundamental part of achieving reliable and safe operations. In additional normal industry practice, LNG facilities are subject to rigorous maintenance programs to comply with 49 CFR part 193. This will include development of a maintenance program for Rio Puerco that will include definition of the required maintenance activities and associated frequency, documentation required for the activity, length of time the maintenance or inspection records are to be kept, and other associated information.

The maintenance and inspection frequency depends on the nature of the activity and include daily (Walkdown Logs) weekly, monthly, annual, and longer interval maintenance. Rio Puerco LNG will keep to normal industry practice of complying will all 49 CFR 193 maintenance and inspection requirements as part of a fully compliance operating program. Examples of maintenance activities with associated frequency are *(from 49 CFR 193)*:

- Control Systems:
  - Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months with the exceptions:
    - Control systems used seasonally, such as for liquefaction or vaporization, must be inspected and tested before use each season.
    - Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months.
  - Control systems that are normally in operation, such as required by a base load system, must be inspected and tested once each calendar year but with intervals not exceeding 15 months.
- Transfer hoses:
  - Tested once each calendar year, but with intervals not exceeding 15 months, to the maximum pump pressure or relief valve setting; and
  - Visually inspected for damage or defects before each use.
- Auxiliary power systems:
  - Each auxiliary power source must be tested monthly to check its operational capability and tested annually for capacity. The capacity test must take into account the power needed to start up and simultaneously operate equipment that would have to be served by that power source in an emergency.

CRF part 193.2615 addresses the requirements for isolating and purging and the LNG facility must be able to be effectively isolated and be able to safely purged out of service and back into service.

6 ISOLATION CLASSIFICATIONS

The following section describes the two types of isolation shall be implemented at the Rio Puerco LNG facility in alignment with normal industry practice:

- **Positive Isolation:** when leakage cannot be tolerated, e.g., for major maintenance or process outlets to the environment.
- **Valved Isolation including:**
  - Double Block and Bleed (DBB)
  - Single Block and Bleed (SBB)
  - Single Valve Isolation (SVI)

The following sections describes the types of isolation in more and defines the conditions under which the relevant isolation is require.

6.1 POSITIVE ISOLATION

Positive isolation is the most secure method of isolation and shall be used in cases where leaks or cross-contamination cannot be tolerated such as to enable confined spaces/equipment entry and to support an extended maintenance activity. A full list of when positive isolation shall be applied is seen below.

Positive isolation is achieved by application of one of the following methods:

- Installation of a fully rated spectacle blind or spade and ring spacer. The line size and flange rating dictate the blinding device required, as detailed in Table 2 below.
- Removal of a flanged spool piece and fitting of fully rated blind flanges to exposed pipes.
- Fitting of a fully rated blind flange on open ended valves or pipes.

In all cases appropriate valve isolation will be provided to enable installation and removal of positive isolation where required without shutdown of the main facilities. See Figure 2 below for illustration of the application of positive isolation.

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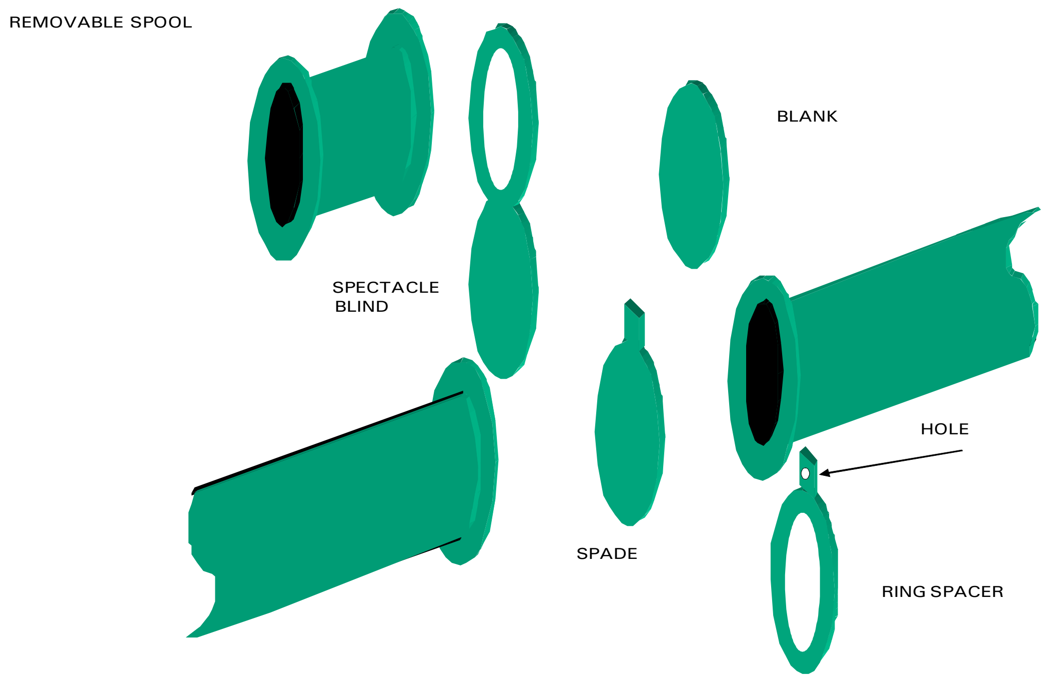

Figure 2. Positive Isolation Diagram

6.1.1 Type of Positive Isolation

The type of positive isolation facilities required depends on the flange class and size to be isolated. Smaller bore piping and lighter flange class piping may be flexible enough to allow spade insertion, when required, and do not require permanently installed positive isolation facilities. The type of positive isolation required is seen below in Table 2.

Table 2. Type of Positive Isolation

SIZE	PIPING CLASS		
	150 lbs	300 lbs	600 lbs and Greater
≤ 4"	NO PERMANENT DEVICE	SPECTACLE BLIND	SPECTACLE BLIND
6"	SPECTACLE BLIND	SPECTACLE BLIND	RING SPACER AND SPADE
≥8"	8-10" SPECTACLE BLIND ≥12" RING SPACER AND SPADE	RING SPACER AND SPADE	RING SPACER AND SPADE

For cryogenic service, spacers will be installed instead of spectacle blinds.

6.1.2 Positive Isolation General Diagrams

An air space formed by removing a spool or springing and blinding smaller lines is always an acceptable means to assure positive isolation. The general sketches of achieving positive isolation are seen below in Figure 3.

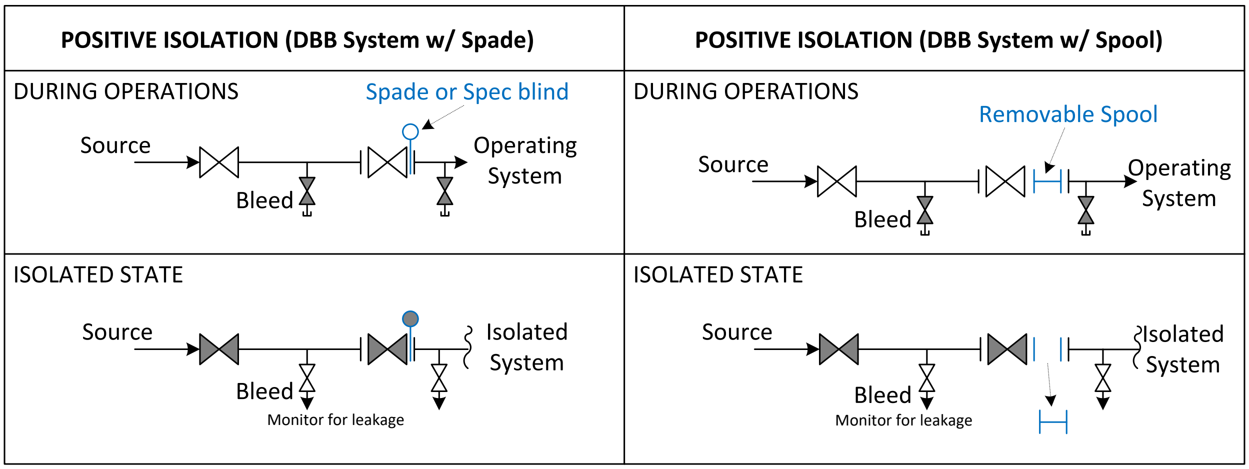

Figure 3. Positive Isolation of DBB Valve System

6.2 VALVED ISOLATION

Valved Isolation can be provided by one of the following:

1. Single Block valve (SVI): Single block valve isolation is insufficient to allow isolation for maintenance. Their use is limited to general isolation of flow in a particular line or segregation of systems where some leakage is accepted (e.g., isolation of a piece of equipment because its duty is not required).

2. Single Block and Bleed (SBB): The bleed valve is located on the equipment side (isolated side) such that the integrity of the block valve (leakage) can be checked prior to breaking containment. The bleed valve shall be terminated locally such that it can be monitored to confirm that the isolation valve is effective in not passing.

3. Double Block and Bleed (DBB) Isolation integrity is provided by the bleed valve preventing a high differential pressure across the second isolation valve. The bleed valve shall be terminated locally such that it can be monitored to confirm that the isolation valve is effective.

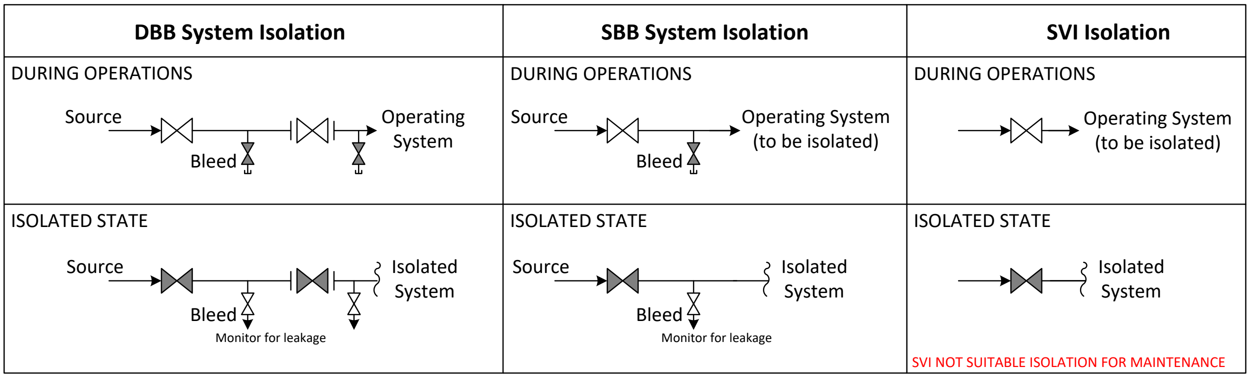

Figure 4. General Valved Isolation Diagrams

6.3 APPLICATION OF CORRECT LEVEL OF ISOLATION

The following table defines the minimum isolation requirements for Rio Puerco LNG:

Table 3. Summary of Isolation Requirements

FLUID TYPE	OPERATING PRESSURE		
	< 1135 kPa(g) (<150 PSIG)	1135 – 4928 kPa(g) (150 – 700 PSIG)	>4928 kPa(g) (>700 PSIG)
PROCESS FLUIDS AND HAZARDOUS UTILITIES	V - SBB I - DBB +A E - Positive	V - SBB + B I - DBB + B E - Positive	V - DBB +A I - DBB + B E - Positive
NON-HAZARDOUS UTILITIES	V - SBB I - SBB E - Positive	V - SBB + A I - DBB + B E - Positive	V - DBB + B I - DBB + B E - Positive
Notes: Pipework and instrument lines of 3/4" nominal bore and below may be treated in the below 150 psig category.			
For each category the requirements are given for: V – Initial valving of live system to allow further isolation to proceed. The required valves of live system to allow the system of "I" to be implemented. I – The valving required to permit carrying out maintenance that requires containment to be broken without positive isolation being established. E – The valving required to enter a vessel or conduct long-term maintenance. DBB - Double block and bleed general isolation SVI – Single valve and bleed general isolation Positive – Positive isolation by blinding, removal of spool, spec blind, etc. A - Use of mandatory operating safeguards given in list "A" below B – Use of mandatory operating safeguards given in list "B" below			

Mandatory Operating Safeguards	Category A (Low Risk)	Category B (High Risk)
Pressure build-up check to test valve integrity	YES	YES
Regular Monitoring of isolation integrity	YES	YES
Raise a Maintenance Permit		YES
Develop contingency plan against leak		YES
Operations technician in full time attendance with second operator on-site.		YES
Minimize task time		YES
Portable firefighting equipment available		YES
Identify back-up isolation valves, shutdown systems, etc.		YES

6.3.1 Application of Positive Isolation

Positive isolation is regarded as the most secure method and shall be considered when planning maintenance work. It is mandatory for entry into confined spaces and recommended in the following situations, in view of the additional security it offers:

- Plant Isolation - Major Maintenance and Construction
  The entire plant shall be positively isolated during major maintenance and construction activities to provide fail-safe means to ensure construction and maintenance personnel cannot be exposed to a major release. Major maintenance involves the removal of a piece of equipment. Construction involves at least one crane and / or hotwork on process piping. Positive isolation for the entire plant is provided with the use of the spectacle blinds at the pipeline battery limit.
- Equipment Isolation – Contamination
  To prevent contamination of utility systems, during normal operation, where these are permanently connected to a process unit.
- Equipment Vents and Drains
  On fill, vent and drain valves on process systems and equipment. These shall be fitted with either a fully rated blank flange or plug.
- Long duration isolations (e.g., more than one day).
- Isolations left in place when maintenance activities involving loss of containment are left unmanned.
- Where equipment is to be mothballed.
- Where naked flame hot work is to be undertaken.
- For process fluids at or above auto-ignition temperature (none expected for the project)
- For maintenance on systems involving toxic fluids (none expected for the project).

6.3.2 Application of Valved Isolation

Valved isolation shall be applied to the following situations:

- Systems which are regularly isolated for routine operations / maintenance.
- Isolation of parallel equipment on parallel trains when maintenance is performed during normal operation on adjacent equipment or trains. An example of this is the instrument air compressor trains.
- Instrumentation isolation.
- Permanently piped nitrogen purge connections shall use double block and bleed valves. These are not currently envisaged.
- Vents and Drains routed to the vent header.

7 VALVING ARRANGEMENT REQUIREMENTS AND DETAILS

7.1 GENERAL REQUIREMENTS

- Control valve failure action to be shown on P&IDs, (i.e., fail-open, fail-close)

- Piping class may not necessarily change across the control valve. Where the downstream system has a higher rating the spec breaks need to be reviewed.

- Where a valve is to be locked open or closed for operational purposes it should also be designated Locked Open (LO) or Locked Closed (LC). The lock may be applied with padlocks or car-seals.

- For instrumentation in non-cryogenic and / or services prone to flashing or auto-refrigeration, integrated DBB monoblocks shall be used and the bleed valve may be integral to the DBB block.

- Drain valves to be plugged or blanked according to pipe specification.

7.2 BATTERY LIMIT ISOLATIONS

The isolation at the battery limit between the feed gas pipeline connection and the train, along with between each LNG production train is required to support both positive and valved isolation for major maintenance / construction as well as routine maintenance.

The battery limit valving arrangements are seen in Figure 5.

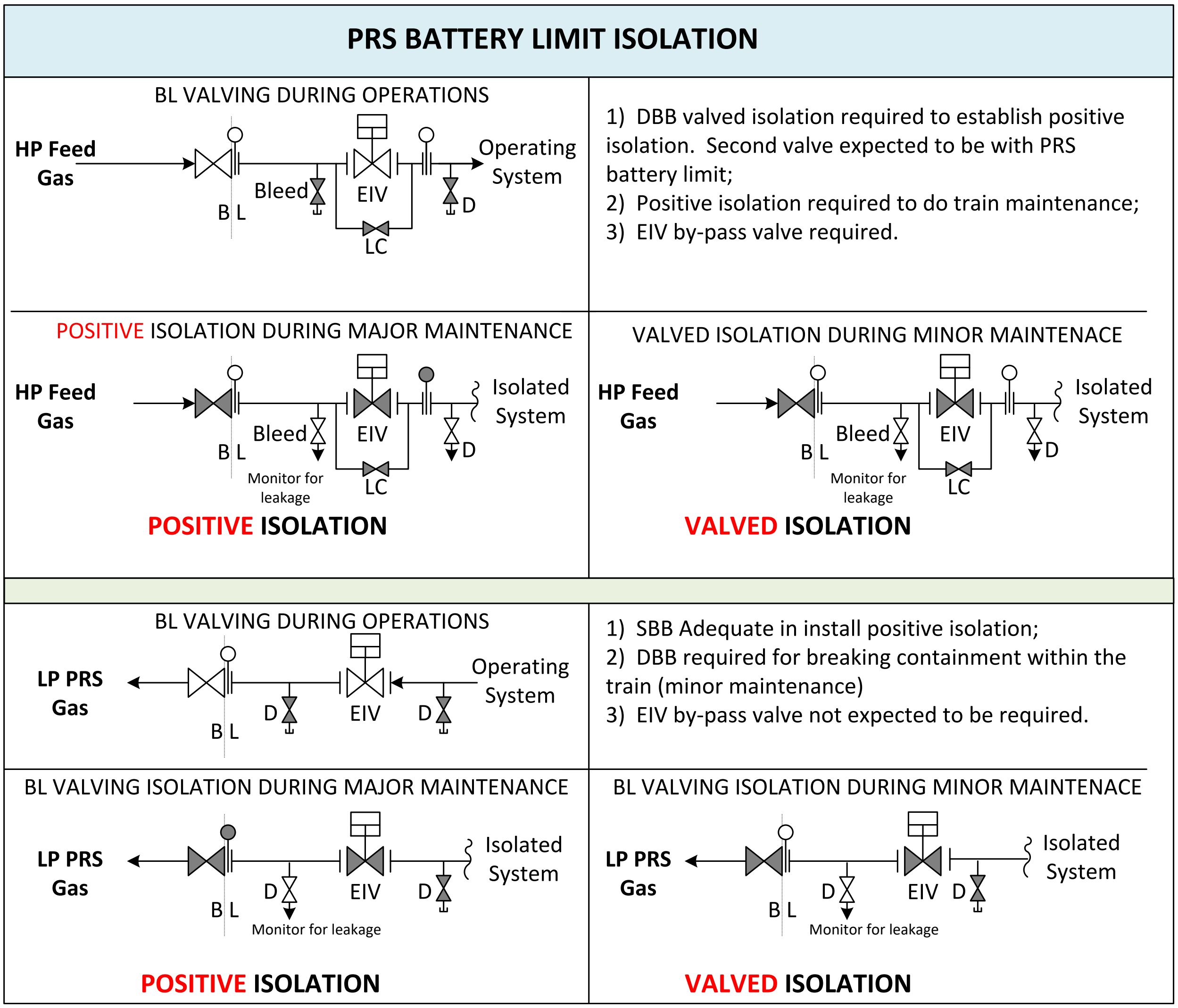

Figure 5. Facility Battery Limit Isolations

7.3 VENTS AND DRAINS

7.3.1 Location of Vents

- Vents shall be made available on equipment side of isolation.
- Vents shall be located where indicated on other standard isolation drawings in this document, or where gaseous volumes can be intentionally isolated.
- Vents should also be placed where there are no other small-bore process taps on a process line where there may need for temporary sampling and pressure gauge installation.

7.3.2 Locations of Drains

- Downstream of slopped piping, except for the relief header if it features a knock-out drum.
- On all filters and separators not in cryogenic service.
- Piping spools where upstream operations may result in intermittent or continuous liquid deposits (such as an oil flooded compressor or air dehydration unit).
- Piping systems that may need a chemical clean at some point in the future.
- Drains for water in the instrument air system shall be routed to a suitable catch pan in an accessible area.
- Drains for oil and other liquids and the system compressors shall be routed to a location that facilitates maintenance.

7.3.3 Vent and Drain Valves

The following guidance shall be applied to the vent and drain valves:

- Vent and drain valves where single valve isolation is acceptable and for normal service (Carbon Steel) shall be ½" ball valves with threaded connections.
- Vent and drain valves for cryogenic service shall be brass gate valves with threaded fittings.
- Vents and drains that discharge directly to the atmosphere shall always be equipped with a plug or cap to provide positive isolation. The plug or cap shall be rated for the system's design pressure.
- Any vent or drain valve that could release LNG or condensate shall be designated LC.

Vent valves subject to auto-refrigeration or cryogenic service that could be prone to sticking or icing shall be equipped with some provision to prevent sticking of the valve when venting. This is often a globe or gate valve located one meter downstream of a ball valve such that the majority of the pressure drop is across a valve not required to provide general isolation.

7.4 RELIEF VALVES

CFR part 193.2619 mandates that relief valves are required to be inspected and tested once each calendar year but with intervals not exceeding 15 months. This inspection and testing regime means the relief valve must be inspected and tested for verification of the valve seat lifting pressure and reseating. The isolations described in the following sections are intended to support this frequent inspection in a cost-effective and safe manner that minimizes breaking containment by completing the testing in place (or in situ). This also offers the benefit of decreasing hydrocarbon venting associated with depressurizing and purging hydrocarbon containing valves.

Several different relief valve configurations are required:

- PSVs shall have upstream isolation valve along with an upstream test port valve to facilitate in-situ PSV recertification and to allow isolation and removal of the PSV without purging the protected system upstream of the isolation valve to decrease hydrocarbon venting, risk of air ingress, etc.
- PSV inlet isolation valves shall be block-type valves and comply with API inlet loss requirements.
- All critical service relief valves shall be arranged with:
  - A lockable inlet isolation valve and test port to allow in-situ annual recertification / testing of the relief valve without removal from service.
  - No isolation valves or restriction located downstream of the PSV.
  - Relief valve nozzles whether on the vessel or the piping shall not have spectacle blinds of other means to block flow other than the single isolation valve.
  - Isolation valves shall have their lockable state reflected on the P&IDs.
- Relief valve piping in all cases shall be designed to prevent standing fluid against the discharge side of the PSV. Relief to safe location shall make provision to ensure debris and water can not readily enter or collect in the relief value discharge piping.
- Application of bypasses around relief valve sets shall be assessed on a case-by-case basis. Where a bypass is supplied, the line will contain a block valve and a globe valve for maintenance depressurizing. This bypass maybe omitted where depressurization is possible from another source.

NEW MEXICO GAS COMPANY

Project Name: Rio Puerco LNG Plant

Document Name: Plant Segregation Philosophy
Document Number: N2101-P-003
Revision: 1
Date: 10/05/2022

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Approved:	-	JZ	JZ	JZ
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Rev	Date	Description of Change
A	7/01/2022	Issued for Internal Review
B	7/15/2022	Issued for Client Review
0	9/01/2022	Issued for Project Description
1	9/05/2022	Issued for Project Description (October)

Holds

No.	Description
1	

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1 ABBREVIATIONS AND DEFINITIONS

BCF	Billion Cubic Feet
BDV	Blowdown Valve
BOD	Basis of Design
BOG	Boil-off Gas
BPCS	Basic Process Control System
CFR	Code of Federal Regulations
DCS	**D**istributed **C**ontrol **S**ystem. A Control System used to control oil and gas processes that are continuous or batch-oriented.
ESD	Emergency Shut Down A Control System that minimizes the consequences of emergency situations that may otherwise be hazardous by de-energizing, and/or isolation, thereby bringing the plant to a safer state.
FEED	Front End Engineering and Design
FGS	Fire & Gas System. A Safety System that monitors hazardous conditions (including fire and flammable gas releases) in the plant It initiates protective actions to prevent consequences of the incident through the ESD system.
HC	Hydrocarbon
HH	High High alarm trip
HMI	Human Machine Interface
HSE	Health, Safety and Environment
LEL	Lower Explosive Limit The flammable gas content in air required to sustain ignition or explosion.
LL	LowLow alarm trip
LNG	Liquefied Natural Gas
LSD	Liquefaction Shutdown
MAOP	Maximum Allowable Operating Pressure
MCC	Motor Control Centre
MCR	Main Control Room
MMscfd	Million Standard Cubic Feet per Day
NFPA	National Fire Protection Association
NMGC	New Mexico Gas Company
PLC	Programmable Logic Controller
PSD	Plant Shutdown
PSV	Pressure Safety Valve Used interchangeably with Pressure Relief Valve (PRV).
SDV	Shutdown Valve. A fail closed isolation valve designated as part of the Emergency Shutdown System (ESD).
STV	Shell & Tube Vaporizer
SIS	Safety Instrumented System
TSD	Trucking Shutdown
TRV	Thermal Relief Valve
TSO	Tight Shut Off
VSD	Vaporization Shutdown

2 PURPOSE

This document describes the high-level project requirements for the Emergency Isolation and Shutdown Systems planned for the Rio Puerco LNG facility.

It should be used in conjunction with other design basis and philosophy documents for the project including:

Table 1 Project Philosophies

N2101-B-002	Project Description
N2101-P-001	Relief System Philosophy
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3 INTRODUCTION

New Mexico Gas Company (NMGC) is a member of the Emera family of energy companies. NMGC is headquartered in Albuquerque and is the largest natural gas utility in New Mexico. The Company is situated between two large natural gas production basins, the Permian Basin in southeast New Mexico, and the San Juan Basin in northwest New Mexico. NMGC operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout the state.

During normal operations the control system along with the trained operators at the Rio Puerco LNG facility control the system with no interruption. These conditions prevail most of the time. However, from time to time in the facility conditions may arise that require a portion of entire facility to be shutdown. Although this is an unusual event, Rio Puerco LNG will be equipped with robust systems meeting or exceeding both normal industry practice and CFR 193 and NFPA 59A requirements. This is to avoid equipment damage, loss of containment, or other serious consequences.

Hydrocarbon processing facilities, including gas processing ones such as Rio Puerco LNG, typically include control systems, shutdown systems and some means to isolate systems that have a problem for other systems. This document describes the planned Rio Puerco LNG facility's approach to shutdown system and facility segregation in line with or exceeding good industry practice and applicable codes and standards. It is intended to specify the minimum project requirements for facility shutdown systems and facility automatic shutdown valves to enhance the facility safety and reliability for both operators and the community.

Rio Puerco LNG facility is equipped with a Basic Process Control System (BPCS) and Safety Instrumented System (SIS) that are responsible for the operation of the facility within its normal envelope and shutdown a portion or the complete facility when it deviates from its safe operating envelope. This is schematically seen in Figure 1.

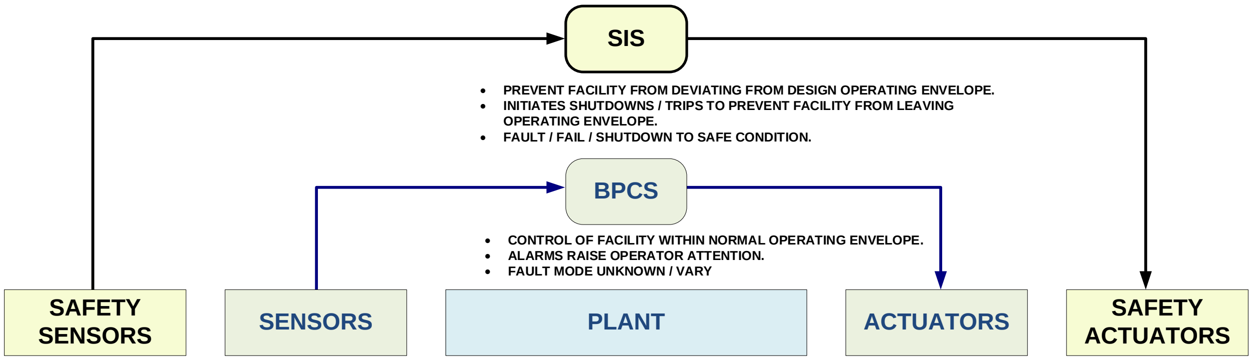

Figure 1. BPSC and ESD SIS Arrangement A Rio Puerco

The purpose of the BPCS is to keep the plant operating within its normal operating envelope. Examples of control within the BPCS is level control on a separator with a level control valve on the bottom getting a signal through the Process PLC to open and close based on a signal from a level instrument measuring level in the vessel. The Process PLC, level instrument, and control valve are all administered through the BPCS that work together to maintain level in the vessel (say between 25-50% full). The level instrument may also have a Level Alarm Low and/or level alarm high that will appear on the Human-Machine Interface (HMI) to alert the operator if level drops below or climbs above the desired level range. The control system for an LNG facility has hundreds of inputs / outputs to the BPCS that collectively work within the Process PLC programming to keep the plant operation running as intended.

In the event of a problem in the example above, for instance a downstream blockage in the line causing levels to build, the level would continue build as the BPCS attempted to drain the vessel by opening the level control valve and would raise an alarm to alert the operator. The operator would have some time to take corrective action. Extending this example, if equipment damage or hazardous condition could occur if the vessel flooded, there would be an additional level transmitter on the vessel that would close the upstream valve feeding liquid to the vessel. This level instrument and control valve actuator would be administered through the Emergency Shutdown (ESD) SIS to robustly shutdown the system before damage or a hazardous condition could arise.

The BPCS and ESD SIS share an HMI that a terminal operator will primarily use to operate the facility. The BPCS and ESD SIS are important to the control of the plant and administration of the ESD system to segregates and de-energizes sections of the plant. This ESD SIS and associated segregation is the content of this philosophy.

The SIS also interacts with the Fire & Gas System (FGS) that identifies hazardous conditions (e.g., flammable gas detection, fire detection) and responds actively to those hazardous or emergency conditions to minimize harm to personnel, damage to facilities, and escalation.

4 FACILITY ISOLATION AND SEGREGATION

Note: *The Rio Puerco LNG Facility includes multiple protective measures to prevent accidents or equipment damage from occurring including the shutdown and segregation facilities described in this philosophy. These features, while quite familiar to engineers and operators in the LNG, hydrocarbon processing, or related industries, may sound unusual to non-industry participants. The safety features described in this document are typical for hydrocarbon processing industries to help make sure the facility is as safe as practicable and aligned with sound engineering practice. The planned Rio Puerco LNG facility does not pose any usual risks or challenges associated with segregation or shutdown relative to other similar installations.*

Rio Puerco LNG shall be provided with a standalone, independent ESD SIS that can segregate the facility components and ensure a safe, reliable shutdown of the facility. The Safety Instrumented System (SIS) emergency shutdown (ESD) system, including an ESD SIS, which is intended to:

- Detect hazardous conditions with high reliability.
- Shut down equipment and brings the facility to a safer state.
- Isolate / segregate hydrocarbon-containing plant areas, including pipeline connections.
- De-energize affected plant areas.

This section of this philosophy describes the hierarchy of shutdowns within Rio Puerco LNG facility and associated actions and facility segregation.

4.1 SHUTDOWNS AND FACILITY ISOLATION

ESD functions shall be implemented where malfunctioning or mal operation of plant equipment or a control system can give rise to:

- Hazards to personnel or public
- Damage to the environment
- Economic loss (e.g., damage to main plant equipment or severe / sustained production loss)

4.2 ESD SIS SHUTDOWN HIERARCHY

The Rio Puerco ESD SIS administers three levels of shutdown in the following hierarchy:

Level 1: ESD – Emergency Shutdown. Plant power is de-energized for shutdown and evacuation, all equipment fails to its fail-safe condition / position. A facility ESD is manually initiated only under very serious emergency conditions.

Level 2: PSD - Plant Shutdown. Power is maintained as equipment and systems throughout the plant are shut down and isolated.

Level 3: Area Shutdowns. Area shutdowns which shutdown and isolate a specific process area within the plant where a problem or hazard is occurring. The following area shutdowns are relevant for Rio Puerco:

- LSD – Liquefaction shutdown
- VSD – Vaporization Shutdown
- TSD – Trucking Shutdown

These are intended to shut down their respective areas only and safety isolated equipment during emergency conditions.

4.3 ISOLATION SYSTEMS OBJECTIVES

As typical for modern gas processing and LNG facilities, a key part of the ESD SIS at the Rio Puerco LNG facility is the ability to automatically close a set of shutdown valves (SDV) to robustly isolate the facility from the connected pipelines and segregate hydrocarbon containing sections of the plant from each other to bring the facility to a safer condition when required. Figure *2* shows the main SDVs relevant to the facility.

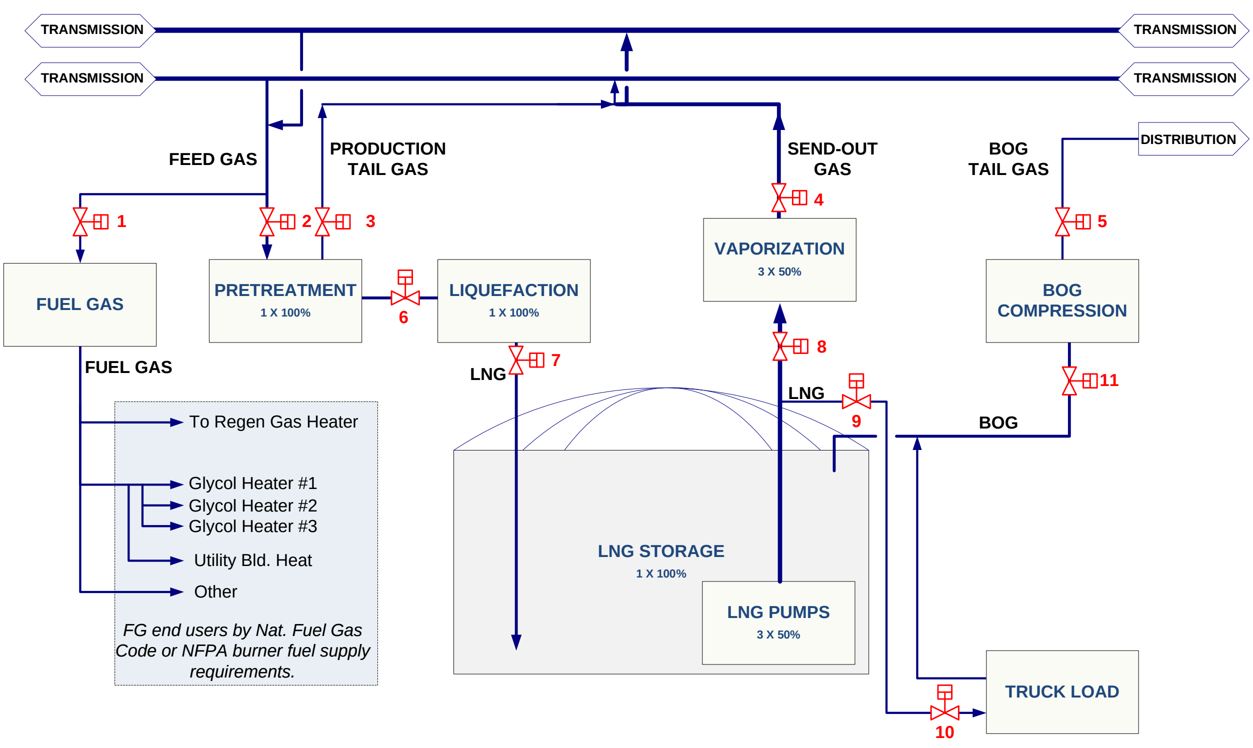

Figure 2. Main SDV Segregation of Rio Puerco LNG

Pipeline Isolation: Rio Puerco will be connected to two high-pressure transmission lines and a low-pressure distribution line. These are robustly segregated from the facility by means of a fail-closed SDV on each connection to a pipeline. This includes the following:

1. Fuel gas tap off the feed gas line upstream of the main SDV to allow a small flow of fuel gas to the facility for gas consumers such as building heat and building hot water heat.
2. Feed gas is robustly isolated from the transmission piping by means of a fail-closed SDV to segregates the pipeline from the pretreatment facilities.
3. The pretreatment facility produces a tail gas that is returned to one of the transmission lines that flows to Sana Fe Junction for mixing and send-out to NMGC grid. This line includes an SDV.
4. The send-out line from vaporization includes a dedicated SDV.
5. The outlet of the BOG Compression is equipped with an SDV to isolate the discharge of BOG compression from the distribution pipeline.

Plant Area Isolation: Rio Puerco includes several process areas that shall be robustly segregated from each other by means of fail closed SDV. The following minimum requirements shall be met:

1. An SDV shall be supplied between Pretreatment Liquefaction. This valve allows segregation of the pretreatment beds from the coldbox and may closed for a number of reasons including high-high temperature from the pretreatment system to prevent damage to the coldbox, hazardous condition detected, and liquefaction system trip.
2. An SDV shall be located close to the outlet of the coldbox to provided segregation between the LNG storage tank and the coldbox. Amongst other protective functions, SDV is important to minimize LNG leaking the in the event of an incident and is an important means to limit the spilled LNG and associated vapor cloud.
3. An SDV located between the LNG storage tank pump discharge line and the STV. In practice multiple SDVs will be located in this area to minimize hydrocarbon release potential and provide robust segregation between each STV vaporizer and the LNG pumps.
4. An SDV on the small LNG loading / unloading line running to the truck load facility. This is close to the LNG pump discharge line (TEE to truck load).
5. A second SDV on the small LNG loading / unloading line located at the LNG truck load connection point. There will be fire block valves on the LNG trailer per DOT requirements during loading operations (not shown).
6. An SDV for segregation between the LNG storage tank and the BOG Compressor. This segregates these two plant areas and closes on a number of protective measures such as Low-Low temperature and Low-Low pressure to the suction of the BOG compressor.

There are several fuel gas consumers shown in Figure *2*. These will have shutdown valves at or close-to the end-user per NFPA requirements (National Fuel Gas Code, NFPA86, etc.). For the burners in the Glycol-Water Heaters and the Regen Gas Heater in pretreatment this normally includes redundant SDVs on the main fuel supply to each burner and either a single or redundant SDV on the separate pilot line.

4.4 ESD SIS INITIATION

Reliable system shutdown and segregation through the ESD SIS may be initiated by a range of manual and automatic means that will be discussed in this section. The actions of the ESD SIS are executed through the high-integrity, redundant safety PLC. The means of initiating various ESD conditions include:

- Manual push buttons located in the MCR and in strategic locations within the facility.
- Safety devices terminating to the SIS safety PLC.
- Input to the SIS from the FGS.

4.4.1 Shutdown Push Button

There are expected to be shutdown pushbuttons located strategically throughout the facility which activate the overall and unit shutdowns in the facility (ESD, PSD, LSD, TSD, or VSD). The specific location of these devices will be developed in FEED and shall ensure shutdowns can be manually initiated by operators in a timely fashion typically without moving towards a potentially hazardous area.

Facility ESD is the highest level of shutdown that is reserved for major incidents. It de-energizes the facility and closes all SDV in the facility. It is depressed prior to personnel abandoning the facility and proceeding to muster. There are two means to activate Facility-wide ESD. A physical pushbutton in the control room and another on the plant control system HMI (Human Machine Interface) screen.

PSD shutdowns all processing equipment but maintains some power to the facility and operation of some critical utilities. PSD pushbuttons are located in strategic locations around the facility including in the Control Room, outside the MCC, at a centralized area by the LNG vaporization equipment just inside secondary LNG impoundment, around pretreatment and coldbox areas, and other areas as deemed required in FEED.

The area shutdowns associated with the next lower level of facility shutdown are primarily located the process area they are intended to serve. They are often located next to PSD pushbuttons. These pushbuttons give personnel in the field to quickly shutdown a portion of the facility without affecting the entire plant. In some cases, a shutdown of one of the areas will cascade to trigger fa PSD of other areas after a brief period.

An indicative list of ESD SIS pushbuttons is seen in Table 1 below for illustrative purposes.

Table 2: Indicative SD Push Buttons Locations

Indicative Area	ESD	PSD	LSD	VSD	TSD
Control Room Main Panel	■	■			
Control Room Secondary SD Panel			■	■	■
HMI Computer	■	■	■	■	■
Outside of MCC		■	■	■	
Vaporizer Platform Area		■	■	■	
Vaporizer Stairs Area		■	■	■	
Heater Building 1		■	■	■	
Heater Building 2		■	■	■	
Storage Tank top platform		■	■	■	
BOG Compressor Building 1		■			
BOG Compressor Building 2		■			
Regen Gas Heater Area		■	■		
Pretreatment Area 1		■	■		
Pretreatment Area 2			■		
Refrigeration Building Exit 1			■		
Refrigeration Building Exit 2			■		
Heater Building 3				■	
Truck Loading Egress					■
Truck Loading Kiosk					■

4.4.2 Safety Critical Device Initiation

The second means of initiating the ESD SIS is with input from safety critical control elements monitoring the operations of equipment and facilities. Safety critical instruments are terminated in the safety PLC and are independent of the BPCS. These are typically either designated as Switches, Low-Low Trips (LL) or High-High Trips (HH) on the P&IDs and associated actions are described in the ESD SIS Cause & Effect documentation.

Depending on the function and nature of the safety critical device they may trigger either a PSD or one or more unit shutdown(s). Additionally, following a unit shutdown, it is common to have upset conditions cascade into a PSD if the operator cannot quickly take action or remedy the cause of the unit shutdown. Examples of safety critical devices initiating a shutdown to prevent equipment damage or hazardous conditions are seen below:

- A Level High-High Trip in LNG Storage Tank will trigger a PSD. This is because PSD is above unit shutdowns in the hierarchy.
- A Temperature High-High Trip on refrigeration compressor suction will trigger an LSD shutting down liquefaction only. The rest of the plant will continue to function.
- A Temperature Low-Low Trip in LNG secondary containment associated with truck load would trigger a TSD and send an alarm to the FGS.
- A Feed Gas Line ESD Valve incorrect position feedback (closed during LIQUEFACTION mode) would trigger an LSD. Position indication on SDVs are safety critical devices terminated to the ESD SIS.

Low Temperature detectors are in areas of higher potentials for cryogenic LNG leaks including:

- Liquefaction spill trench and impoundment.

- Truck loading spill trench and impoundment.
- LNG tank spill impoundment.
- Relevant sub- impoundment for the LNG vaporizers.

These analog devices are terminated in the Safety PLC (ESD SIS) that then takes action according to the Safety PLC Cause & Effect and sends a digital cold detected alarms to the FGS for annunciation and further action according to the FGS Cause & Effect and associated logic.

4.4.3 FGS Initiation

The third means of initiating the ESD SIS is with an input from the FGS. The FGS includes fire detectors and gas detectors distributed throughout the facility along with smoke detection in buildings and cold detection (input to the FGS from the SIS / safety PLC). It is continuously monitoring the facility for hazardous conditions and alerts the operator by means of sirens, beacons and callouts to such hazardous condition should they develop. The FGS also sends signals to the ESD SIS for action.

There are one or more NFPA 72 compliant fire panels located in strategy locations in the facility as required. The main panel is in the PLC Room of the Control Building a second remote panel is located on the Firewater Pump House. Other panels may be required depending on facility layout and that will be determined in FEED. The following devices are wired to the fire panels:

All UV/IR Fire Detectors gas detected dry contact. Detector state and analog gas concentration may be routed to the ESD SIS.
All Heat Detectors.
All Smoke/Heat Detectors.
All Manual Pull Stations.

The following alarms and shutdowns are triggered from the fire panels:

Visual and Audible Annunciation for Fire Detection.
Visual and Audible Annunciation for Gas Detection.
Plant PSD System hardwired output to the ESD SIS.
Plant TSD System hardwired output to the ESD SIS.
Various other equipment shutdowns as deemed necessary.

5 REQUIREMENTS FOR ESD SIS

The following additional requirements are relevant for the Rio Puerco LNG facility shutdown valves. These exceed typical industry practice in a couple respect including definition of the integrity requirements and prohibition of natural gas as the motive fluid to actuate the valve.

5.1 SDV LOCATIONS

SDV shall be located in areas that facilitate periodic maintenance, inspection, and testing. SDV shall be located in locations where they can reliably function when call-upon and cannot be exposed to accidental loads that would prevent the device from reliably functioning. SDVs intended for liquid retention and minimizing the size of liquid releases should be located as close as practicable to the liquid inventory.

5.2 ISOLATION VALVE AND INTEGRITY REQUIREMENTS

SDV are safety critical elements as part of the ESD SIS. It is necessary to operate the valve by means of an actuator expected to be fail-safe (spring return) pneumatic cylinder type. Hydraulic cylinder and Electro-hydraulic actuator are also acceptable.

Additionally, the SDV shall:

- Have a fail-safe position. SDVs will be fail-closed. BDVs are typically fail-open
- Not have any other control function within the DCS (e.g., no flow control, pressure control, etc.)
- Be fire-safe rated
- Be specified as tight shut-off (TSO)
- Be quarter turn valves. Most applications for Rio Puerco will be suitable for ball valves.
- Any by-pass around a SDV shall either be a locked-closed valve during operations or also be equipped as an SDV (albeit smaller) meeting all the requirements described above.
- Shall not be actuated by natural gas. Natural gas actuated control and shutdown valves vent a small amount of natural gas when actuating to the environment and is not permitted for this project. Air actuation is expected although others may be considered.

Exceptions, such as a cryogenic control valve with a separate solenoid to reliably close the valve through the ESD system shall be made on a case-by-case basis with owner approval.

5.3 VALVE TESTING REQUIREMENTS

All safety systems for the Rio Puerco LNG facility will be subject to periodic testing and maintenance to help make sure they are ready to perform their function when called upon. CFR 193.2619 requires LNG facilities exceed typical requirements for testing. For this purposes SDVs shall be considered part of the control system intended for fire protection and will subject to documented inspection and testing at a frequency not exceeding six months.

Testing of SDVs can, in theory, be conducted with either a Proof test (shuts the valve) and a Diagnostic Test (partial stroke test). A Proof test is a manual test that that allows the operator to determine whether the valve is in the "as good as new" condition by testing for all possible failure modes and requires the valve to close for to verify function. For the Rio Puerco LNG facility Proof Testing will be planned for because it is easier to administer and can be completed with no to very limited downtime.

NEW MEXICO GAS COMPANY

Project Name: Rio Puerco LNG Plant

Document Name:	Equipment Sparing Philosophy
Document Number:	N2101-P-004
Revision:	1
Date:	10/05/2022

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Revision:	A	B	0	1
Date:	7/05/2022	7/26/2022	9/01/2022	10/5/2022
By:	MAB	SM	SM	MAB
Checked:	SM	MAB	MAB	PP
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Rev	Date	Description of Change
A	7/01/2022	Issued for Internal Review
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1	10/05/2022	Issued for Project Description

Holds

No.	Description
1	

TABLE OF CONTENTS

1 ABBREVIATIONS AND DEFINITIONS

BCF	Billion Cubic Feet
BOD	Basis of Design
BOG	Boil-off Gas
C&I	Controls & Instrumentation
CAPEX	Capital Expense
ESD	Emergency Shut Down
FEED	Front End Engineering and Design
F&G	Fire & Gas Detection
HC	Hydrocarbon
HPN2	High Purity Nitrogen
IO	Input / Output
LNG	Liquefied Natural Gas
LO	Lube Oil
MAOP	Maximum Allowable Operating Pressure
MMscfd	Million Standard Cubic Feet per Day
NFPA	National Fire Protection Association
NMGC	New Mexico Gas Company
OPEX	Operating Expense
OPP	Overpressure Protection
PSA	Pressure Swing Adsorption
PSV	Pressure Safety Valve, used interchangeably
SIS	Safety Instrumented System
STV	Shell & Tube Vaporizer
TRV	Thermal Relief Valve
TSO	Tight Shut Off

2 PURPOSE

This document describes the planned Rio Puerco LNG facility's equipment sparing and process train philosophy. It is intended to balance capital cost with reliability and uptime potential for the facility and reflects a number of capital cost and cost-benefit analysis as well as typical best practice.

This document should be used in conjunction with other design basis and philosophy documents for the project including:

Table 1 Project Philosophies

N2101-B-001	Basis of Design
N2101-P-001	Relief & Blowdown Philosophy
N2101-P-002	Isolation for Maintenance Philosophy
N2101-P-003	Plant Segregation Philosophy

3 INTRODUCTION

New Mexico Gas Company (NMGC) is a member of the Emera family of energy companies. NMGC is headquartered in Albuquerque and is the largest natural gas utility in New Mexico. The Company is situated between two large natural gas production basins, the Permian Basin in southeast New Mexico, and the San Juan Basin in northwest New Mexico. NMGC operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout the state.

The Rio Puerco LNG facility will become an important piece of gas infrastructure for New Mexico and a large impetus for the facility is improving reliability of gas delivery during cold weather / high gas demand events. To satisfy this function the facility's storage, BOG compression and vaporization functionality must be exceptionally reliable and cold-weather tolerant. For non-critical systems, such as liquefaction, lower redundancy of equipment and resultant lower availability is cost-effective and appropriate. This document describes the features of the installation that are intended to achieve exceptional availability of critical functions (like send-out) as well as a cost-effective overall installation.

4 PLANT TARGET AVAILABILITY

Plant target Availability is a key measure of reliability that measures the percentage of time the facility is able to execute its mission when called upon. Within the discipline of reliability engineering Availability describes the percent uptime when required to be operating and is slightly different than Reliability that measures the probability of a failure. For the purposes of this philosophy:

Availability = Percentage of time that a system is performing its desired function.

Establishing availability targets is important because higher availability generally increases CAPEX to pay for redundant systems, elimination of common failure modes and other features required to achieve higher availability. Therefore, a facility must balance the trade-off between availability and cost based on how important the function is. For Rio Puerco LNG there are different availability requirements for the three operating modes:

HOLDING – The facility has LNG in the storage tank but is neither adding to gas inventories or withdrawing through Vaporization or Liquefaction activities. During this time Boil-off Gas must be managed and control and safety systems are operational.

VAPORIZATION – The facility is actively vaporizing and sending-out gas. During this time, in addition to HOLDING mode functionality, the LNG pumps and vaporization facility are operational. Reliable performance during this period is critical because it underpins the purpose of the facility.

LIQUEFACTION – The facility is activity liquefying feed gas from the pipeline to rebuild inventories of stored gas. During this time, in addition to HOLDING mode functionality, the pretreatment and refrigeration systems are operational.

The availability requirements of the Rio Puerco LNG facility for each of these modes is expressed qualitatively in the table below.

Table 2. Rio Puerco Availability Targets

MODE	AVAILABILITY TARGET	NOTES
HOLDING	Exceptionally High	Includes control system, essential utilities, storage tank, and BOG compression, odorization and send-out. Minimum uptime requirement.
VAPORIZATION	Exceptionally High	Includes all systems equipment to send-out gas to transmission piping at nameplate capacity. Includes all equipment in HOLDING mode plus LNG pumps, STV vaporizers, glycol heating system, and gas send-out.
LIQUEFACTION	Industry Standard	Includes all equipment in HOLDING mode plus feed gas, pretreatment, liquefaction and rundown to LNG storage tanks.

Referring to Table 2, to achieve exceptionally high availability during HOLDING and VAPORIZATION modes extensive equipment sparing, redundancy and other features will be required. These requirements will be described in the following sections.

5 FACILITY AND EQUIPMENT PROCESSING TRAIN STRATEGY

A process **train** refers to a sequence of processing stages that produce an intermediate or finished product. Where there are multiple trains, any train may be taken out of service for maintenance without adversely impacting the process performance or capacity of adjacent similarly functioning trains.

5.1 OVERALL FACILITY PROCESSING TRAINS

Rio Puerco LNG shall be initially implemented as a single train facility with a single LNG production train and single LNG storage tank. Plot space and minimal pre-investment in site improvements such as space on pipe racks, space on cable trays, and very limited spare space in ESD and F&G and other core panels, and minimal space reservation for additional HMI screens to prepare for potential:

- **1 BFC Storage Tank:** Future same sized single containment LNG storage tank sharing secondary impoundment with the first LNG storage tank.
- **10 MMscfd second liquefaction train.** A future 10 MMscfd N2 expander liquefaction train using MS pretreatment similar in dimension and function to the system installed in the original build of the facility.

Pre-investment in future trains shall be minimal. For instance, no provisions for future piping tie-in will be made. If plans for a second train or storage tank are realized in the future, it will require a shutdown to cut-in a new TEE on the piping (rather than installing it with blind flanges in the initial build).

5.2 RIO PUERCO EQUIPMENT TRAIN REQUIREMENTS

To achieve the required availability targets for the facility some equipment and system will need to be installed in parallel, relatively autonomous trains. This strategy is summary as follows:

1) Equipment that is arranged in trains shall minimize common failure modes and may be maintained or replaced without impacting the functionality of adjacent trains.
2) Critical utilities, such as air, emergency power generation, and fire water shall be arranged in trains so that they can be maintained and remain highly available (approaching 100%).
3) Vaporization (send-out) when called-upon is an essential function of the facility. Three parallel and interconnected equipment line-ups help send-out reliability:
    a. Normal send-out capacity is 195 MMscfd.
    b. Send-out critical equipment including LNG pumps, vaporizers, and Glycol/ water heaters shall be arranged into equipment trains such that any combination of LNG pump, Shell & Tube Vaporizer (STV), and Water-Glycol Heater can operate together.

c. Any failure of an LNG pump, STV or Water-Glycol Heater will allow continued operation of the remaining equipment with reduced send-out capacity of at least 130 MMscfd.
d. Send-out is designed to operate even through grid power outages and below the coldest ambient temperature recorded at site to help provide for excellent availability.

4) Holding mode critical equipment, including BOG compression shall be arranged in equipment trains to ensure BOG generated in the storage tank is reliably compressed and sent-out to distribution.

Table 3 indicates the equipment train arrangements for the Rio Puerco LNG facility.

Table 3. Rio Puerco Equipment Train Arrangement

Equipment	Train	Supported Mode
STV LNG Vaporizers	3 x 65 MMscfd	Vaporization
LNG Send-out Pumps. Includes ability to extra any pump and maintain with LNG storage tank remaining in service.	3 x 65 MMscfd	Vaporization
Water-Glycol Heaters with ancillary glycol circulation pumps, fuel gas, etc.	3 x 65 MMscfd	Vaporization
Odorization package to Rio Puerco ML send-out	2 x 100%	Vaporization
Odorization package to NMGC distribution (primarily compressed BOG)	2 x 100%	All modes
Firewater pumps, drivers and fuel day tanks. Drivers may be different with at least one diesel driven.	2 x 100%	All / BOP Critical Utility
Dry instrument air supply including compressors, coolers, wet air receiver (if any) and heatless dryers.	2 x 100%	All / BOP Critical Utility
Screw or equivalent BOG compression with discharge to distribution line.	2 x 100%	All / BOP
Notes: *1. All train configurations described above can simultaneously, continuously operate all parallel installed equipment trains.*		

The following are also relevant to equipment training arrangements.

High Purity Nitrogen: High purity Nitrogen (HPN2) is required as refrigerant, for compressor seals, and other plant demands. A non-spared N2 generator including air compressor, air and N2 receivers, PSA or membrane N2 generation, and associate filters and controls will be the primary source of HPN2. This supply will be backed-up by a Liquid Nitrogen storage tank and two (duty and stand-by) ambient air vaporizers as back-in in the event the N2 generator is down. The LN2 supply can also be used during periods of peak demand such as commissioning and large inerting activity for maintenance operations.

Emergency natural gas power generation: Emergency power generation is a critical utility to help ensure send-out can function during a black-out.

Other Utilities (as needed): All essential utilities shall be spared to ensure they are not a source of unavailability at Rio Puerco. Exceptions shall be agreed with OWNER on a case-by-case basis.

6 EQUIPMENT AND COMPONENT SPARING

6.1 INSTALLED SPARES

Installed spares are intended to be used when there is the failure of a component within the system. By use of the installed spare, the system may remain operational without any significant downtime or requirement to complete maintenance. In contract to installed trains there may be some limits to installed spares:

- Installed spare equipment may not include all the valving required to extract or complete maintenance on a spare piece of equipment when the spare is running.
- It may not be possible to operate the facility with both the duty and spare component lined-up / operational.

The following installed spares requirements shall apply to Rio Puerco LNG:

- Equipment trains shall not include additional installed spares. The intention of the train is to allow maintenance, repair, or outage without resulting in downtime.
- All small filter and coalescers in critical service shall include an installed spare that allows on-line maintenance unless the filter may be by-pass and isolated on-line for a shift with no detrimental effects to the facilities.
- Turboexpander LO Pump: 2 x 100%
- Turboexpander LO Filter: 2 x 100%
- Mole Sieve Particulate filter: 2 x 100% arrangement.
- Refrigerant Compressor LO Pump: 2 x 100%
- Refrigerant Compressor LO Filter: 2 x 100%
- Firewater jockey pump: 2 x 100%. A warehouse spare may be considered as an alternative.
- LNG Storage PSVs shall be installed in a 2 x 100% arrangement on the LNG storage tanks with both normally in service

Additional installed sparing may be considered based on cost-benefit analysis or other factors.

6.2 CAPITAL SPARES

Capital spares are equipment items (spare parts) that are expected to have a long life or a small chance of failure, but because of their nature would cause shutdown of equipment for a prolonged period because of a long procurement cycle. As such capital spares can be thought of as some insurance against long-term plant outage due to equipment failure.

Capital spares shall be limited to critical equipment for producing LNG and that maintenance time or time-to-repair (including procurement) are excessive. To allow for warehousing and security, an annual OPEX cost of 10% of CAPEX shall be applied for all capital spares. The following capital spares shall be held at the site:

- Each unique turboexpander Mechanical Center Section (MCS) including installed compressor and turboexpander wheels as well as a second set of spare turboexpander and compressor wheels (loose) shall be provided.

The following equipment are sometimes maintained as capital spares at similar facilities but will not be for Rio Puerco LNG:

- LNG Export Pump, stored in sealed N2 environment. The installed three-pump arrangement (3 x 65 MMscfd) is considered adequate.
- Scientific Instruments level and density meter for the LNG storage tank. Redundant level and temperature measurement on the storage tank is considered adequate to facility repair time.

6.3 WAREHOUSE MAINTENANCE SPARES

The following maintenance spares shall be stored on-site:

- Each none-spared critical service lube oil pumps for the expander, refrigerant compressor, and BOG compressors (if any).
- All unique critical-service motors below 100 hp shall be spared.
- All expected maintenance spares for the first two years of operation shall be included in the CAPEX of the plant. This shall include:
    - All manufacture recommended spare parts for the first two years.
    - All recommended / anticipated commissioning spares and supplies.
    - All filter elements, dryer cartridges, and other consumables shall be spared to allow operation through the first two years including initial installation and in anticipation of heavy loading through initial start-up.
    - Sufficient sealed adsorbent materials and other catalysts / chemicals to last two years or replace the material in a single bed (as appropriate).
    - Flange bolts, piping, vent and drain fittings, gaskets, etc.
    - Pump couplings and other items prone to failure
    - Common valve actuators and maintenance packs. The design shall minimize the number of different valves and fittings to facilitate maintenance sparing.
    - Any specialty items that may be prone to damage or failure.

- Any other manufacturer recommended maintenance spares.
- All PSVs in critical service for HOLDING or VAPORIZATION service that do not have an installed spare shall have a warehouse spare.
- All relays, IO cards, and other C&I components that are prone to failure shall be included on-site as maintenance spares. Exception to this shall only be through the use of a documented service agreement that provided replacement components within 24 hours.

3. PROCESS FLOW DIAGRAMS

New Mexico
GAS COMPANY

LISBON
GROUP

New Mexico
GAS COMPANY

RIO PUERCO LNG PLANT

PROCESS FLOW & UTILITY FLOW DIAGRAMS

LISBON GROUP JOB NO. N2101

LISBON
GROUP

ISSUED FOR PROJECT DESCRIPTION (OCT.) - REV.1 DATE: 10/07/2022

PROCESS DRAWING LIST

DRAWING NO.	TYPE	DRAWING DESCRIPTION
PS-001	PFD	COVERSHEET
PS-002	PFD	PROCESS DRAWING LIST
PS-003	PFD	PFD LEGEND SHEET
PS-004	BFD	BLOCK FLOW DIAGRAM
PS-005	PFD	RECEPTION AND INTERFACES
PS-007	PFD	MS ADSORPTION PRETREATMENT
PS-010	PFD	LIQUEFACTION
PS-015	PFD	LNG STORAGE TANK AND VAPORIZATION
PS-016	PFD	BOIL-OFF GAS COMPRESSORS
PS-020	PFD	FUEL GAS
PS-021	PFD	HEATING MEDIA
PS-022	PFD	BOG COMPRESSOR GLYCOL COOLING MEDIA
PS-023	PFD	INSTRUMENT AIR AND NITROGEN SYSTEM
PS-031	HMB	HEAT AND MATERIAL BALANCE

NOTES:

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
1	10/07/2022	SN	JZ	SM	MAB	ISSUED FOR PROJECT DESCRIPTION (OCT.)
0	09/06/2022	SN	JZ	SM	MAB	ISSUED FOR PROJECT DESCRIPTION
C	07/28/2022	PP	WD	SM	MAB	ISSUED FOR PRE-FEED
B	04/06/2022	SN	CW	SM	MAB	ISSUED FOR CLIENT REVIEW
A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

LISBON GROUP
New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
PROCESS DRAWING LIST

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	N/A	PS-002	1

L:\Mechanical Design\N2101 NMGC\N2101 New Mexico Gas Company\PID DWG\PFD\N2101-PS-002 - PROCESS DRAWING INDEX.dwg Son Nguyen 10/07/22 4:02pm

DRAWING NO.:PS-003 REVISION: 1

EQUIPMENT NUMBERING

AA - A A X Y A / B

- EQUIPMENT TYPE
- EQUIPMENT AREA
- SEQUENTIAL #
- PARALLEL EQUIPMENT DESIGNATION (IF ANY, MAY BE ALPHABETICAL OR NUMERICAL)

A	=	DRIER
B	=	BLOWER
AC	=	AIR COOLER
E	=	HEAT EXCHANGER
F	=	FILTER
GE	=	GAS ENGINE
H	=	HEATER
K	=	COMPRESSOR/TURBINE
KT	=	GAS TURBINE
P	=	PUMP
PK	=	PACKAGE
C	=	COLUMM
V	=	VESSEL

INSTRUMENTATION IN MAJOR CONTROL LOOPS

AI	ANALYZER INDICATION, CO2, H2O, ETC.
AT	ANALYZER TRANSMITTER
FT	FLOW TRANSMITTER
TC	TEMPERATURE CONTROL
TI	TEMPERATURE INDICATION
TT	TEMPERATURE TRANSMITTER
PC	PRESSURE CONTROL
PI	PRESSURE INDICATION
LT	LEVEL TRANSMITTER
LI	LEVELING INDICATION
LC	LEVEL CONTROL
LS	LEVEL SWITCH
ILC	INTERFACE LEVEL CONTROL
ILIC	INTERFACE LEVEL CONTROL W/ INDICATION
LIC	LEVEL CONTROL W/ INDICATION
ZC	SPEED CONTROL
PDIC	DIFFERENTIAL PRESSURE CONTROL W/ INDICATION
HC	HAND CONTROL
HS	HAND SWITCH
FFIC	FLOW RATIO CONTROL W/ INDICATION

LINE TYPES

- PACKAGE BOUNDARY
- MAIN PROCESS LINE
- MINOR PROCESS LINE
- ELECTRICAL \ CONTROL SIGNAL

LEGEND

NNF	NORMALLY NO FLOW
QCV	QUICK CLOSING VALVE
ASC	ANTISURGE CONTROL
PSV	PRESSURE SAFETY VALVE

EXISTING ON SHADED SIDE | NEW ON WHITE SIDE — INTERFACE, SHOWN ON LINE WITH EXISTING FACILITIES ON THE SHADED SIDE AND NEW FACILITIES IN WHITE.

EG	ETHYLENE GLYCOL
MeOH	METHANOL INJECTION
CI	CORROSION INHIBITOR INJECTION
FG	FUEL GAS
CD	CLOSED DRAIN
OD	OPEN DRAIN
CHW	HEATING MEDIA RETURN
WHM	HEATING MEDIA FEED
V	VENT
IG	INERT GAS
IA	INSTRUMENT AIR

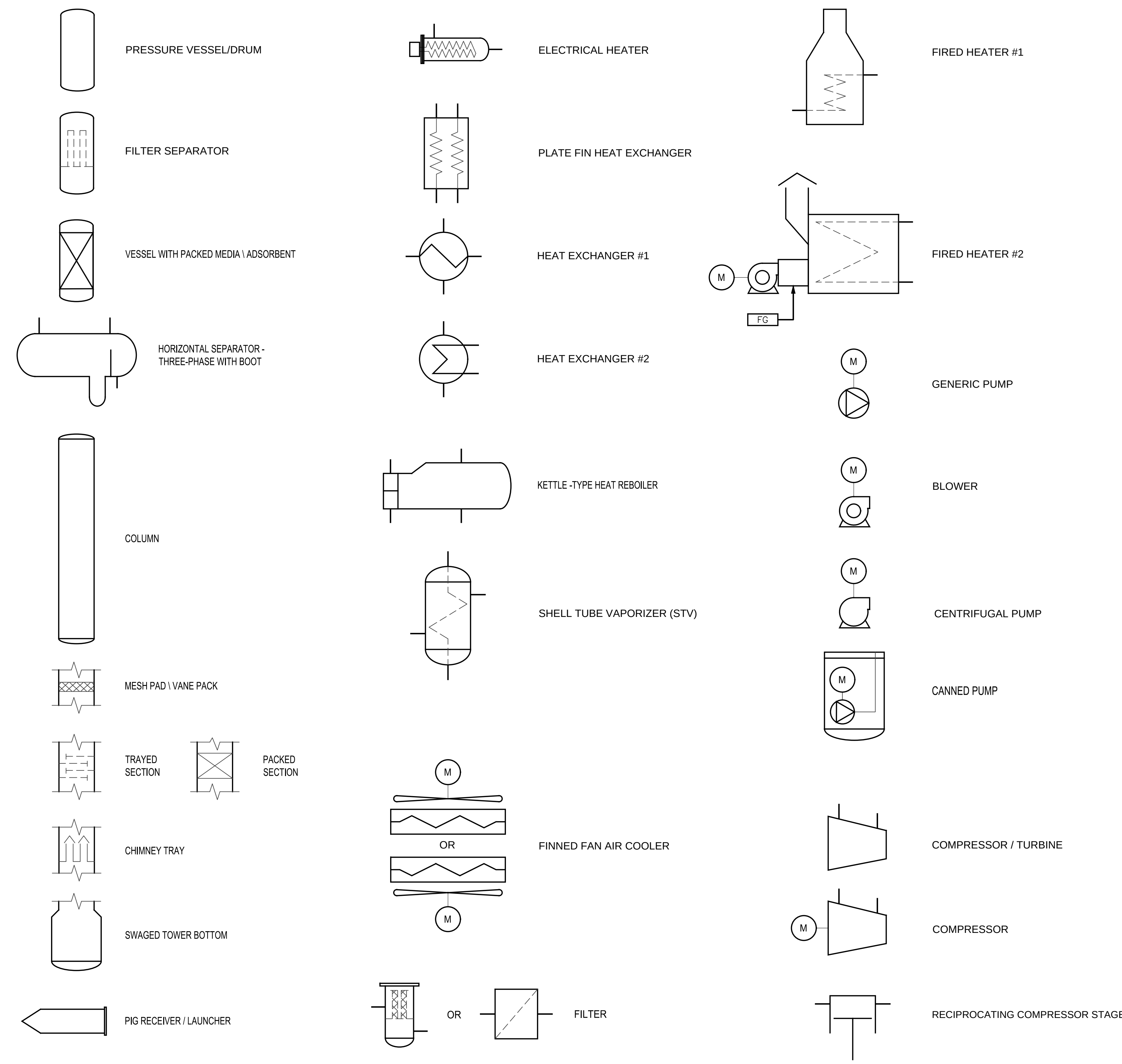
VALVING

- MANUAL VALVE, TYPE NOT SPECIFIED
- CONTROL VALVE, TYPE NOT SPECIFIED
- PRESSURE REGULATOR
- SDV SHUT-DOWN VALVE
- BDV BLOWDOWN VALVE
- PRESSURE VALVE
- LOUVER OR GUIDE VANE

DRIVER

- M ELECTRIC MOTOR DRIVE
- E ENGINE DRIVE
- T TURBINE DRIVE

EQUIPMENT



NOTES:

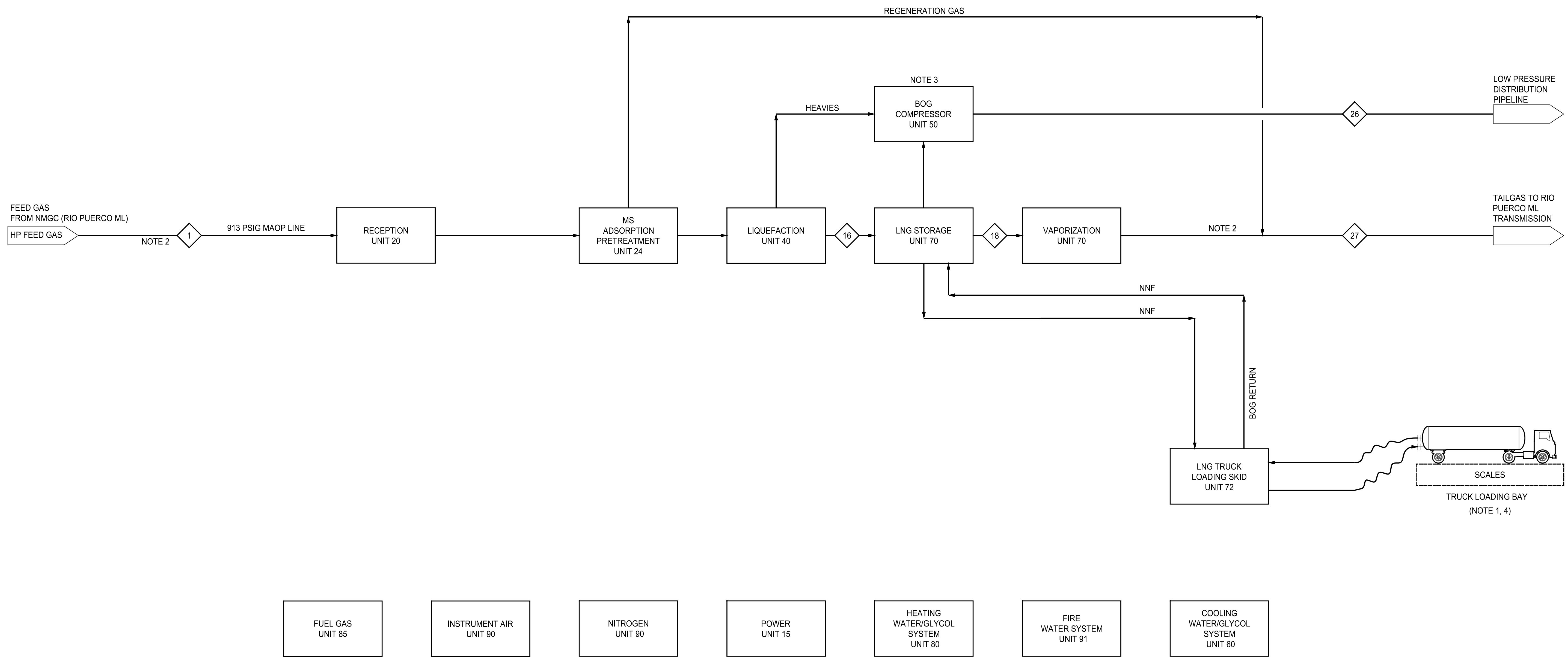
REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
1	10/07/2022	SN	JZ	SM	MAB	ISSUED FOR PROJECT DESCRIPTION (OCT.)
0	09/06/2022	SN	JZ	SM	MAB	ISSUED FOR PROJECT DESCRIPTION
C	07/28/2022	PP	WD	SM	MAB	ISSUED FOR PRE-FEED
B	04/06/2022	SN	CW	SM	MAB	ISSUED FOR CLIENT REVIEW
A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

LISBON GROUP — New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
PFD LEGEND SHEET

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	N/A	PS-003	1



NOTES:

1. TRUCK LOADING / UNLOADING FACILITIES NORMALLY NO FLOW (NNF). PROVIDED FOR BACK-UP FILLING CAPABILITY, ON-NETWORK PIPELINE OUTAGE SUPPORT AND SIMILAR ACTIVITIES TO IMPROVE FACILITY AND NETWORK RELIABILITY.
2. FEED GAS WILL BE CONNECTED WITH ANY ONE (24" OR 16") OF THE RIO PUERCO ML AND THE SEND OUT GAS LINE WILL NEED TO BE CONNECTED TO THE OTHER RIO PUERCO ML (16" OR 24" RESPECTIVELY).
3. BOG COMPRESSION SUPPLIED WITH INSTALLED SPARE (2 X 100%) FOR HIGH AVAILABILITY. BOTH MACHINES INSTALLED FOR CONTINUOUS SIMULTANEOUS OPERATIONS.
4. VAPOR RECOVERY FROM TRUCK LOAD IN ACCORDANCE WITH NO OPERATIONAL VENTING REQUIREMENTS FOR FACILITY.
5. BACK-UP POWER USING ESSENTIAL DIESEL GENERATOR ALLOWS HOLDING MODE AND VAPORIZATION MODE OPERATIONS DURING POWER OUTAGES. LIQUEFACTION CAN NOT RUN DURING POWER OUTAGE.

LEGEND:

NNF NORMALLY NO FLOW
QCV QUICK CLOSING VALVE
ASC ANTI-SURGE CONTROL
MS MOLECULAR SIEVE
◆ INTERFACE

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
1	10/07/2022	SN	JZ	SM	MAB	ISSUED FOR PROJECT DESCRIPTION (OCT.)
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B	04/06/2022	SN	CW	SM	MAB	ISSUED FOR CLIENT REVIEW
A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

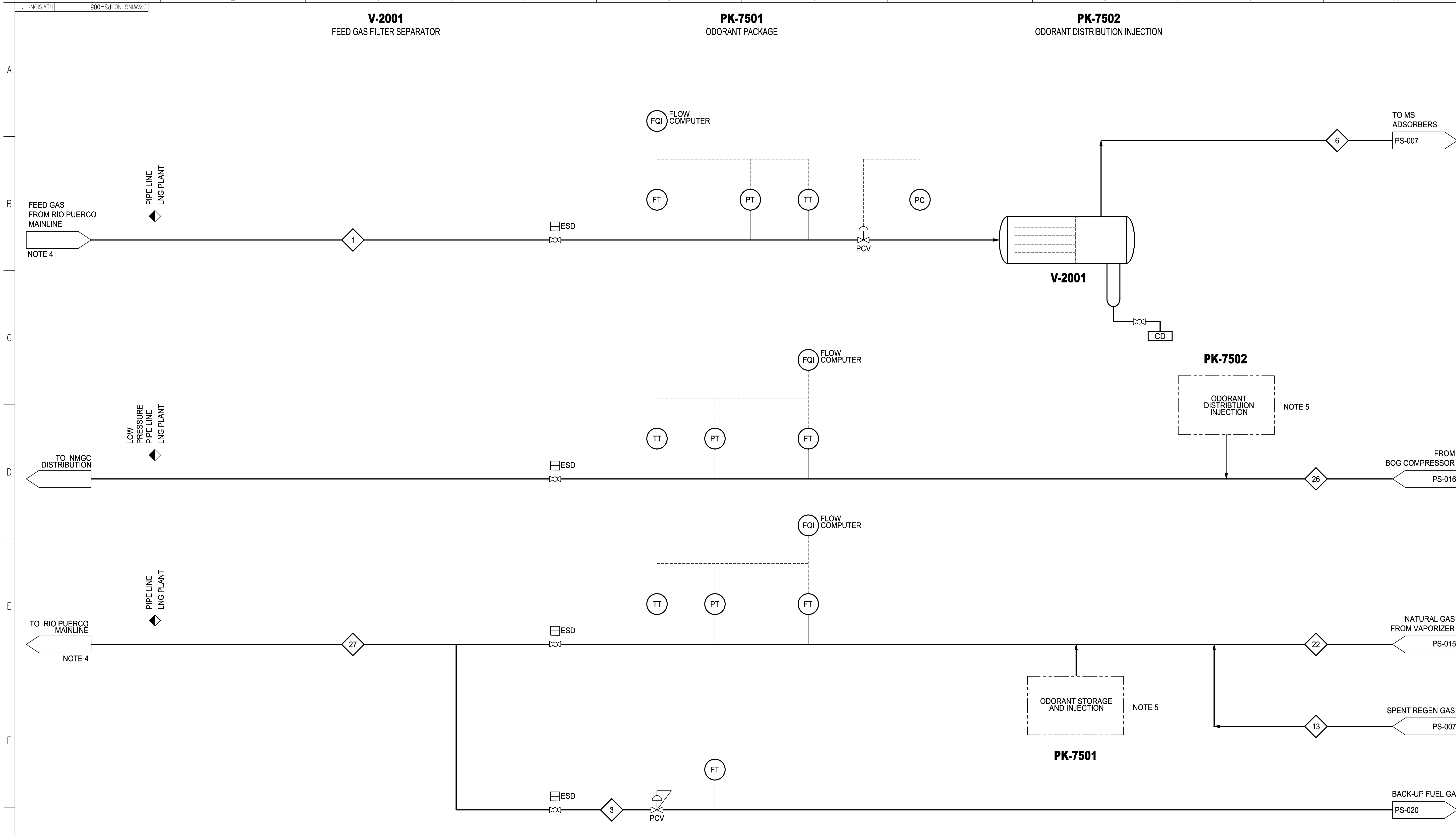
LISBON GROUP
New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

BLOCK FLOW DIAGRAM

DRAWING REFERENCE NO. N/A | AREA N/A | DRAWING NO. PS-004 | REV. 1

L:\Mechanical Design\N2101 NMGC\N2101 New Mexico Gas Company\PID DWG\PFD\N2101-PS-004 - BLOCK FLOW DIAGRAM.dwg Son Nguyen 10/07/22 2:55pm



NOTES:

1. FEED GAS WILL BE CONNECTED WITH ANY ONE (24" OR 16") OF THE RIO PUERCO ML AND THE SEND OUT GAS LINE WILL NEED TO BE CONNECTED TO THE OTHER RIO PUERCO ML (16" OR 24" RESPECTIVELY.)
2. SEND-OUT GAS NOT RETURNED TO SAME LINE AS FEED GAS AND MUST FLOW TO SANTA FE JUNCTION AND MUST FLOW TO SANTA FE JUNCTION.
3. DISTRIBUTION LINE FEED GAS IS BACK-UP FUEL GAS. PRIMARY FUEL GAS IS COMPRESS BOG.
4. FEED GAS AND TAILGAS MAY BE DRAWN/RETURN TO EITHER THE 24" OR 16" RIO PUERCO MAIN LINE PIPELINES. ONE WILL SERVE AS FEED GAS SUPPLY WHILE OTHER TAILGAS.
5. REDUNDANT ODORIZATION CAPABILITY FOR BOTH TRANSMISSION AND DISTRIBUTION SEND-OUT LINES.

LEGEND:

NNF NORMALLY NO FLOW
QCV QUICK CLOSING VALVE
ASC ANTI-SURGE CONTROL
MS MOLECULAR SIEVE
GC GAS CHROMATOGRAPH
MA MOISTURE ANALYZER
◆ INTERFACE

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
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B	04/06/2022	SN	CW	SM	MAB	ISSUED FOR CLIENT REVIEW
A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

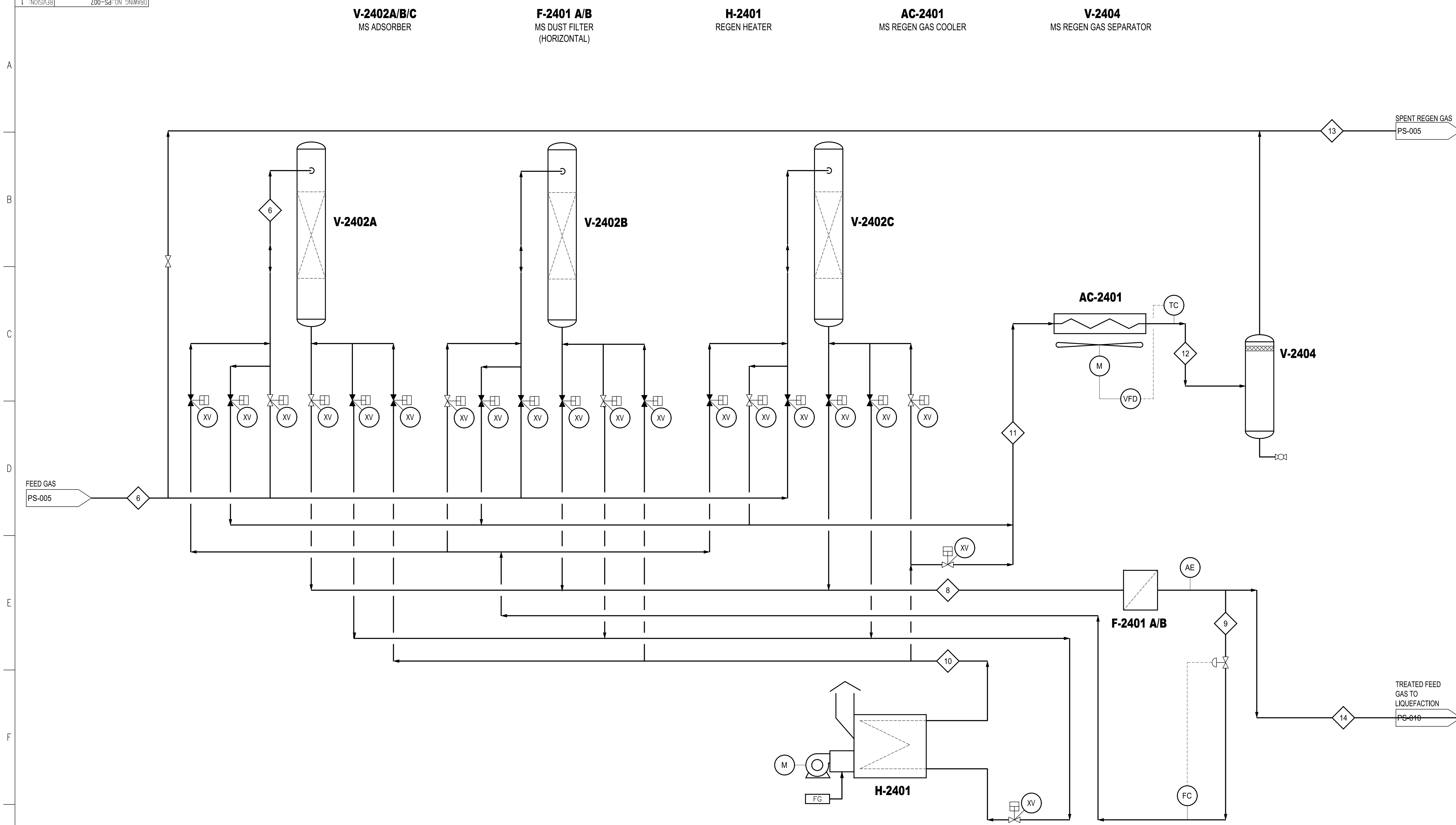
LISBON GROUP

New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
RECEPTION AND INTERFACES

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	20&75	PS-005	1



NOTES:

LEGEND:

- NNF NORMALLY NO FLOW
- QCV QUICK CLOSING VALVE
- ASC ANTI–SURGE CONTROL
- MS MOLECULAR SIEVE
- GC GAS CHROMATOGRAPH
- MA MOISTURE ANALYZER
- INTERFACE

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A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

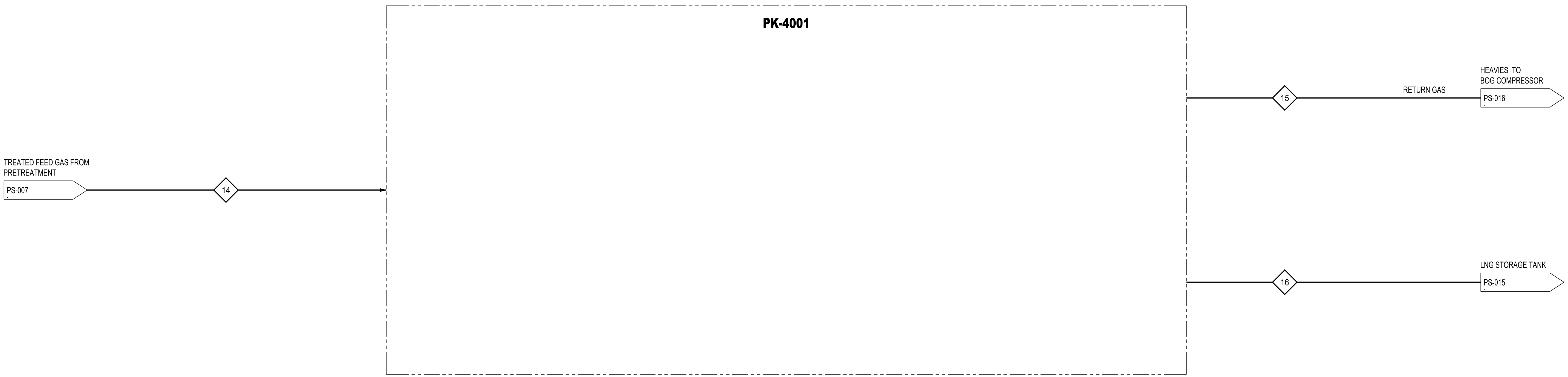
PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
MS ADSORPTION PRETREATMENT

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	24	PS–007	1

DRAWING NO.:PS-010 REVISION: 1

PK-4001
LIQUEFACTION PACKAGE



NOTES:

1. LIQUEFACTION BASED ON DUAL N2 EXPANDER LIQUEFACTION PROCESS. PFD TO BE DEVELOPED IN FEED.

LEGEND:

NNF NORMALLY NO FLOW
QCV QUICK CLOSING VALVE
ASC ANTI-SURGE CONTROL
MS MOLECULAR SIEVE

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
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B	04/06/2022	SN	CW	SM	MAB	ISSUED FOR CLIENT REVIEW
A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

LISBON GROUP
New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
LIQUEFACTION

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	40	PS-010	1

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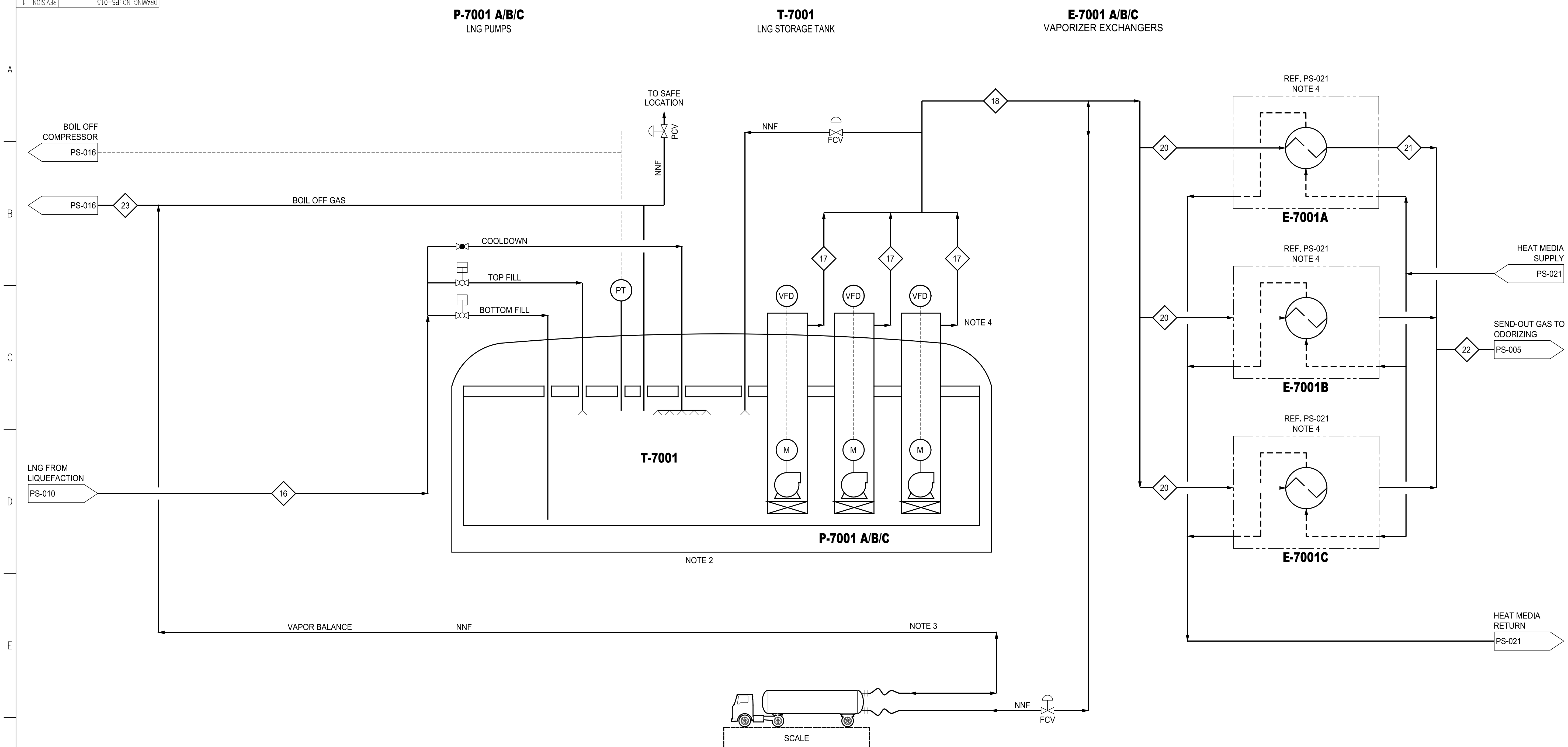

NOTES:

1. TRUCK LOADING / UNLOADING FACILITIES NORMALLY NO FLOW (NNF). PROVIDED FOR BACK-UP FILLING CAPABILITY, ON-NETWORK PIPELINE OUTAGE SUPPORT AND SIMILAR ACTIVITIES TO IMPROVE FACILITY AND NETWORK RELIABILITY.
2. 1 BCF SINGLE-CONTAINMENT LNG STORAGE TANK. OVERALL HEIGHT LIMITED TO 100 FT.
3. VAPOR RECOVERY FROM TRUCK LOAD IN ACCORDANCE WITH NO OPERATIONAL VENTING REQUIREMENTS FOR FACILITY.
4. 195 MMSCFD VAPORIZATION LNG WITH ALL LNG PUMPS, VAPORIZERS, AND WATER-GLYCOL HEATERS RUNNING SIMULTANEOUSLY. ANY LNG PUMP MAY BE OPERATED WITH ANY VAPORIZER OR HEATER.

LEGEND:

NNF NORMALLY NO FLOW
QCV QUICK CLOSING VALVE
ASC ANTI-SURGE CONTROL
MS MOLECULAR SIEVE
GC GAS CHROMATOGRAPH
MA MOISTURE ANALYZER
◆ INTERFACE

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B	04/06/2022	SN	CW	SM	MAB	ISSUED FOR CLIENT REVIEW
A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

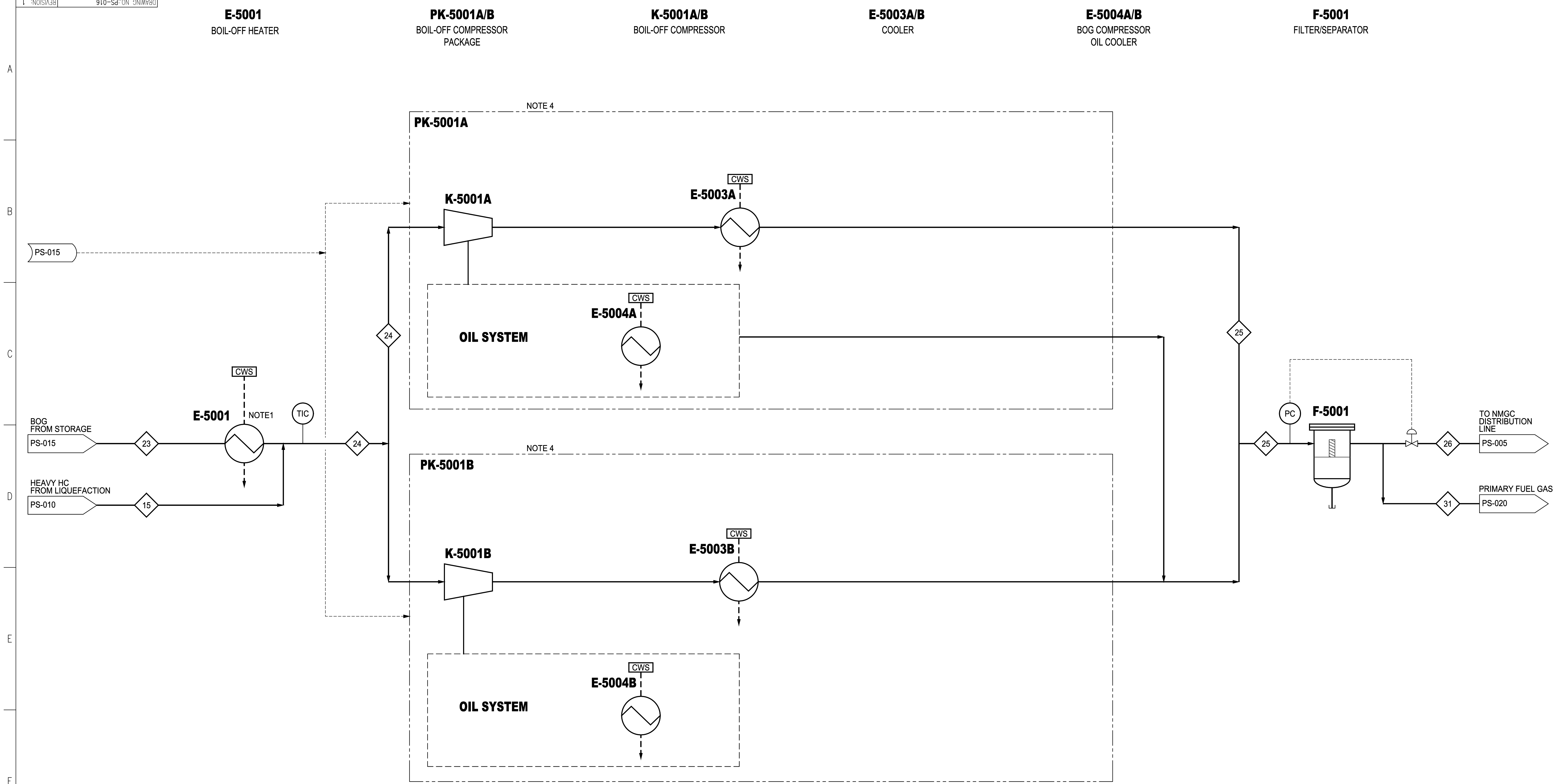
LISBON GROUP
New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
LNG STORAGE TANK AND VAPORIZATION

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	70	PS-015	1

L:\Mechanical Design\N2101 NMGC\N2101 New Mexico Gas Company\PID DWG\PFD\N2101-PS-015 - LNG STORAGE TANK AND VAPORIZATION.dwg Son Nguyen 10/07/22 5:30pm



NOTES:
1. SEE PS-022 FOR DETAIL OF COOLING MEDIA.
2. COOLING WATER IS GLYCOL-WATER MIX IN CLOSED LOOP SYSTEM FOR BOIL-OFF COMPRESSORS.
3. COMPRESSOR RUN SIGNAL FROM HIGH SELECT ON LNG STORAGE TANKS WITH LEAD/LAG COMPRESSOR DESIGNATED BY OPERATOR.
4. BOG COMPRESSION SUPPLIED WITH INSTALLED SPARE (2 X 100%) FOR HIGH AVAILABILITY. BOTH MACHINES INSTALLED FOR CONTINUOUS SIMULTANEOUS OPERATIONS.

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A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

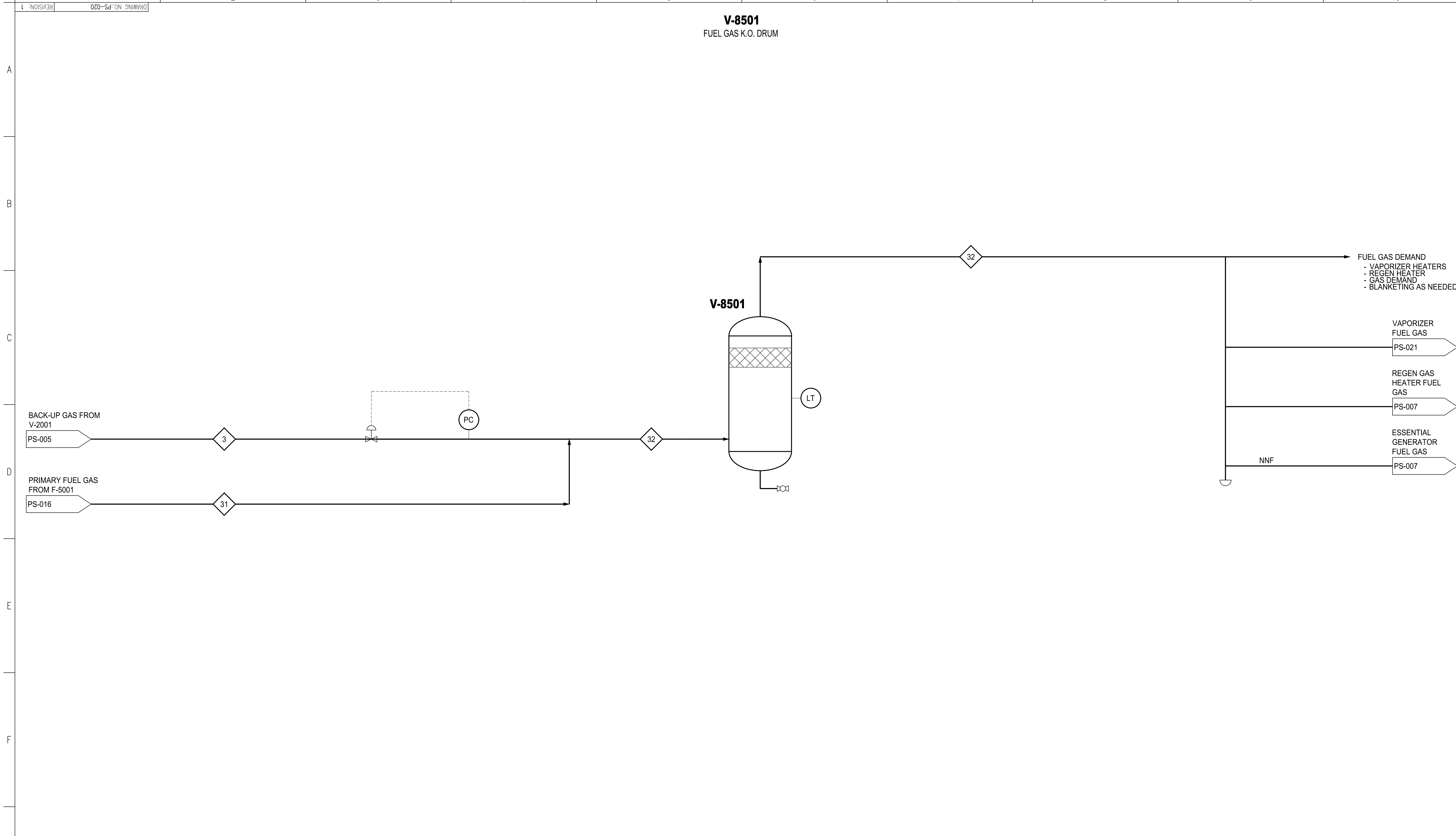
LISBON GROUP
New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
BOIL-OFF GAS COMPRESSORS

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	50	PS-016	1

L:\Mechanical Design\N2101 NMGC\N2101 New Mexico Gas Company\PID DWG\PFD\N2101-PS-016 - BOIL-OFF GAS COMPRESSORS.dwg Son Nguyen 10/07/22 4:02pm



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NOTES:

-

LEGEND:

NNF NORMALLY NO FLOW
QCV QUICK CLOSING VALVE
ASC ANTI-SURGE CONTROL
MS MOLECULAR SIEVE

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
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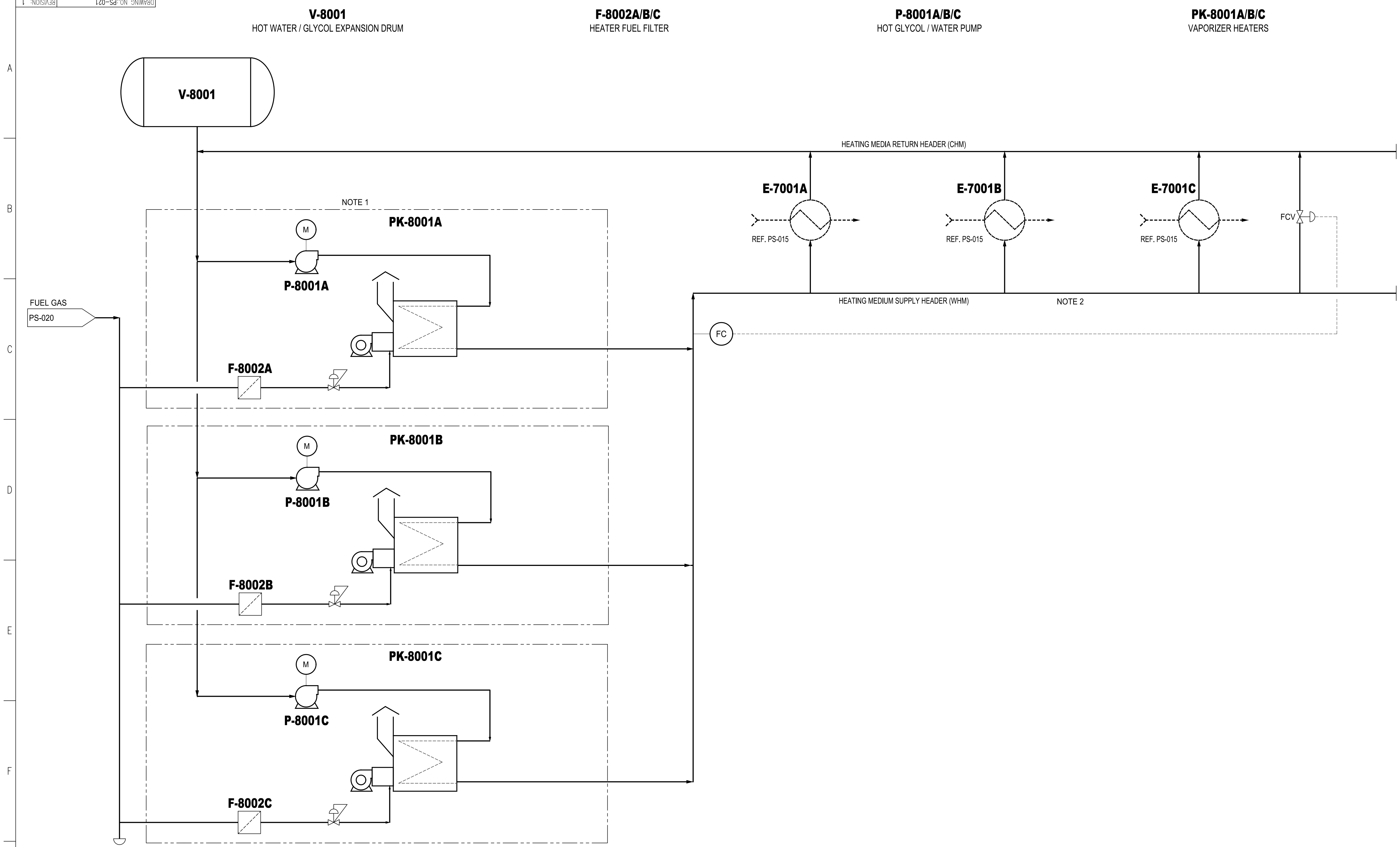
A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

LISBON GROUP
New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
FUEL GAS

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	85	PS-020	1



NOTES:

1. PIPING, INSTRUMENTATION, AND UTILITIES TO ALLOW SIMULTANEOUS OPERATION OF ALL THREE 50% VAPORIZER HEATERS. CAN SUPPLY SUFFICIENT HEAT TO CONTINUOUSLY VAPORIZE 195 MMSCFD WITH ALL LNG PUMPS / VAPORIZERS OPERATING SIMULTANEOUSLY. DELIVERS HEATING TO SUPPORT 130 MMSCFD SEND-OUT WITH ANY TWO HEATERS OPERATING.
2. SHELL & TUBE VAPORIZERS (STV) LOCATED IN LNG STORAGE TANK IMPOUNDMENT AREA TO MINIMIZE EXTENT OF LNG PIPING IN PROCESS AREAS.

LEGEND:

NNF NORMALLY NO FLOW
QCV QUICK CLOSING VALVE
ASC ANTI-SURGE CONTROL
MS MOLECULAR SIEVE
GC GAS CHROMATOGRAPH
MA MOISTURE ANALYZER
INTERFACE

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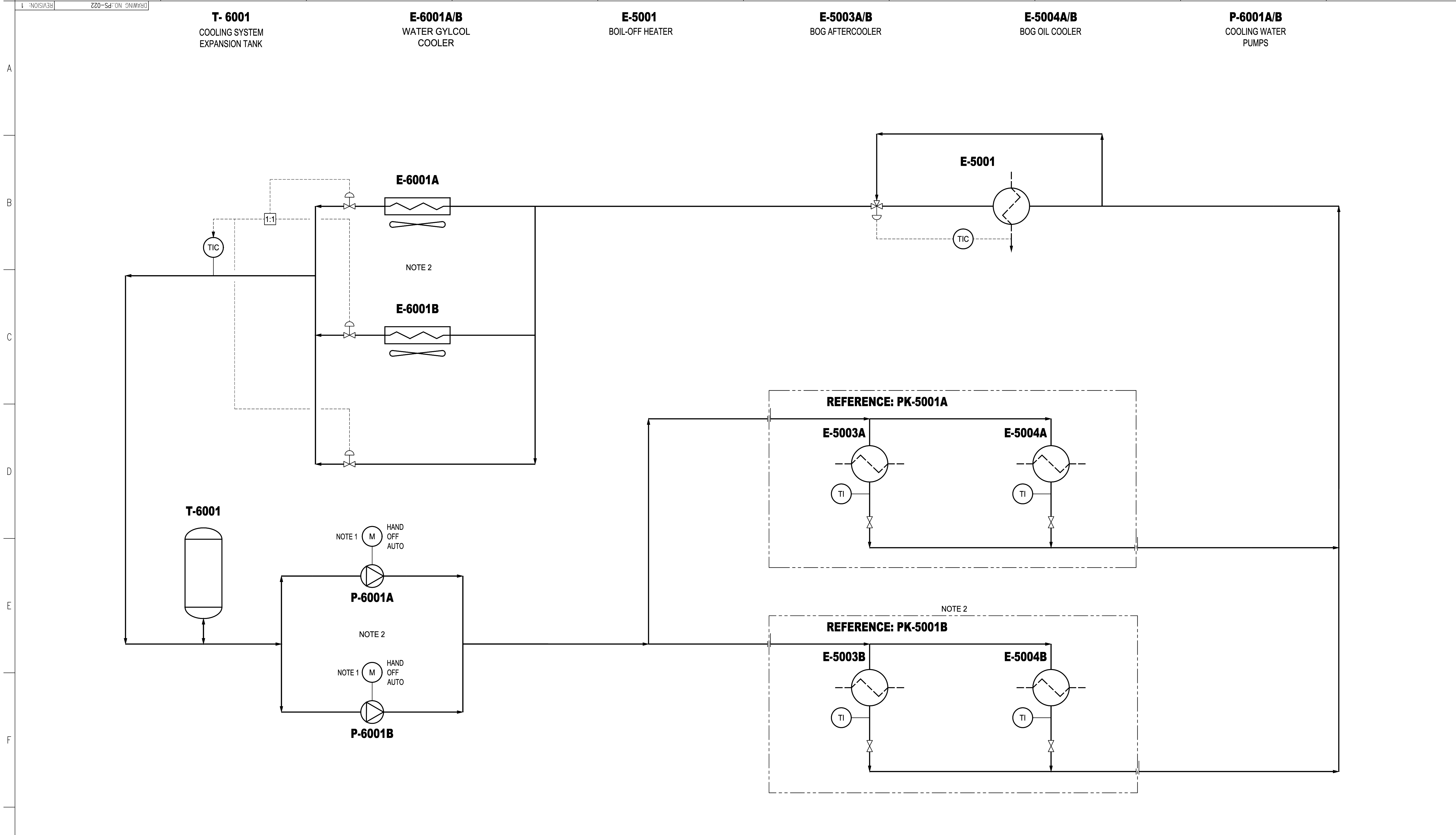
LISBON GROUP

New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

UTILITY FLOW DIAGRAM
HEATING MEDIA

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	80	PS-021	1



NOTES:

1. OPERATOR SELECT COOLING WATER PUMP TO RUN. SECOND PUMP AUTO-START IF FIRST PUMP FAILS.
2. 2x100% REDUNDANCY INSTALL FOR ENHANCED RELIABILITY.

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LISBON GROUP
New Mexico GAS COMPANY

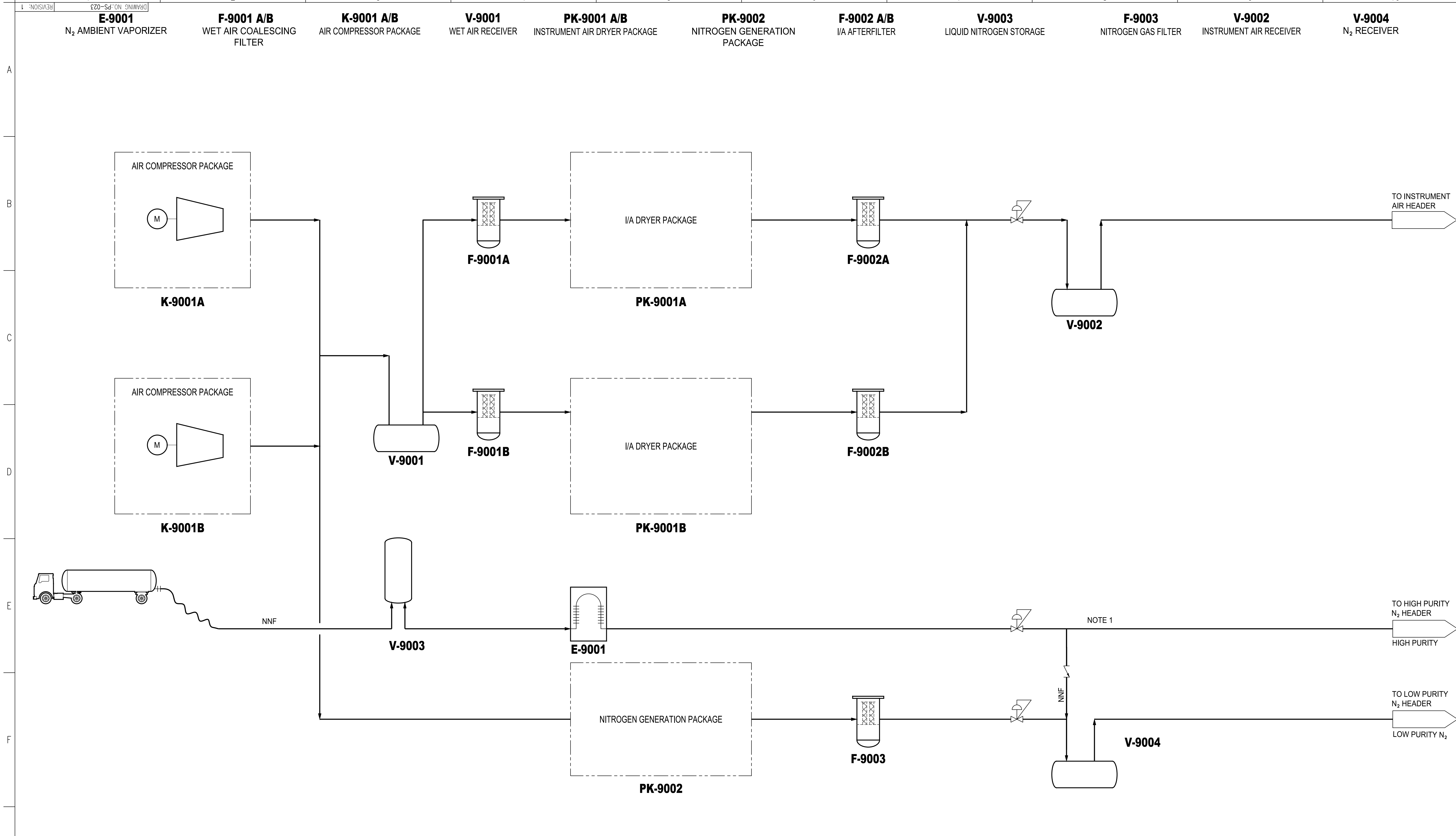
PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
BOG COMPRESSOR GLYCOL COOLING MEDIA

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	60	PS-022	1

DRAWING NO.:PS-022 REVISION: 1

L:\Mechanical Design\N2101 NMGC\N2101 New Mexico Gas Company\PID DWG\PFD\N2101-PS-022 - BOIL-OFF GLYCOL COOLING MEDIA.dwg Son Nguyen 9/06/22 9:12am



NOTES:

1. LIQUID N_2 FOR BACK UP TO ONSITE GENERATED N_2 FOR LARGE PURGING OPERATIONS.

LEGEND:

- NNF NORMALLY NO FLOW
- QCV QUICK CLOSING VALVE
- ASC ANTI-SURGE CONTROL
- MS MOLECULAR SIEVE
- GC GAS CHROMATOGRAPH
- MA MOISTURE ANALYZER
- ◆ INTERFACE

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A	03/22/2022	DM	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

LISBON GROUP

New Mexico GAS COMPANY

PROJECT: RIO PUERCO LNG PLANT

PROCESS FLOW DIAGRAM
INSTRUMENT AIR AND NITROGEN SYSTEM

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	90	PS-023	1

4. HEAT AND MATERIAL BALANCES

New Mexico Gas Company

LISBON GROUP

LIQUEFACTION MODE

Stream	Unit	1	3	6	8	9	10	11	12	13	14	15	16	18	22	23	24	25	26	27	31	32
Vapour Fraction	-	1	1	1	1	1	1	1	1	1	1	1	0.005	0	1	1	1	1	1	1	1	1
Temperature	°F	80	120	80	80	80	580	505	120	120	80	65	-261	-256	120	-259	20	120	120	120	120	120
Pressure	psig	650.0	634.0	649.0	644.0	642.0	640.0	640.0	635.0	634.0	642.0	10.0	0.5	634.0	0.5	0.5	0.4	70.0	60.0	629.0	60.0	60.0
Molar Flow	MMscfd	14.35	–	14.35	14.28	3.88	3.88	3.95	3.95	3.95	10.40	0.32	10.08	–	0.00	0.88	1.20	1.20	1.11	3.95	0.1	0.1
Mass Flow	lb/hr	26,308	–	26,308	25,956	7,416	7,416	7,769	7,769	7,769	18,540	403	18,137	–	0	1,628	2,215	2,215	2,058	7,399	166	166
Liquid Volume Flow	Barrel/Day	-	–	-	-	-	-	-	-	-	-	89.1	-	0.00	-	-	-	-	-	-	-	-
Heat Flow	MMBtu/hr	-52.2	0.0	-52.2	-50.9	-14.5	-12.1	-13.4	-15.7	-15.7	-36.3	-0.8	-42.2	0.0	0.0	-3.5	-4.0	-3.9	-3.6	-15.7	-0.3	-0.3

Composition		1	3	6	8	9	10	11	12	13	14	15	16	18	23	23	24	25	26	27	31	32
Methane	mol. frac.	0.960	0.948	0.960	0.965	0.965	0.965	0.947	0.947	0.947	0.965	0.939	0.966	0.966	0.939	0.939	0.941	0.941	0.941	0.947	0.939	0.939
Ethane	mol. frac.	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.045	0.025	0.025	0.000	0.000	0.010	0.010	0.010	0.025	0.000	0.000
Propane	mol. frac.	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.007	0.002	0.002	0.002	0.000	0.002	0.002	0.002	0.002	0.001	0.001
i-Butane	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
n-Butane	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C4+	mol. frac.	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0027	0.0001	0.0001	0.0001	0.0000	0.0005	0.0005	0.0005	0.0002	0.0005	0.0005
Nitrogen	mol. frac.	0.008	0.007	0.008	0.008	0.008	0.008	0.007	0.007	0.007	0.008	0.006	0.008	0.007	0.061	0.061	0.047	0.047	0.047	0.007	0.061	0.061
CO2	mol. frac.	0.005	0.017	0.005	0.000	0.000	0.000	0.018	0.018	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.000	0.000
H2O	mol. frac.	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000

NOTES:

1. H&MB CORRESPONDENCE TO 10 MMSCFD OF FLOW TO THE LIQUEFACTION BASED ON 0.5 MOL% CO2 AT THE ADSORBER INLET.

2. THE CO2 COMPOSITION OF STREAM 13 IS SHOWN AS AVERAGE VALUE. THE ACTUAL VALUE OF CO2 VARIES WITH TIME DURING THE REGENERATION STEP, AND WILL BE SIGNIFICANTLY HIGHER WITH SPIKE FOR SOME PERIOD. BLENDING WITH THE PIPELINE GAS AT THE SANTA FE JUNCTION ENSURES THAT THE PIPELINE TARIFF FOR CO2 HAS BEEN MET PRIOR TO TRANSMISSION TO USERS.

3. REGENERATION GAS COMPOSITION REPRESENTS AN AVERAGE STEADY-STATE CONDITION. ACTUAL COMPOSI THE OPERATING CYCLE AND GAS MUST BE MIXED WITH OTHER PIPELINE GAS AT SANTA FE JUNCTION.

4. HOLDING MODE BOG GENERATION BASED ON GOVERNING CAPACITY FOR COMPRESSOR. ACTUAL NORMAL BOG ESTIMATED AS APPROXIMATELY 0.35 MMSCFD.

VAPORIZATION MODE

Stream	Unit	3	17	18	20	22	23	24	25	26	27	31	32
Vapor Fraction	-	1	0	0	0	1	1	1	1	1	1	1	1
Temperature	°F	60	-256	-256	-256	60	-196	60	120	119	60	119	74
Pressure	psig	634	655	655	650	635	0.45	0.30	70.0	60.0	634	60.0	60.0
Molar Flow	MMscfd	1.0	66.1	198.3	66.1	198.3	1.2	1.2	1.2	0.0	195.1	1.2	3.2
Mass Flow	lb./hr	1,856	119,940	359,821	119,940	359,821	2,248	2,248	2,248	0	236625	2,248	5,994
Liquid Volume Flow	Barrel/day	-	18,943	56,829	18,943	-	-	-	-	-	-	-	-
Heat Flow	MMBtu/hr	-3.66	-553.95	-553.95	-553.95	-470.58	-4.95	-4.10	-4.10	0.00	-466.92	-4.56	-12.15

Composition		3	18	18	20	22	23	25	25	26	27	31	32
Methane	mol. frac.	0.966	0.966	0.966	0.966	0.966	0.990	0.990	0.990	0.990	0.966	0.990	0.979
Ethane	mol. frac.	0.025	0.025	0.025	0.025	0.025	0.003	0.003	0.003	0.003	0.025	0.003	0.013
Propane	mol. frac.	0.002	0.002	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.002	0.000	0.001
i-Butane	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
n-Butane	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C4+	mol. frac.	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.000	0.000	0.000	0.000	0.0000	0.0001
Nitrogen	mol. frac.	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
CO2	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2O	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

HOLDING MODE

Stream	Unit	3	18	23	24	25	26	31	32
Vapor Fraction	-	1	0	0	0	1	1	1	1
Temperature	°F	60	-256	-261	-261	120	119	119	20
Pressure	psig	634.0	655.0	0.5	0.5	70.0	60	60	60
Molar Flow	MMscfd	0.00	0.00	1.18	1.18	1.18	1.18	0.00	0.00
Mass Flow	lb./hr	–	–	2,093	2,093	2,093	2093	0	0
Liquid Volume Flow	Barrel/day	–	–	–	–	–	–	–	–
Heat Flow	MMBtu/hr	0.0	0.0	-4.95	-4.95	-4.95	-4.95	0.0	0.0

Composition		3	18	23	24	25	26	31	32
Methane	mol. frac.	0.961	0.966	0.990	0.990	0.990	0.990	0.990	0.961
Ethane	mol. frac.	0.025	0.025	0.003	0.003	0.003	0.003	0.003	0.025
Propane	mol. frac.	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.002
i-Butane	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
n-Butane	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C4+	mol. frac.	0.0002	0.0002	0.0000	0.0000	0.0000	0.000	0.000	0.000
Nitrogen	mol. frac.	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
CO2	mol. frac.	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.005
H2O	mol. frac.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

NOTES:
-

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
1	10/07/2022	SN	JZ	SM	MAB	ISSUED FOR PROJECT DESCRIPTION (OCT.)
0	09/06/2022	SN	JZ	SM	MAB	ISSUED FOR PROJECT DESCRIPTION
B	09/06/2022	SN	JZ	SM	MAB	ISSUED FOR CLIENT REVIEW
A	08/25/2022	SN	JZ	SM	–	ISSUED FOR INTERNAL COMMENTS

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PROJECT: RIO PUERCO LNG PLANT

HEAT & MATERIAL BALANCE

DRAWING REFERENCE NO. N/A | AREA N/A | DRAWING NO. PS-031 | REV. 1

DRAWING NO.:PS-031 REVISION: 1

L:\Mechanical Design\N2101 NMGC\N2101 New Mexico Gas Company\PID DWG\PFD\N2101-PS-031 - HEAT & MATERIAL BALANCE.dwg Son Nguyen 10/09/22 8:39pm

5. DRAWINGS AND LISTS

New Mexico GAS COMPANY

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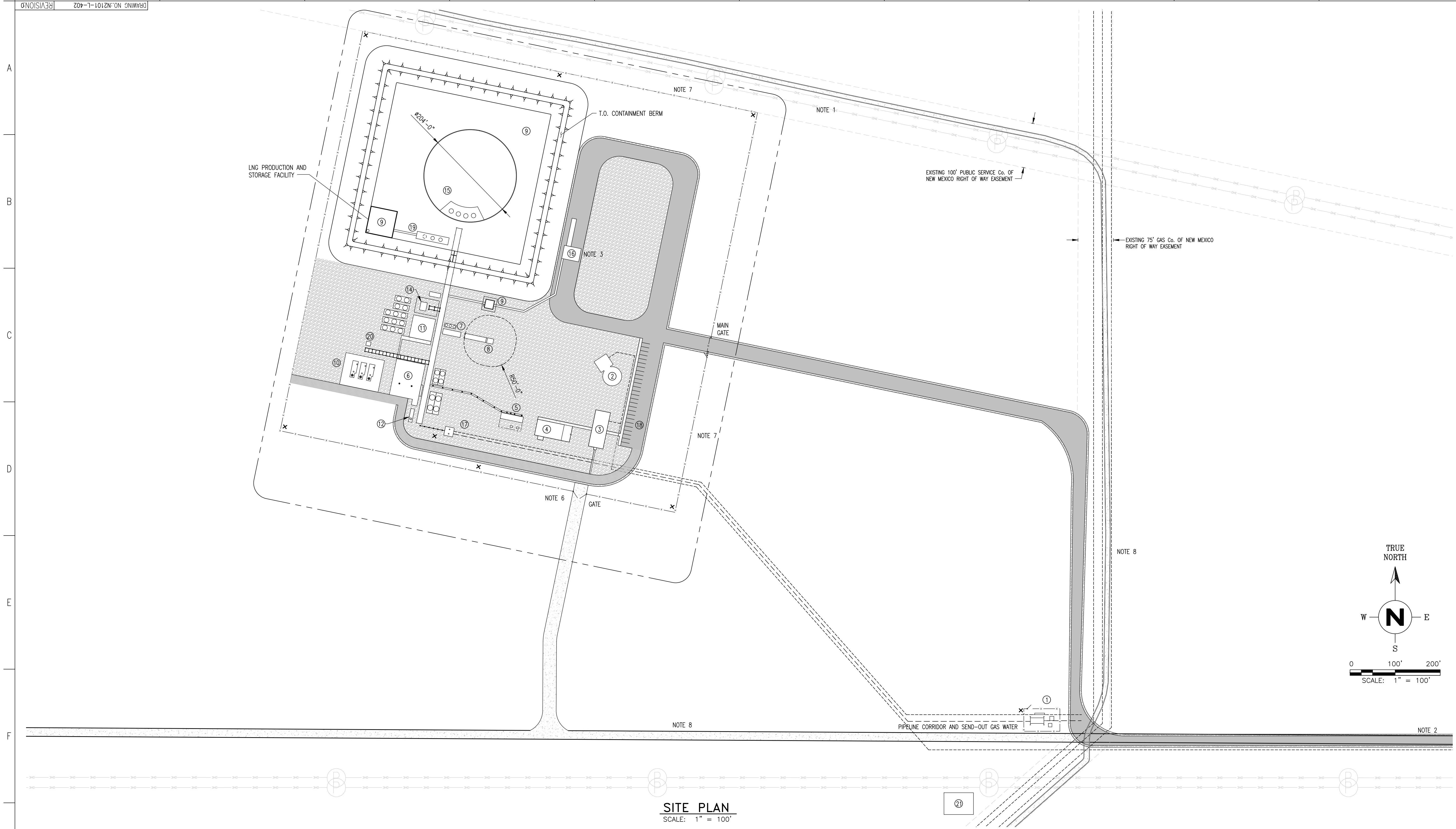

SITE PLAN

SCALE: 1" = 100'

NOTES:

1. EXISTING 100' PUBLIC SERVICE CO. OF NEW MEXICO RIGHT OF WAY EASEMENT FOR POWER LINES.
2. EXISTING DIRT ROAD TO PASEO DEL NORTE BLVD.
3. METERING AND TRUCK LOADING SKID UNDER CANOPY.
4. NOT USED.
5. NOT USED.
6. MAINTAINED GRAVEL ROAD PROVIDES SECONDARY MEANS OF ACCESS / EGRESS TO SITE. NO ACCESS DURING NORMAL OPERATIONS AND SECURITY GATE FOR SITE PROTECTIVE ENCLOSURE IS NORMALLY LOCKED / CLOSED.
7. SECURITY FENCING WITH BARBED WIRE, INTRUSION DETECTION AND OTHER FEATURES MEETING THE REQUIREMENTS OF CFR 103.2905 AND 193.2407 PROTECTIVE ENCLOSURES.
8. GENERAL PURPOSE (LIGHT DUTY) FENCING AROUND NMGC PROPERTY FOR LIVESTOCK AND BOUNDARY DEMARCATION. NOTE INTENDED TO MEET CFR 193 REQUIREMENTS FOR PROTECTIVE ENCLOSURES.

EQUIPMENT:

1 METERING AND RECEPTION FACILITIES
2 FIREWATER
3 MAIN CONTROL ROOM
4 UTILITY HOUSE
5 TRANSFORMER / MCC
6 COMPRESSOR HOUSE
7 MOLE SIEVE ADSORPTION
8 REGEN GAS HEATER
9 LNG SECONDARY IMPOUNDMENT
10 WATER – GLYCOL HEATER HOUSE
11 REFRIGERATION HOUSE
12 HP LIQUID NITROGEN STORAGE
13 NOT USED.
14 COLDBOX
15 LNG STORAGE
16 TRUCK LOAD
17 INLET ESDV AREA
18 PARKING AREA
19 STV VAPORIZER AREA
20 GLYCOL EXPANSION
21 ELECTRICAL SUBSTATION

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
0	09/26/2022	SN	JZ	SM	MAB	ISSUED FOR PROJECT DESCRIPTION
C	07/12/2022	SN	JZ	SM	MAB	ISSUED FOR CLIENT COMMENTS
B	04/04/2022	SN	JZ	SM	MAB	ISSUED FOR CLIENT COMMENTS
A	03/29/2022	SN	CW	SM	–	ISSUED FOR INTERNAL COMMENTS

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PROJECT: NMGC RIO PUERCO LNG PROJECT

LAYOUT
SITE PLAN

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	N/A	N2101-L-402	0

NEW MEXICO GAS COMPANY

RIO PUERCO LNG PLANT

EQUIPMENT LIST

PROJECT NAME	JOB NO.	DOC. OWNER	ISSUED STATUS	APPROVALS	
RIO PUERCO LNG PLANT	N2101	SM	PreFEED (Oct.)	BY	SM
DOCUMENT NAME	DOC. NUMBER	DATE	ISSUED REVISION	CHECKED	MAB
PRELIMINARY EQUIPMENT LIST	N2101-IR-001	5-Oct-2022	0	APPROVED	JZ

REV	DATE	DESCRIPTION	REV	DATE	DESCRIPTION
A	6/12/2022	Issued for Internal Review			
B	9/1/2022	Issued for Pre-Feed			
0	10/5/2022	Issued for Pre-Feed (October)			

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NOTES

GENERAL NOTES

1 PRELIMINARY BASED ON PRE-FEED ACTIVITY AND ALIGNED WITH REV C PFDS.

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REVISION NOTES

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EQUIPMENT LIST FOR STATIC EQUIPMENT
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ITEM No.	EQUIPMENT NAME	PFD no.	DIMENSIONS DIA inch	DIMENSIONS T/T Ft	MATERIAL	TYPE	DESIGN TEMP °F	DESIGN PRESS PSIG	REMARKS	REV
V-2001	FEED GAS FILTER/SEPARATOR	PS-005	TBD	TBD	CS	HORIZONTAL COALESCING FILTER	150	770		A
V-2402A/B/C	MS ADSORBER VESSELS	PS-007	TBD	TBD	CS	VERTICAL VESSEL	650	770		A
F-2401A/B	MS DUST FILTERS	PS-007	TBD	TBD	CS	HORIZONTAL FILTER	150	770		A
V-2404	MS REGEN GAS SEPARATOR	PS-007	TBD	TBD	CS	VERTICAL VESSEL	250	770		A
F-5001	BOG COMPRESSOR FILTER SEPARATOR	PS-016	TBD	TBD	CS	VERTICAL COALESCING FILTER	150	75		A
T-6001	COOLING SYSTEM EXPANSION TANK	PS-022	TBD	TBD	CS	VERTICAL VESSEL	150	100		A
T-7001	LNG STORAGE TANK	PS-015	TBD		See Note	TANK	-260	2	9% Ni for Inner Tank and CS for outer tank	B
V-8001	HOT WATER / GLYCOL EXPANSION DRUM	PS-021	TBD		CS	VERTICAL VESSEL	250	5		A
V-8501	FUEL GAS KNOCKOUT DRUM	PS-020	TBD	TBD	CS	VERTICAL VESSEL	150	150		A
V-9001	PLANT AIR RECEIVER	PS-023	TBD	TBD	CS	HORIZONTAL VESSEL	250	150	Integrated into the instrument air compressor package.	A
V-9002	INSTRUMENT AIR RECEIVER	PS-023	TBD	TBD	CS	HORIZONTAL VESSEL	250	150	External to instrument air package and downstream of dryers.	B
V-9003	LIQUID NITROGEN STORAGE	PS-023	TBD	TBD	SS	VERTICAL VESSEL	150 / -325 F	150	Vertical vacuum jacket LN2 storage tank.	A
V-9004	N2 RECEIVER	PS-023	TBD	TBD	CS	HORIZONTAL VESSEL	250	150		B
F-9001 A/B	WET AIR COALESCING FILTER	PS-023	TBD	TBD	CS	VERTICAL VESSEL	250	150		B
F-9002 A/B	INSTRUMENT AIR AFTER FILTER	PS-023	TBD	TBD	CS	VERTICAL VESSEL	250	150		B
F-9003	N2 GAS FILTER	PS-023	TBD	TBD	CS	VERTICAL VESSEL	150	150		A
T-9101	FIREWATER TANK	NA	TBD	TBD	CS	TANK	150	2		B
T-9102	FIREWATER PUMP DIESEL TANK	NA	TBD	TBD	CS	TANK	150	2		B

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EQUIPMENT LIST FOR ROTATING EQUIPMENT

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ITEM no.	EQUIPMENT NAME	PFD no.	TYPE	MATERIAL	DESIGN TEMP. °F	PRESSURE PSIG SUCT'N	PRESSURE PSIG DISCH.	CAPACITY MMSCFD (NTP) USGPM NORM.	CAPACITY MMSCFD (NTP) USGPM DESIGN	RATING HP SHAFT	RATING HP RATED	REV
P-6001A/B	GLYCOL / WATER CIRCULATION PUMPS FOR COOLING SYSTEM	PS-022	SINGLE STAGE CENTRIFUGAL	CS	250	1	65	613	650	16.2	25	B
P-7001A/B/C	IN TANK LNG PUMPS	PS-015	CRYOGENIC IN-TANK PUMPS	SS	-260	2	760	300-540	560	372.5	449.2	B
P-7005 A/B	LNG STORAGE AREA SUMP PUMP	NA	SINGLE STAGE CENTRIFUGAL	CS	150	ATM	30	857	857	22.7	26.8	B
P-4009	LNG PRODUCTION AREA SUMP PUMP	NA	SINGLE STAGE CENTRIFUGAL	CS	150	ATM	30	223	223	5.2	6.7	B
P-8001A/B/C	HOT GLYCOL / WATER PUMP	PS021	SINGLE STAGE CENTRIFUGAL	CS	250	1	42	800-1448	1600	38.3	50	B

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EQUIPMENT LIST FOR HEAT EXCHANGERS AND FIRED HEATERS

ITEM no.	EQUIPMENT NAME	PFD no.	AREA Ft²	TYPE	DES. TEMP. °F Shell	DES. TEMP. °F Tube	DES. PRESS. PSIG Shell	DES. PRESS. PSIG Tube	MATERIAL Shell	MATERIAL Tube	HEAT LOAD MMBTU/Hr	REV
H-2401	REGEN GAS HEATER	PS-007	TBD	FUEL GAS FIRED DIRECT HEATER	-	750	-	770	CS	CS	2.42	A
AC-2401	MS REGEN GAS COOLER	PS-007	TBD	AIR COOLED	-	650	-	770	CS	CS	2	A
E-5001	BOG HEATER	PS-016	TBD	SHELL & TUBE	-260 / 150	-260 / 350	75	75	SS	SS	0.9	B
AC-6001A/B	WATER GLYCOL COOLER	PS-022	TBD	AIR COOLED	-	150	-	100	CS	CS	TBD	A
E-7001A/B/C	STV LNG VAPORIZER	PS-015	TBD	SHELL & TUBE	-260/250	-260/250	TBD	913	SS	SS	41.22	A
E-9001	NITROGEN AMBIENT VAPORIZER	PS-023	TBD	FINNED TUBE NATURAL DRAFT	TBD	TBD	TBD	TBD		SS	TBD	A

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EQUIPMENT LIST FOR PACKAGED EQUIPMENT
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ITEM no.	EQUIPMENT NAME	PACKAGE DESCRIPTION	REV
PK-4001	N2 EXPANDER LIQUEFACTION PACKAGE	DUAL N2 EXPANDERS REFRIGERATION SYSTEM WITH COLDBOX GENERATING A NET 10 MMSCFD OF LNG (IN TANK). MAJOR EQUIPMENT INCLUDES REFRIGERATION COMPRESSOR, HT EXPANDER, LT EXPANDED, COLDBOX AND ASSOCIATED COOLERS. INCLUDED N2 RECOVERY COMPRESSOR.	B
PK-5001A/B	BOG COMPRESSOR PACKAGE	MOTOR DRIVEN, OIL-FLOODED SINGLE STAGE SCREW COMPRESSOR PACKAGE. WATER COOLING FOR OIL AND AFTERCOOLER. INTEGRATED HIGH-EFFICIENCY OIL COALESCING FILTER REMOVAL, SUCTION DRUM, RECYCLE, ETC. EACH PACKAGE CAPABLE OF COMPRESSING DESIGN BOG RATE (E.G., 2 X 100% INSTALLATION) WITH MACHINES ABLE TO RUN SIMULTANEOUSLY.	B
PK-8001A/B/C	VAPORIZER HEATER PACKAGE	DIRECT FIRED WATER / GLYCOL FUEL GAS FIRED HEATERS EACH SUPPORTING 65 MMSCFD OF LNG VAPORIZATION CAPABILITY. INCLUDES BOILER, FUEL TRAIN, BMS / CONTROL SYSTEM AND BLOWER. USINGS ABLE TO OPERATE SIMULTANEOUSLY.	B
PK-7002	LNG TRUCK LOADING / UNLOADING SKID PACKAGE	INTEGRATED LNG TRUCK LOADING AND UNLOADING SKID PACKAGE WITH ALL VALVING, INSTRUMENTATION, PIPING, CONTROLS TO LOAD / UNLOAD LNG TRAILERS. INCLUDES VAPOR RETURN LINE TO BOG SYSTEM.	B
PK-7501	ODORANT PACKAGE	TRANSMISSION PIPELINE GAS ODORANT STORAGE AND INJECTION SKID, SIZED AND DESIGNED FOR INTERMITTENT REGEN GAS FLOW AND INTERMITTENT VAPORIZER FLOW. FULL ODORANT INJECTION SYSTEM REDUNDANCY TO ALLOW SEND-OUT DURING SYSTEM MAINTENANCE OR REPAIR.	0
PK-7502	ODORANT DISTRIBUTION INJECTION PACKAGE	DISTRIBUTION PIPELINE GAS ODORANT STORAGE AND INJECTION SKID, SIZED AND DESIGNED FOR COMPRESSED BOG SEND-OUT. FULL ODORANT INJECTION SYSTEM REDUNDANCY (DUTY / SPARE) TO ALLOW SEND-OUT DURING SYSTEM MAINTENANCE OR REPAIR OF DOSING PUMP, INJECTION QUILL OR OTHER COMPONENT.	0
PK-9001A/B	INSTRUMENT AIR COMPRESSOR AND DRYER PACKAGE	INSTRUMENT AIR PACKAGE WITH AIR COMPRESSORS, WET AIR RECEIVER, WET AIR COALESCING FILTERS, AFTER FILTERS, DRYER PACKAGE	A
PK-9002	NITROGEN GENERATION PACKAGE	150 SCFM N2 GENERATION PACKAGE CAPABLE OF GENERATING 99.8% PURITY N2 STREAM SUITABLE AS REFRIGERANT FOR LIQUEFACTION PROCESS AS WELL AS OTHER PLANT PURPOSES. PSA OR MEMBRANE ACCEPTABLE. INCLUDES PACKAGE CONTROL, CARBON BED, RECEIVERS, FILTERS, AIR COMPRESSOR AND ANCILLARIES	B
PK-9005	ESSENTIAL GAS GENERATOR	2.2 MW NATURAL GAS GENERATOR INTEGRATED PACKAGE WITH FUEL SUPPLY REGULATION, FILTRATION, CONTROLS, ETC. BLACK START CAPABILITY. INTEGRATED 600 MW LOAD BANK FOR OFF-LINE SYSTEM FUNCTION TESTING.	0
PK-9101	FIRE WATER PUMPS PACKAGE	INTEGRATED PACKAGE INCLUDING MOTOR-DRIVEN FW PUMP, DIESEL FW PUMP, AND 2 X 100% JOCKEY PUMPS TO MAINTAIN RING MAIN IN PRESSURIZED STATE AS WELL AS CONTROLS, DIESEL DAY TANK, AND ALL REQUIRED INSTRUMENTATION, PIPING, VALVING, ETC. IN NFPA 20 COMPLIANT PACKAGE.	0

NEW MEXICO ENERGY COMPANY

RIO PUERCO LNG PLANT

ELECTRICAL LOAD LIST

PROJECT NAME	JOB NO.	DOC. OWNER	ISSUED STATUS	APPROVALS	
NMGC RIO PUERCO LNG	**N2101**	SLS	IFCC	**BY**	SLS
DOCUMENT NAME	**DOC. NUMBER**	**DATE**	**ISSUED REVISION**	**CHECKED**	MAB
Electrical Load List	N2101-ER-001	10/5/2022	1	**APPROVED**	JZ

REV	DATE	DESCRIPTION	REV	DATE	DESCRIPTION
A	12/28/2021	Issued for Internal Review	1	10/5/2022	Issued for Project Description (October)
B	09/02/2022	Issued for Client Comments			
0	9/4/2022	Issued for Project Description			

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NOTES

NOTES

1 Load Types:

M = Motor
H = Heater
L = Lighting
O = Other

1 Load Types:

E = Emergency
N = Normal

2 Service:

		% Usage	
C = Continuous		90	Chg % Usage here to update Load List tab
I = Intermittent		50	
S = Standby		20	

3 Power factors calcuated

kW * 1000 / SQRT(3) * Volts * FLA * 100

4 Rated kW calculated for Motors based on Electrical HP Conversion

1 HP(e) = 0.746 kW

5 %h set equal to power factor, can be changed

6 Distribution Panel / Transformer Power Factor set to Typical of .80 or 80%

7 Starter Tyoe

		Start FLA Multiplier	Change Start Multiplier Here
DOL	Direct On Line	7.50	Typical 5 to 9
SD Starter	Star Delta	4.00	Typical 4
Soft Start		2.00	Typical 2 to 4
VFD		1.00	Typical 0 to 2

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LOAD LIST

			SERVICE MODE													SERVICE MODE LIQUEFACTION				SERVICE MODE VAPORIZATION				SERVICE MODE - HOLD				
NO.	TAG	DESCRIPTION	LIQ	VAP	HOLD	TYPE	E/N	Volts	Phase	FLA	HP	RATED kW	%η	% P.F.	INPUT kW	% USAGE	kW	kVAR	kVA	% USAGE	kW	kVAR	kVA	% USAGE	kW	kVAR	kVA	NOTES
1	MK-4001	REFRIGERANT COMPRESSOR	C			M	N	4,160	3	832.74	6,770.00	5,250.00	87.50	87.50	6,000.17	90.00	5,400.15	2,988.17	6,171.77									
2	MP-7001A	LNG PUMP A		C		M	N	4,160	3	103.10	449.20	335.00	87.50	90.00	372.22					90.00	335.00	185.36	382.86					
3	MP-7001B	LNG PUMP B		C		M	N	4,160	3	103.10	449.20	335.00	87.50	90.00	372.22					90.00	335.00	185.36	382.86					
4	MP-7001C	LNG PUMP C		C		M	N	4,160	3	103.10	449.20	335.00	87.50	90.00	372.22					90.00	335.00	185.36	382.86					
5	MAC-2401	MS REGEN GAS COOLER	C			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	90.00	20.23	10.36	22.73									
6	MH-2401	REGEN HEATER BLOWER MOTOR	C			M	N	480	3	5.59	5.00	4.00	86.00	86.00	4.65	90.00	4.19	2.48	4.87									
7	HE-4001-A	REFRIGERANT COMP LUBE OIL HEATER	I	I		H	N	480	3	13.52		10.00	89.00	89.00	11.24	50.00	5.62	2.88	6.31	50.00								
8	HE-4001-B	REFRIGERANT COMP LUBE OIL HEATER	I	S		H	N	480	3	13.52		10.00	89.00	89.00	11.24	50.00	5.62	2.88	6.31	20.00								
9	MP-4001-A	REFRIGERANT COMP LUBE OIL PUMP MOTOR	C			M	N	480	3	34.97	15.00	25.00	86.00	86.00	29.07	90.00	26.16	15.52	30.42									
10	MP-4001-B	REFRIGERANT COMP LUBE OIL PUMP MOTOR	S			M	N	480	3	34.97	15.00	25.00	86.00	86.00	29.07	20.00	5.81	3.45	6.76									
11	MAC-4003	REFRIGERANT COMP LUBE OIL COOLER MOTOR	S			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	20.00	4.49	2.30	5.05									
12	MAC-4001-A	N2 FIRST STAGE AFTER COOLER FAN MOTOR A	C			M	N	480	3	33.79	30.00	25.00	89.00	89.00	28.09	90.00	25.28	12.95	28.40									
13	MAC-4001-B	N2 FIRST STAGE AFTER COOLER FAN MOTOR B	C			M	N	480	3	33.79	30.00	25.00	89.00	89.00	28.09	90.00	25.28	12.95	28.40									
14	MAC-4001-C	N2 FIRST STAGE AFTER COOLER FAN MOTOR C	I			M	N	480	3	33.79	30.00	25.00	89.00	89.00	28.09	50.00	14.04	7.19	15.78									
15	MAC-4001-D	N2 FIRST STAGE AFTER COOLER FAN MOTOR D	I			M	N	480	3	33.79	30.00	25.00	89.00	89.00	28.09	50.00	14.04	7.19	15.78									
16	MAC-4002-A	N2 SECOND STAGE AFTER COOLER FAN MOTOR A	C			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	90.00	20.23	10.36	22.73									
17	MAC-4002-B	N2 SECOND STAGE AFTER COOLER FAN MOTOR B	C			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	90.00	20.23	10.36	22.73									
18	MAC-4002-C	N2 SECOND STAGE AFTER COOLER FAN MOTOR C	I			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	50.00	11.24	5.76	12.63									
19	MAC-4002-D	N2 SECOND STAGE AFTER COOLER FAN MOTOR D	I			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	50.00	11.24	5.76	12.63									
20	MAC-4004-A	RECOMPRESSOR AFTER COOLER FAN MOTOR A	C			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	90.00	20.23	10.36	22.73									
21	MAC-4004-B	RECOMPRESSOR AFTER COOLER FAN MOTOR B	C			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	90.00	20.23	10.36	22.73									
22	MAC-4004-C	RECOMPRESSOR AFTER COOLER FAN MOTOR C	C			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	90.00	20.23	10.36	22.73									
23	MAC-4004-D	RECOMPRESSOR AFTER COOLER FAN MOTOR D	I			M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	50.00	11.24	5.76	12.63									
24	MAC-4005	EXPANDER LUBE OIL COOLER FAN MOTOR	C			M	N	480	3	33.79	30.00	25.00	89.00	89.00	28.09	90.00	25.28	12.95	28.40									
25	MP-4002-A	EXPANDER LUBE OIL PUMP MOTOR	C			M	N	480	3	13.99	12.50	10.00	86.00	86.00	11.63	90.00	10.46	6.21	12.17									
26	MP-4002-B	EXPANDER LUBE OIL PUMP MOTOR	S			M	N	480	3	13.99	12.50	10.00	86.00	86.00	11.63	20.00	2.33	1.38	2.70									
27	HE-4002-A	EXPANDER LUBE OIL HEATER A	I	I		H	N	480	3	6.68		5.00	89.00	90.03	5.55	50.00	2.78	1.42	3.12	50.00								
28	HE-4002-B	EXPANDER LUBE OIL HEATER B	I	S		H	N	480	3	6.68		5.00	89.00	90.03	5.55	50.00	2.78	1.42	3.12	20.00								
29	MPK-4002	N2 RECOVERY COMPRESSOR PACKAGE	C			M	N	480	3	47.30	45.00	35.00	89.00	89.00	39.32	90.00	35.39	18.13	39.76									
30	HE-T-7001 A	LNG TANK FOUNDATION HEATER A	I	C	C	H	N	480	3	80.00		60.00	90.21	90.21	66.51	50.00	33.26	15.91	36.86	90.00	59.86	28.63	66.36	90.00	59.86	28.63	66.36	
31	HE-T-7001 B	LNG TANK FOUNDATION HEATER B	I	C	C	H	N	480	3	80.00		60.00	90.21	90.21	66.51	50.00	33.26	15.91	36.86	90.00	59.86	28.63	66.36	90.00	59.86	28.63	66.36	
32	MK-5001 A	BOG COMPRESSOR A PACKAGE	C	C	I	M	N	480	3	251.14	255.00	190.00	91.00	91.00	208.79	90.00	187.91	85.62	206.50	90.00	187.91	85.62	206.50	50.00	104.40	47.57	114.72	
33	MK-5001 B	BOG COMPRESSOR B PACKAGE	S	S	S	M	N	480	3	251.14	255.00	190.00	91.00	91.00	208.79	20.00	41.76	19.03	45.89	20.00	41.76	19.03	45.89	20.00	41.76	19.03	45.89	
34	ME-6001 A	WATER GLYCOL COOLER A	C	C	C	M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	90.00	20.23	10.36	22.72	90.00	20.23	10.36	22.72	90.00	20.23	10.36	22.72	
35	ME-6001 B	WATER GLYCOL COOLER B	S	S	S	M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	20.00	4.49	2.30	5.05	20.00	4.49	2.30	5.05	20.00	4.49	2.30	5.05	
36	MP-6001 A	WATER GLYCOL PUMP A	C	C	C	M	N	480	3	33.79	30.00	25.00	89.00	89.00	28.09	90.00	25.28	12.95	28.40	90.00	25.28	12.95	28.40	90.00	25.28	12.95	28.40	
37	MP-6001 B	WATER GLYCOL PUMP B	S	S	S	M	N	480	3	33.79	30.00	25.00	89.00	89.00	28.09	20.00	5.62	2.88	6.31	20.00	5.62	2.88	6.31	20.00	5.62	2.88	6.31	
38	MP-8001 A	HOT GLYCOL CIRCULATION PUMP A		C	S	M	N	480	3	81.09	80.00	60.00	89.00	89.00	67.42					90.00	60.68	31.09	68.18	20.00	13.48	6.91	15.15	
39	MP-8001 B	HOT GLYCOL CIRCULATION PUMP B		C		M	N	480	3	81.09	80.00	60.00	89.00	89.00	67.42					90.00	60.68	31.09	68.18					
40	MP-8001 C	HOT GLYCOL CIRCULATION PUMP C		S		M	N	480	3	81.09	80.00	60.00	89.00	89.00	67.42					20.00	13.48	6.91	15.15					
41	MH-8001 A	VAPORIZER HEATER BLOWER MOTOR A		C	S	M	N	480	3	13.99	12.50	10.00	86.00	86.00	11.63					90.00	10.46	6.21	12.17	20.00	2.33	1.38	2.70	
42	MH-8001 B	VAPORIZER HEATER BLOWER MOTOR B		C		M	N	480	3	13.99	12.50	10.00	86.00	86.00	11.63					90.00	10.46	6.21	12.17					
43	MH-8001 B	VAPORIZER HEATER BLOWER MOTOR C		S		M	N	480	3	13.99	12.50	10.00	86.00	86.00	11.63					20.00	2.33	1.38	2.70					
44	MPK-9002	NITROGEN GENERATION PACKAGE	C			M	N	480	3	152.01	155.00	115.00	91.00	91.00	126.38	90.00	113.74	51.81	124.99									
45	MPK-9001A	INSTRUMENT AIR COMPRESSOR A	C	C	I	M	N	480	3	54.06	50.00	40.00	89.00	89.00	44.94	90.00	40.45	20.73	45.45	90.00	40.45	20.73	45.45	50.00	22.47	11.51	25.25	
46	MPK-9001B	INSTRUMENT AIR COMPRESSOR B	S	S	S	M	N	480	3	54.06	50.00	40.00	89.00	89.00	44.94	20.00	8.99	4.61	10.10	20.00	8.99	4.61	10.10	20.00	8.99	4.61	10.10	
47	MP-9101 A	FIRE WATER SYSTEM - JOCKEY PUMP A	I	I	I	M	N	480	3	6.99	6.75	5.00	86.00	86.00	5.81	50.00	2.91	1.72	3.38	50.00	2.91	1.72	3.38	50.00	2.91	1.72	3.38	
48	MP-9101 B	FIRE WATER SYSTEM - JOCKEY PUMP B	S	S	S	M	N	480	3	6.99	6.75	5.00	86.00	86.00	5.81	20.00	1.16	0.69	1.35	20.00	1.16	0.69	1.35	20.00	1.16	0.69	1.35	
49	MP-9102	FIRE WATER PUMP (ELECTRIC)	S	S	S	M	N	480	3	396.54	400.00	300.00	91.00	91.00	329.68	20.00	65.94	30.04	72.46	20.00	65.94	30.04	72.46	20.00	65.94	30.04	72.46	
50	HE-9001	N2 VAPORIZER TRIM HEATER	S	S	S	M	N	480	3	6.99	6.00	5.00	86.00	86.00	5.81	20.00	1.16	0.69	1.35	20.00	1.16	0.69	1.35	20.00	1.16	0.69	1.35	
51	MP-7005 A	LNG STORAGE AREA SUMP PUMP A	S	S	S	M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	20.00	4.49	2.30	5.05	20.00	4.49	2.30	5.05	20.00	4.49	2.30	5.05	
52	MP -7005 B	LNG STORAGE AREA SUMP PUMP B	I	I	I	M	N	480	3	27.03	25.00	20.00	89.00	89.00	22.47	50.00	11.24	5.76	12.63	50.00	11.24	5.76	12.63	50.00	11.24	5.76	12.63	
53	MP-4009	LNG TRUCK AND PRODUCTION SUMP PUMP	S	S	S	M	N	480	3	6.99	6.00	5.00	86.00	86.00	5.81	20.00	1.16	0.69	1.35	20.00	1.16	0.69	1.35	20.00	1.16	0.69	1.35	
54	MB-BLD4 A	COMPRESSOR BLDG. VENTILATION FAN MOTOR	I	I	I	M	N	480	3	20.27	20.00	15.00	89.00	89.00	16.85	50.00	8.43	4.32	9.47	50.00	8.43	4.32	9.47	50.00	8.43	4.32	9.47	
55	MB-BLD4 B	COMPRESSOR BLDG. VENTILATION FAN MOTOR B	I	I	I	M	N	480	3	20.27	20.00	15.00	89.00	89.00	16.85	50.00	8.43	4.32	9.47	50.00	8.43	4.32	9.47	50.00	8.43	4.32	9.47	
56	MB-BLD4 C	COMPRESSOR BLDG. VENTILATION FAN MOTOR C	S	S	S	M	N	480	3	20.27	20.00	15.00	89.00	89.00	16.85	20.00	3.37	1.73	3.79	20.00	3.37	1.73	3.79	20.00	3.37	1.73	3.79	
57	MB-BLD5 A	REFRIGERANT COMP. BLDG. VENTILATION FAN MOTOR	I			M	N	480	3	20.27	20.00	15.00	89.00	89.00	16.85	50.00	8.43	4.32	9.47									
58	MB-BLD5 B	REFRIGERANT COMP. BLDG. VENTILATION FAN MOTOR B	I			M	N	480	3	20.27	20.00	15.00	89.00	89.00	16.85	50.00	8.43	4.32	9.47									
59	MB-BLD5 C	REFRIGERANT COMP. BLDG. VENTILATION FAN MOTOR C	S			M	N	480	3	20.27	20.00	15.00	89.00	89.00	16.85	20.00	3.37	1.73	3.79									
60	MB-BLD6 A	VAPORIZER BLDG. VENTILATION FAN MOTOR	I	I	I	M	N	480	3	20.27	20.00	15.00	89.00	89.00	16.85	50.00	8.43	4.32	9.47	50.00	8.43	4.32	9.47	50.00	8.43	4.32	9.47	
61	MB-BLD6 B	VAPORIZER BLDG. VENTILATION FAN MOTOR B	S	S	S	M	N	480	3	20.27	20.00	15.00	89.00	89.00	16.85	20.00	3.37	1.73	3.79	20.00	3.37	1.73	3.79	20.00	3.37	1.73	3.79	
62	UTIL	COMPRESSOR BLDG. DISTRIBUTION PANEL	C	C	C	O	N	480	3	36.08		24.00	80.00	80.00	30.00	90.00	27.00	20.25	33.75	90.00	27.00	20.25	33.75	90.00	27.00	20.25	33.75	
63	UTIL	DISTRIBUTION PANEL	C	C	C	O	N	480	3	36.08		24.00	80.00	80.00	30.00	90.00	27.00	20.25	33.75	90.00	27.00	20.25	33.75	90.00	27.00	20.25	33.75	
64	UTIL	DISTRIBUTION PANEL	C	C	C	O	N	480	3	180.42		120.00	80.00	80.00	150.00	90.00	135.00	101.25	168.75	90.00	135.00	101.25	168.75	90.00	135.00	101.25	168.75	
65	UTIL	I&C ROOM DISTRIBUTION PANEL	C	C	C	O	N	480	3	36.08		24.00	80.00	80.00	30.00	90.00	27.00	20.25	33.75	90.00	27.00	20.25	33.75	90.00	27.00	20.25	33.75	
66	UTIL	PRETREATMENT HEAT TRACING DISTRIBUTION PANEL	I	I	I	O	N	480	3	36.08		24.00	80.00	80.00	30.00	50.00	15.00	11.25	18.75	50.00	15.00	11.25	18.75	50.00	15.00	11.25	18.75	
67	UTIL	PRETREATMENT HEAT TRACING DISTRIBUTION PANEL	I	I	I	O	N	480	3	36.08		24.00	80.00	80.00	30.00	50.00	15.00	11.25	18.75	50.00	15.00	11.25	18.75	50.00	15.00	11.25	18.75	
68	UTIL	PROCESS UPS	C	C	C	O	N	480	3	48.11		32.00	80.00	80.00	40.00	90.00	36.00	27.00	45.00	90.00	36.00	27.00	45.00	90.00	36.00	27.00	45.00	
69	UTIL	SITE LIGHTING CONTACTOR AND DISTRIBUTION PANEL	I	I	I	L	N	480	3	24.06		16.00	80.00	80.00	20.00	50.00	10.00	7.50	12.50	50.00	10.00	7.50	12.50	50.00	10.00	7.50	12.50	
70																												
71																												
72																												
73																												
74																												
75																												
76																												
77																												

LIQUEFACTION RUN LOAD:			VAPORIZATION RUN LOAD:			HOLD LOAD:		
6,712.05 kW	3,708.68 kVAR	7,673.78 kVA	2,029.62 kW	1,132.00 kVAR	2,328.82 kVA	780.84 kW	454.05 kVAR	907.56 kVA

THE LISBON GROUP, LLC

Pre-FEED Report

Basis of Design

NEW MEXICO GAS COMPANY

Project Name: Rio Puerco LNG Plant

Document Name:	Basis of Design
Document Number:	N2101-PB-001
Revision:	D
Date:	10/12/2022

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Document Name:	Basis of Design			
Document Number:	N2101-PB-001			
Revision:	A	B	C	D
Date:	2/18/2022	3/7/2022	9/15/2022	10/12/2022
By:	SM	SM	SM	MAB
Checked:	MAB	MAB	MAB	PP
Approved:	-	JZ	JZ	JZ

Rev	Date	Description of Change
A	2/18/2022	Issued for Internal Review
B	3/7/2022	Issued for Client Review
C	9/15/2022	Issued for Client Review II
D	10/12/2022	Issued for PreFEED

Holds

No.	Description
1	

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1 ABBREVIATIONS

ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society for Health, Refrigeration, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
BCF	Billion Standard Cubic Foot
BOD	Basis of Design
BOG	Boil-off Gas
BTU	British Thermal Unit
CFR	Code of Federal Regulations
DCS	Distributed Control System
DHS	Department of Homeland Security
EGG	Essential Gas Generator
EPC	Engineering, Procurement and Construction
ESD	Emergency Shutdown
ESDV	Emergency Shutdown Valve
FEED	Front End Engineering and Design
FGS	Fire & Gas System
HC	Hydrocarbon
HMI	Human-Machine Interface
HP	High Pressure
H&MB	Heat and Material Balance
K.O. Drum	Knock Out Drum
LNG	Liquefied Natural Gas
LP	Low Pressure
MAOP	Maximum Allowable Operating Pressure
MCC	Motor Control Center
MCR	Main Control Room
MMscfd	Million Standard Cubic Feet per Day
NFPA	National Fire Protection Association
PFP	Passive Fire Protection
PLC	Programmable Logic Control
PSA	Pressure Swing Adsorption
PSV	Pressure Safety Valve
SCF	Standard Cubic Foot
STV	Shell & Tube Vaporizer
UPS	Uninterruptible Power Supply

2 PURPOSE

This Basis of Design (BOD) documents the key project functional requirements, conditions, and assumptions for the New Mexico Gas Company's Rio Puerco LNG Plant Project.

3 INTRODUCTION

New Mexico Gas Company (NMGC) is a member of the Emera family of energy companies. NMGC is headquartered in Albuquerque and is the largest natural gas utility in New Mexico. The Company is situated between two large natural gas production basins, the Permian Basin in southeast New Mexico, and the San Juan Basin in northwest New Mexico. NMGC operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout the state.

Currently NMGC uses contracted underground gas storage capacity of 2.7 BCF in West Texas (leased capacity from Kinder Morgan) to help ensure gas availability and decrease the gas supply cost to their customers during cold weather / high demand in transmission network during winter. This leased capacity is expensive and has been unreliable resulting or contributing to some network outage and expensive spot market gas purchases in recent years.

To improve gas reliability / cost-effectiveness, New Mexico Gas Company is plans to install a new LNG Facility. The Rio Puerco LNG plant will serve NMGC customers throughout the state of New Mexico. Gas will be injected directly into the Northwest System and can serve the Southeast and Independent systems via offsets on the Interstate Pipelines.

The functional requirements of the proposed LNG facility that have been defined based on best industry practice, cost-benefit analysis, federal and state safety and design regulations, and due consideration of industry environmental trends. The planned LNG facility will:

- Store 1 BCF (~12 million gallons) net natural gas in a single containment LNG storage tank.
- Be capable of send-out of 195 MMscfd natural gas to either of the on-network 16" or 24" transmission pipeline(s) flowing through the eastern edge of the plot using 3 parallel 65 MMscfd pump-vaporizer strings of equipment.
- To fill and maintain LNG level in the storage tank, the facility will liquefy 10 MMscfd (net in-tank) of feed gas from either of the two adjacent transmission pipelines.

The plant will be located outside Albuquerque adjacent to existing NMGC intrastate 16-inch and 24-inch parallel transmission pipelines, each with a normal (average) operating pressure of approximately 650 psig and MAOP of 913 psig. Feed gas for liquefaction shall be supplied by one of these two pipelines with regeneration off-gas blended with feed gas and sent to the other pipeline. The design shall include the flexibility to use either pipeline for supplying the feed gas during liquefaction or send-out during vaporization. The Boiloff gas will be compressed in a screw compressor and sent to the NMGC's Low Pressure (LP) distribution pipeline.

4 SITE DESCRIPTION

The Rio Puerco LNG facility will be located on a 160-acre site situated west of Albuquerque, New Mexico, approximately two miles north of the Double Eagle II Airport in Bernalillo County. The property is undeveloped and is part of a larger master-planned area that is zoned for industrial and commercial uses (approximate site coordinates: 35°10'59.16"N, 106°47'50.95"W). This site was selected for a number of reasons that make it technically suitable and cost-effective:

- Undeveloped, unpopulated, sufficiency sized plot and appropriately zoned site.
- Proximity to infrastructure for construction and operations with the eastern edge of the site located roughly 3000' from Paseo Del Norte Blvd. NE, commuting distance to Albuquerque, reasonable proximity to Interstate 40.
- Proximity to power lines and gas pipelines running through the site.

A photo of the proposed site is seen in Figure 1.

Figure 1. Photo of Rio Puerco LNG facility site.

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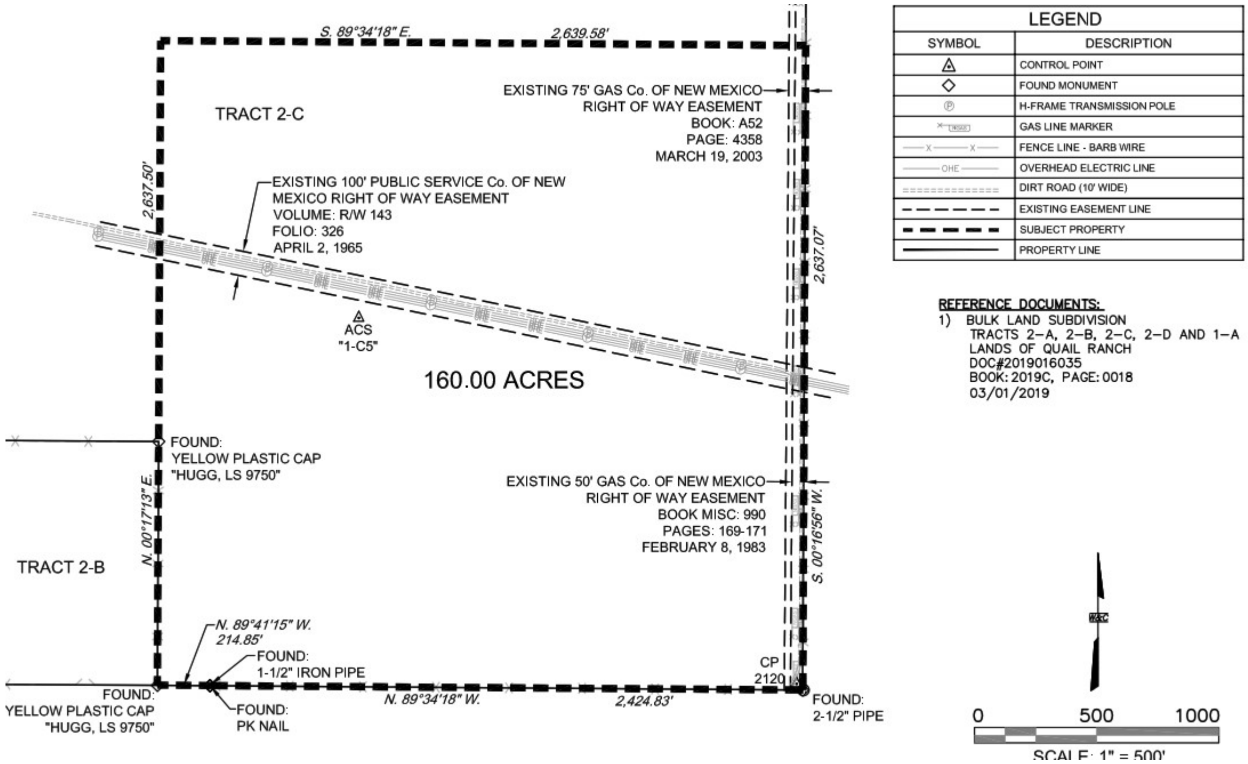

Figure 2. Survey of Rio Puerco LNG Facility site (see engineering drawing for details as needed).

4.1.1 Pipeline access for site

The site has very good pipeline access. Feed process natural gas will be from the existing 16" & 24" Rio Puerco Mainline (ML) buried pipelines installed along the eastern property boundary as seen in Figure 2. The tie-ins will be installed into both lines with suitable isolation valves, metering, redundant odorization, and associated facilities. There is a valve station located approximately 1285' southwest of the southern point of pipeline entry onto the plot. The Santa Fe Junction and Espejo Compressor station are approximately 4.2 miles to the northeast. These pipelines have the following features:

- Feed gas may be lined-up to come from either pipeline during liquefaction.
- Tail gas, a by-product of liquefaction and pretreatment during liquefaction must be returned to the other pipeline that operates at slightly lower pressure (e.g., ~50 psig lower pressure at full capacity). Similar to Feed gas, Tail Gas can be returned to either pipeline.
- Send-out gas can be directed to either pipeline when in Vaporization mode.

For illustrative purposes, Figure 3 shows some of NMGC gas network including the Rio Puerco ML relevant for this project.

The Boiloff Gas (BOG) is compressed to low pressure and send out to NMGC distribution network to the east using new distribution piping run along the access road and then Paseo Del Norte Blvd.

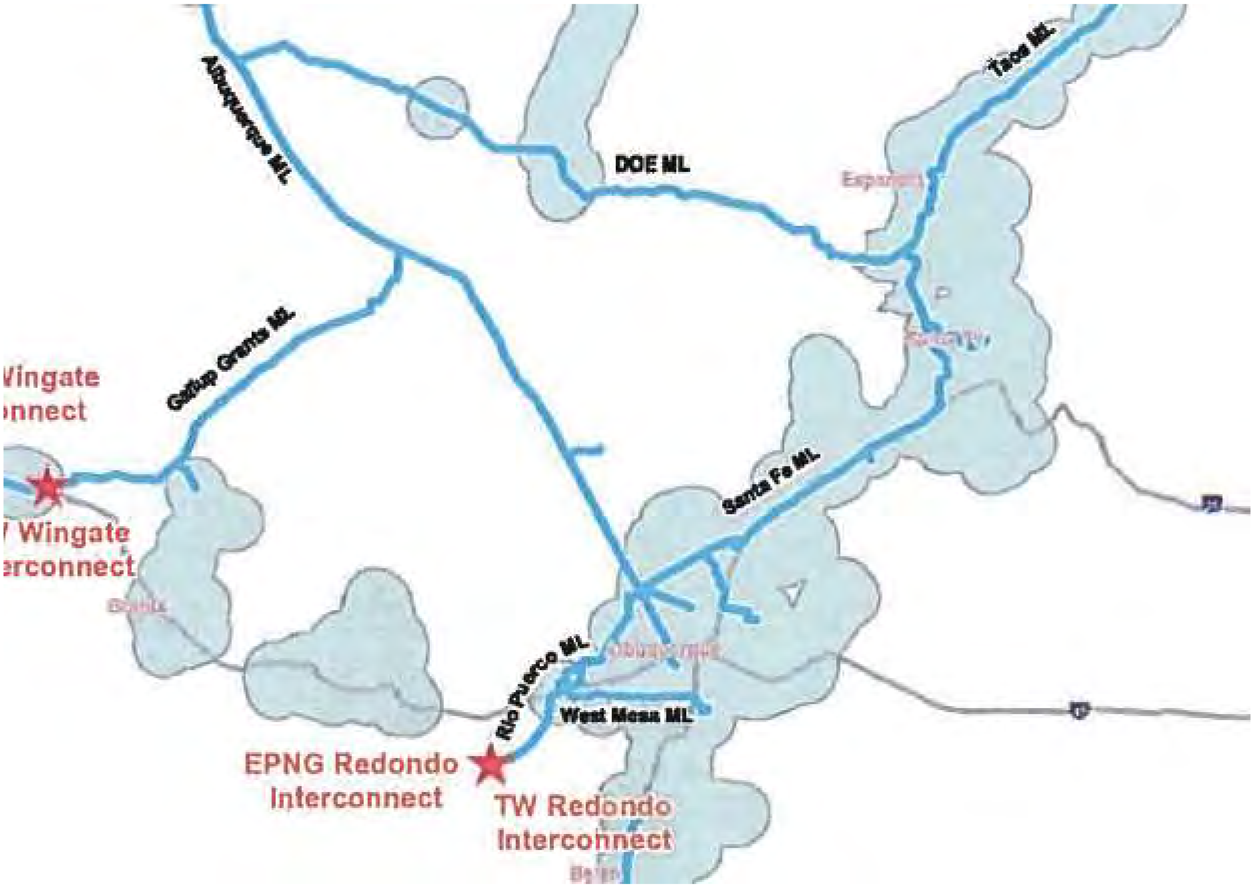

Figure 3: Pipeline Network

4.1.2 Road access and infrastructure

The site offers good road access for construction and operations. The selected site offers proximity to Interstate Highway I-40 and I-25, which will benefit the site during the construction phase. A 23 ft wide asphalt road with 3 ft of prepared gravel on both shoulders between the 160-acre plot bottom SE corner and Paseo Del Norte to provide paved access to the site. This is installed after construction when heavy traffic will damage it and provides the required all weather accessible road access to the site.

The site also offers rail line access that may be used during construction when cost-effective / selected by the contractor. A rail facility operated by New Mexico Transload (NMT) is located south of Albuquerque. This facility is capable of handling a range of palletize, bulk and construction materials and has been used previously by NMGC for pipe offloading.

The main existing approach to the site is via an approximately 3,000' dirt service road running due west from Paseo del Norte Blvd. NW. This road will be improved as part of the scope of the project. There is an existing dirt service road running along the pipelines on the east site of the plot, diagonally along some power lines through the plot and a final dirt access road from the northeast corner of the plot to the north and then back along to Paseo del Norte Blvd.

4.1.3 Utilities Available at Site

The LNG compressors are driven by electric motors. There is good availability of the required power in close proximity to the plot as seen in Figure 2.

Power: There is High Voltage transmission lines within 1000 ft of the plot and there is MV transmission on the edge of the site

Figure 4: Available Electrical Services

Water: Water is required on-site for the firewater system, service water and sanitary systems. Water will be supplied by one or more wells located on the property along with required RO treatment and dosing. Small amounts of potable water for drinking are expected to be supplied by delivery.

4.1.4 Adjacent and nearby properties

Double Eagle II Airport property is located to the south of the Rio Puerco LNG Facility's proposed location. This is a public Airport located within 10 miles from the site. LNG facility siting complies with 49 CFR 193.2155(b) that requires the LNG storage tank to be located no closer than one mile (1.6 km) from the ends of the runway or 1⁄4 mile (0.4 km) from the nearest point of a runway, whichever is longer. Additionally, the LNG facility will comply with Federal Aviation Administration requirements in 14 CFR Section 1.1. as directed in CFR 193.

Quail Ranch Solar facility is a photovoltaic solar power generation facility located immediately west of the LNG facility plot. Access to this facility is along the service road connecting to Paseo del Norte that will be used for construction and upgraded to a paved road for operations.

An aggregate **Quarry** is located on a property north of the proposed facility property.

No other adjacent or nearby facilities are directly relevant to the facility siting or design. Facility esthetics and lighting, tank overall height, and other features will consider the greater Albuquerque area that is rich in history and natural beauty including Petroglyph National Monument that protects a variety of cultural and natural resources including volcanic cones, hundreds of archeological sites, the nearby Sandias, etc.

5 PROCESS

The functional requirements of the proposed LNG facility that have been defined based on best industry practice, cost-benefit analysis, federal and state safety and design regulations, and due consideration of industry environmental trends. The planned LNG facility will:

- Store 1 BCF (~12 million gallons) net natural gas in a single containment LNG storage tank. Net working tank capacity shall be defined as the volume from the lowest operating level (e.g., tank low level alarm) to highest normal operating level (e.g., tank high level alarm) conditions.
- Send-out 195 MMscfd natural gas in a highly reliable manner:
    - To either of the on-network 16" or 24" Rio Puerco Mainline transmission pipeline(s) flowing through the eastern edge of the plot.
    - Should consist of multiple strings of equipment installed in parallel such that failure of a single equipment item (LNG pump, vaporizer, vaporizer heater, odorizer, etc.) does not result in total disruption of ability to send-out gas when needed.
    - Shall be designed to operate through a grid power outage (black-out) condition using back-up power.
    - Shall be designed to operate to an ambient temperature below the minimum recorded at site, *Minimum Design Ambient Temperature* as documented in the *Environmental & Site Conditions Basis* (*S2102-B-003*).
- To fill and maintain LNG level in the storage tank, the facility shall be equipped with a liquefaction facility capable of:
    - Nominal liquefaction capacity of 10 MMscfd natural gas producing liquid LNG saturated at 0.5 psig during Design Dry Bulb (0.4% DB) ambient temperatures as documented in the *Environmental & Site Conditions Basis* (*S2102-B-003*).
    - Drawing feed gas from either existing 16" & 24" Rio Puerco ML transmission pipeline (650 psig operating) while returning a tail gas to the second line.
    - Be air cooled. Processes requiring machine water or water cooling may be considered provided they are arranged in a closed-loop fashion with rejection of heat to atmosphere by fin-fan coolers. Evaporative cooling and similar arrangements are not acceptable.
    - Be electric motor driven using grid power from the nearby MV power lines using.
    - Use a dual N2 expander refrigeration process.
    - Be able to flexibly liquefy feed gas throughout the year as needed including during winter and start-up and begin producing LNG within one worker shift.
    - Be able to liquefy without disruption while simultaneously conducting truck unloading operations.

Rio Puerco LNG facility is equipped with three operating modes:

HOLDING – The facility has LNG in the storage tank but is neither adding to gas inventories or withdrawing through Vaporization or Liquefaction activities. During this time Boil-off Gas must be managed and control and safety systems are operational.

VAPORIZATION – The facility is actively vaporizing and sending-out gas. During this time, in addition to HOLDING mode functionality, the LNG pumps and vaporization facility are operational. Reliable performance during this period is critical because it underpins the purpose of the facility.

LIQUEFACTION – The facility is activity liquefying feed gas from the pipeline to rebuild inventories of stored gas. During this time, in addition to HOLDING mode functionality, the pretreatment and refrigeration systems are operational.

Rio Puerco LNG is being designed to build levels in the storage tank when required throughout the year. This means it is possible to operate liquefaction throughout the year including through peak heat of the summer as well as throughout the winter months. It is also possible to operate LNG unloading facilities during liquefaction to assist in tank level recovery if desired.

The following section describes the key process design basis information.

5.1 PROCESS DESCRIPTION FUNCTIONAL REQUIREMENTS

5.1.1 Reception

The Feed Gas Reception System consists of an Emergency Shutdown Valve (ESDV), custody transfer meter, and filter separator/ coalescer to remove free liquids and 99.0% of entrained liquids greater than 0.3 micron.

5.2 PRETREATMENT

5.2.1 Pretreatment Arrangement

Gas flowing to liquefaction is required to be treated to remove a number of natural gas components that will freeze in liquefaction. Typical pretreatment specifications are <1 ppm H_2O and <50 ppmv CO_2.

With the two NMGC transmission pipelines connecting to the LNG facility, there is an opportunity to use the molecular sieve-only pretreatment arrangement with one pipeline supplying the feed gas to the LNG plant and the other pipeline receiving the regen off gas from the Pretreatment section of the LNG plant, the scheme is seen below in Figure 5. The pipeline receiving the regeneration off gas need to operate 30 – 50 psig lower than the Feed gas pipeline.

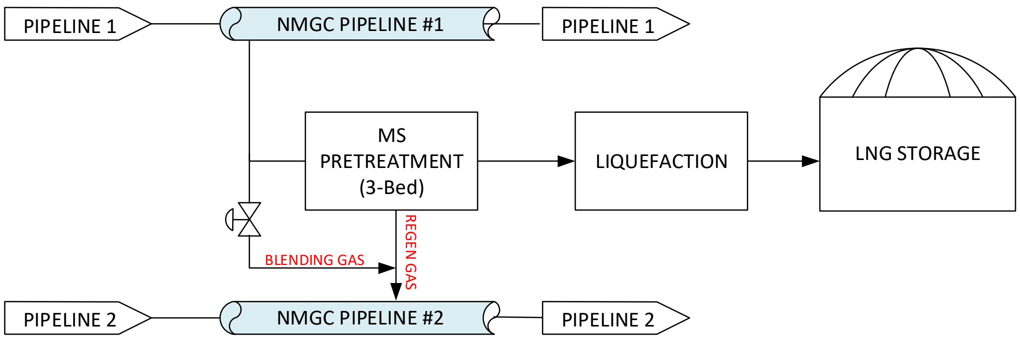

Figure 5. Pretreatment Line-up Options

The availability of the blending gas at Santa Fe Junction and possibility of operating the two Rio Puerco ML pipelines at different pressure levels have been confirmed by NMGC and Mole Sieve only pretreatment scheme has been decided.

The LNG facility will include pretreatment facilities consisting of 3-bed Mole Sieve System, which would remove impurities that will freeze in the liquefaction process or cause other problems. The feed gas entering liquefaction will be treated to the following specification:

- <50 ppmv CO_2
- <0.1 ppmv H_2O

- Heavy hydrocarbon removal. Heavy hydrocarbon removal system has been considered within the Liquefaction package to meet the LNG specification.
- Mercury removal: mercury is not anticipated in the feed gas; the facility will not consider the inclusion of any mercury removal bed
- Oxygen removal: the Gas Tariff allows for some oxygen to be present in the feed gas. In practice oxygen is not typically present and an oxygen removal capability is not included in plant design.

5.3 LIQUEFACTION

One 10 MMscfd Dual N_2 Expansion liquefaction train will be installed. Refrigerant supply, make-up and recovery shall be considered.

A graded concrete trough is located under the LNG rundown line outside the LNG storage tank impoundment berm intended to catch any possible LNG release and convey them to an impoundment area shared with the LNG trailer unload / load facilities. Additionally, potential LNG leak points along this line such as valves, flanges, and instrument shall be minimized.

5.4 LNG TANK & PUMPS

1 BCF Net Working Storage Single Containment LNG Storage Tank with a maximum height of 100 ft will be installed. The maximum boil-off rate shall be specified as less than 0.05% boil off per day.

The LNG storage tank is equipped with a tank dome with stair access that houses pumps, tank instrumentation, various isolation and relief valves, and the LNG send-out pumps. Three multistage centrifugal deep-well LNG pumps will be installed on the tank dome in parallel along with a fourth well installed with no pump. These pumps will have submerged electric motor integral to the pump that is cooled by the LNG. The fourth 24” pump wells on the tank dome is a spare well could allow installation of a future pump without taking the storage tank out of service should it be needed.

Each pump can operate independently, and they can be operated in any combination. Nominally, LNG send-out rates are as follows in Table 1.

Table 1. Pump Operating Table

Number of Pumps Operating	Nominal Send-out	Range
One (1)	65 MMscfd of natural gas	~20 - 65 MMscfd. *Turndown based on operation at roughly 30%.*
Two (2)	130 MMscfd	65 – 130 MMscfd
Three (3)	195 MMscfd	120 – 195 MMscfd

The pumps are started and operated with a variable speed drive (VFD) that can limit current in-rush to the motor during start-up and run the pump at reduced speed in recycle or limited turn-down operations.

All LNG piping to / from the LNG storage tank shall be designed to best engineering practices and consider relevant features including insulation, fire protection, leak minimization, pipe support, thermal stress, and other factors. LNG rundown line from Liquefaction to the LNG storage tank and from the LNG storage tank to vaporization to be less than or equal to 3” or greater than or equal to 6”. Pressurized LNG piping from the pump discharge to the vaporizers shall be run in 6” or larger pipe sizes for robustness. Flanges and other potential leak points shall be minimized to the extent practicable.

5.5 BOILOFF GAS COMPRESSION

BOG Compression is required because once there is LNG in the storage tank vapor is produced by heat ingress from the environment, various process operations, and other environmental causes. BOG compression must be highly available / reliable because to allow all the BOG to be recovered and either used as fuel or send-out to the NMGC distribution line depending on operating mode. To accomplish this 2 x 100% BOG compressors are provided such that all the design BOG can be compressed with a single compressor while the other is in stand-by or undergoing maintenance or repair.

BOG compressors shall consider:

- The tank insulation system will be designed to limit the tank boil-off to (0.05%) per day of the tank content having full of liquid.
- In addition to heat leak, BOG shall be estimated considering relevant sources for boil-off gas generation (e.g., truck loading, barometric pressure change, tank foundation heater, in-tank pump motor operational cases, production flash, etc.).
- Boil-off gas from the storage tanks and truck loading stations shall be recovered, compressed, and sent back to the low-pressure distribution pipeline (60 psig operating). The BOG recovery system shall be integrated with the reject gases from the liquefaction system.
- The boil off gas compressors will be relied upon for the pressure control of the storage tank. If for some reason the tank pressure increases beyond maximum operating value, tank relief valves will open.

5.6 LNG VAPORIZER

The pressurized LNG from the LNG pumps is vaporized in three (3) Shell and Tube Vaporizers (STV) that operate in parallel. The LNG is the tube-side fluid in the STVs and water-glycol serves as the heating media that vaporizers the LNG and warms the natural gas for send-out. The STVs are located in the LNG storage impoundment area. They are equipped with a concrete bunded area underneath them contain any LNG releases. This is connected by graded concrete trough to a sub-impoundment area inside the LNG storage tank for containment of NFPA 59A design spills from the vaporization system.

The STVs are heated by three (3) gas-fired Water-Glycol Heaters located in a Heater House building. Bunded spill containment of the glycol-water shall be provided around the heaters, glycol-water expansion vessel, storage vessel and other areas that may be subject to leaks. Propylene glycol will be used in preference to ethylene glycol in mixture with water because its performance is acceptable, and it is less toxic. Piping outside these areas will minimize leak points such as flanges, valves, and instrument connection points.

The system design shall reflect:

- The STVs and Water-Glycol Heaters are designed for send-out of 195 MMscfd.

- Any combination of LNG Pump, STV, and Water-Glycol Heater can operate together.
- Sendout natural gas will be able to be sent to either the 16” or 24” natural gas pipelines adjacent to the facility.
- Sendout gas shall be odorized prior to introduction to the Rio Puerco ML with redundant mercaptan odorizers (duty and standby).

5.7 LNG TRUCK LOADING STATION

One LNG truck trailer station will be included at Rio Puerco LNG facility that is capable of either loading or unloading LNG trailers. Although trailer loading is not a regularly planned activity, truck load facility may be used for such activities trailer loading for pipeline maintenance activities elsewhere on NMGC network or redundancy / support re-filling the storage tank. The Truck load facility capabilities include:

- All either pump trailer load or pressure-build trailer unloading from / to the LNG storage tank.
- Allow trailer unloading while liquefaction is operational.
- Vapor return line that returns truck loading vapors (BOG) back to an LNG storage during and following trailer loading / unloading activities.

LNG trailer loading / unloading operations will be purged with N2 to atmosphere prior to transfer operations when filled with air and to the LNG storage tank via the vapor return line following transfer operations. The very small amount of N2 associated with this purging operation will be managed in the BOG compression system and venting of small amounts of hydrocarbons when loading hose connections are broken can be avoided.

5.8 ODORANT INJECTION SYSTEM

All gas streams returned to pipelines from, the facility shall be odorized. The design shall include:

- Redundant odorant injection systems for sendout lines to the Rio Puerco ML transmission pipelines.
- Redundant odorant injection systems for sendout of BOG to the new NMGC distribution line.
- The odorant injection systems shall be able to be inspected, maintained, and repaired independently.

5.9 VENT STACK AND RELEASES TO ATMOSPHERE

Under normal operating conditions the plant will be designed for zero releases to atmosphere (e.g., a closed system with no hydrocarbon venting). As such, the facility does not include any common vent stacks, flares, thermal oxidizers or other features intended to manage release of hydrocarbons to the atmosphere.

To the extent practicable, the facility shall operate with **normally no venting of hydrocarbon releases**. This means:

- The gas and LNG containing systems in this processing facility are closed to the atmosphere and do not include a vent (or flare) system releasing uncombusted hydrocarbons respectively during normal operations. For clarity, normal operating scenarios include all operating modes where LNG is intentionally being produced, stored in the storage tank, or vaporized for send-out as well as normal start-up, cool-down, process shutdown, stand-by (shutdown) and truck loading / unloading during HOLDING, PRODUCTION AND VAPORIZATION modes of operation.
- Upset, emergency and other unusual conditions may arise during the life of the facility, and these will be protected against by the relief system described in this document as well as other control and protective measures. Safe, well-considered venting of hydrocarbons may occur outside normal operations.
- Rio Puerco LNG locally routes hydrocarbon releases from relief valves and non-normal operational vents such as the LNG storage tank discretionary vent to atmosphere.
- The facility shall be designed to minimize the natural gas vapors released to the atmosphere from truck loading operations at the plant. The LNG loading system shall be provided with a vapor return line that will be modified to directly take truck vapors back to an LNG storage.
- Safety relief valves outlets may be routed to the atmosphere via local tail pipes or integrated vent system provided they are routed to a safe location.
- Thermal relief valves associated solely with protection of piping systems may be routed to large closed systems (LNG storage tank, LNG trailer, or BOG compressor suction line) where safe and practicable to minimize releases of hydrocarbons from cryogenic piping systems.

All pressure relief valves will be vented to safe location.

Exhaust stacks from the Essential Gas Generator, Regen Gas Heater, Water-Glycol Heaters, water heater, and other fuel gas consumers will be by local exhaust stacks complying with normal practices.

5.10 RELIEF AND BLOWDOWN SYSTEMS

- Relief valve sizing will be based on API 520/521 codes and will be sized to the worst-case scenario listed.
- ASME relief valve areas and coefficients shall be used for sizing code certified relief valves.
- All PSVs will have flanged connections with the exception of thermal reliefs.
- MNPT x FNPT threaded connections preferred for Thermal Relief PSVs.
- All PSVs will be conventional spring-loaded pressure relief valves for services in which the back pressure does not exceed 10% of the set pressure.

- Balanced bellows or pilot operated pressure relief valves may be used in certain applications with high variable back pressure.
- PSV hydraulic calculations will be performed on all PSV inlet and outlet piping.

5.11 HAZARDOUS WASTE MATERIALS

Hazardous wastes such as liquid hydrocarbons from some separators or lube oil from compressors will be collected and stored specifically designed underground tanks. These materials can be pumped out periodically and taken away to approved disposal facilities.

5.12 UTILITIES

5.12.1 Electrical Power

There are multiple options for power connection to the facility with HV Transmission lines running across the plot and MV lines running along the southern plot boundary. Provisions will be made to install a NMGC owned substation just inside the plot along the southern property boundary. The electrical scope would include the transformers and MCC on site to take MV power from the substation, stepdown and distribute to electrical consumers.

5.12.2 Nitrogen

A liquid nitrogen storage tank will be provided with ambient vaporizer to supply nitrogen for purging the plant equipment, piping and the cold box. Nitrogen generation by means of an air compressor, carbon bed and PSA dry N_2 capable of generating 99.9% pure N_2 is included.

5.12.3 Instrument Air

An instrument air package consisting of Screw Compressors (2 x 100%), Drier to meet the dew point temperature of -40 F and Instrument Air receiver (15 mins hold up) will be provided. The nominal supply pressure of 120 psig and a minimum pressure of 80 psig will be considered.

5.12.4 Fuel Gas

The fuel gas will be sourced from the feed gas line. A let down pressure control valve will be used to maintain the fuel gas header pressure requirement. The nominal supply pressure of 55 psig and a minimum pressure of 40 psig will be considered.

5.12.5 Potable Water

Sanitary and service water will be supplied from fire water tank. A dedicated pumping system will be installed to supply the potable water throughout the plant. The drinking water will be arranged separately by the plant, not in the scope of the project.

5.13 GAS COMPOSITIONS

5.13.1 Feed Gas

The Feed gas will be taken from 16" & 24" Rio Puerco ML, owned and operated by NMGC.

Table 2: Inlet Gas Specifications

	Typical Condition	*Minimum*	*Maximum*	*Notes*
Operating Pressure (psig)	650-700	650	913	
Operating Temperature	*40 – 120 °F*	40 °F	120 °F	
C1 (mol%)	92.020601	85.19	97	
C2 (mol%)	5.19	2	10.13	
C3 (mol%)	0.24939	0.0316	1.137	.
i-C4 (mol%)	0.0108	0	0.3404	
n-C4 (mol%)	0.0174	0	0.3439	
C5+ (mol%)	0.003	0	0.2	*Max. 0.2% gas spec.*
N_2 (mol%)	0.75	0.2	5.0	*Max based on total inerts limit of 5%.*
CO_2 (mol%)	0.5	0.003	0.5	*Max. based on compositional history analysis*
H_2O	7 lbs. / MMSCF of gas pipeline specification shall be used for design			
Design Pres.	913 psig (pipeline Maximum Allowable Operating Pressure, MAOP)			
Design Temp.	150 °F			

- *The tariff of Rio Puerco ML pipeline: Max CO_2 2 mol% and Heating value 950-1100 Btu/scf, 40 – 120 °F*
- *Liquefaction duty spec to consider 6 ppmv benzene*

5.13.2 LNG Product to Storage

There is no compositional specification relevant to the LNG because it is resultant. LNG shall meet the following requirements:

- LNG will be produced as a saturated liquid at 0.5 psig. This pressure is specified to indicate that excessive flash or extended end-flash are not preferred methods of LNG production. The LNG storage tank normal operating pressure is expected to be slightly higher than rundown temperature.
- Free from solids or agents prone to waxing, deposition or solidification that can cause operational problems.

5.13.3 Send-out Gas

Send-out gas shall meet the tariff for NMGC including:

- Send-out temperature in the range of 40 – 120 °F
- Heating value between 950 – 1,100 British Thermal Unit / Standard Cubic Foot (BTU/SCF).
- Free from free liquids and a hydrocarbon dewpoint that exceeds 15 °F over the entire pressure range from 100 – 1,000 psia.
- Less than 2% CO2 and less than 5% total inerts.
- 7 lbs. / MMSCF of gas pipeline specification shall be used for design.

The tail gas produced during liquefaction is periodically enriched in CO_2 during portions of the MS bed cycling. This is directed to Santa Fe Junction where it is mixed with other gas streams to achieve on-spec gas compositions.

The liquefaction process can generate a HHC Rejection Gas to ensure heavies that can freeze in the LNG may be rejected without complicated / expensive processing. This stream, enriched in heavier components from the feed gas, is mixed the lean BOG/ flash gas from the storage tanks during liquefaction. These are combined upstream of the BOG compressor, compressed and returned to the distribution network.

5.14 PROCESS INTERFACES

The following interfaces are relevant to the project are summarized in Table 2 below:

Table 3: Interface Summary Table

No.	Interface	Description	Conditions
1	Feed Gas & Vaporized LNG Sendout	Feed gas to the plant will be a take-off from the existing MAOP 913 psig buried 16” & 24” Rio Puerco ML pipelines. The send out line from the LNG Vaporizers will also be tied in to both the lines and able to receive vaporized LNG sendout natural gas	NOP: 650-700 psig MAOP: 913 psig
2	Boil-off & HHC gas from liquefaction	A gas stream enriched in heavy hydrocarbon from the new liquefaction facility along with the compressed Boil off gases may be returned to the existing low pressure distribution network.	NOP: 60 psig MAOP: (HOLD)

6 CONTROL AND SAFETY SYSTEMS

The Rio Puerco LNG facility will be equipped with a wide array of hazard detection, emergency response, and active and passive fire protection systems as typical for LNG peak shaving facilities. Descriptions of select key functional requirements are described below.

Rio Puerco LNG shall be provided with a standalone, independent ESD SIS that can segregate the facility components and ensure a safe, reliable shutdown of the facility. The Safety Instrumented System (SIS) emergency shutdown (ESD) system, including an ESD SIS, which is intended to:

- Detect hazardous conditions with high reliability.
- Shut down equipment and brings the facility to a safer state.
- Isolate / segregate hydrocarbon-containing plant areas, including pipeline connections.
- De-energize affected plant areas.

These features shall be described in the *Plant Segregation Philosophy (N2101-P-003)* and associated documentation. This section of this philosophy describes the hierarchy of shutdowns within Rio Puerco LNG facility and associated actions and facility segregation.

6.1 ESD, SHUTDOWNS AND FACILITY ISOLATION

Rio Puerco shall be equipped with a an ESD system with the following three-level shutdown hierarchy:

Level 1: ESD – Emergency Shutdown. Plant power is de-energized for shutdown and evacuation, all equipment fails to its fail-safe condition / position. A facility ESD is manually initiated only under very serious emergency conditions.

Level 2: PSD - Plant Shutdown. Power is maintained as equipment and systems throughout the plant are shut down and isolated.

Level 3: Area Shutdowns. Area shutdowns which shutdown and isolate a specific process area within the plant where a problem or hazard is occurring. The following area shutdowns are relevant for Rio Puerco:

- LSD – Liquefaction shutdown
- VSD – Vaporization Shutdown
- TSD – Trucking Shutdown

These are intended to shut down their respective areas only and safety isolated equipment during emergency conditions.

6.2 HAZARDS DETECTION SYSTEMS

Rio Puerco LNG will be equipped with a hazards detection system (Fire & Gas System or FGS) that will detect hazardous conditions throughout the facility. Elements of this system include:

1. Flammable gas detectors strategically located in areas subject to flammable gas leaks and releases in the plant. At a minimum this will include gas detectors:
    a. In LNG impoundment areas
    b. The LNG tank dome
    c. The vaporization area
    d. The MS pretreatment valve skid and regeneration gas heater
    e. Above each fired Water-Glycol heater
    f. Around the coldbox
    g. The LNG truck loading area.
2. High and low temperature detectors (as required, including low temperature detection in sub-impoundment areas).
3. Smoke detectors (as required in buildings)
4. UV/IR flame detectors
5. Manual local emergency shutdown (ESD) activation push buttons

High and low temperature detectors and UV/IR flame detectors tied into the SIS shall only be used if / where effective and typically deployed in small-scale LNG plants. All hazard signals will alarm both in the control room, locally and via the remote network. Local signals will be both audible and visual (strobe lights) and have distinctive alarms and colors for fire and flammable gas (leak) hazards. Where appropriate a hazard trip may initiate automatic shutdown of equipment and systems and may activate the ESD system.

6.3 FIRE WATER SYSTEMS (FIRE PROTECTION)

6.3.1 Active Fire Protection

Rio Puerco LNG Facility is equipped with a firewater system in compliance with NFPA 59A Section 9.4. The system shall be capable of distributing and applying firewater to protect LNG containers, equipment and other escalation targets from fire exposure and to assist in the control of unignited leaks and spills.

The firewater system shall comply with NFPA standards incorporated by reference into NFPA59A including NFPA 20. The water supply is from an on-site well system and stored onsite in a firewater storage tank sized in accordance with NFPA 59A Section 9.4.2 to provide water supply of fixed fire protection systems, including monitor nozzles, at their design flow and pressure, involved in the maximum single incident expected in the plant plus an allowance of 1000 gpm (63 L/sec) for hand hose streams for not less than 2 hours.

A buried firewater ring main runs around the LNG storage tank impoundment berm and other strategic locations in the plant to provide coverage to all LNG impoundment areas and other sources and escalation targets. Manually operated and controlled hydrants and monitors are distributed around the facility and are each equipped with root valves to allow isolation of the device.

The ring main is a pressurized firewater system with 2 x 100% jockey pumps maintaining water pressure in the firewater system.

A firewater pump room houses the jockey pump as well as the NFPA 20 compliant firewater pumps. Two Fire Water pumps are supplied, one diesel-driven and the other electric motor driven. The firewater pump house are on the essential loads for the facility such that the firewater system remains operational through all black-out and emergency conditions and is equipped with its own UPS and control system such that if pressure in the ring main drops, the electric firewater pump starts, if it continues to drop, the diesel firewater pump starts. Pumps are equipped with alarms, but operate until manually shutdown once started (e.g., run to failure under emergency conditions).

In addition to the firewater system, there are portable wheeled and hand-held fire extinguishers located throughout the facility in accordance with NFPA 10 requirements.

6.3.2 Passive Fire Protection

Passive Fire Protection (PFP) shall be applied to key structures and equipment where determined required in detailed design. API RP 2218 *(Fireproofing Practices in Petroleum and Petrochemical Processing Plants)* shall be considered in application of PFP and is anticipated to be relevant in the following areas:

- LNG rundown rack including vertical and horizontal primary members anywhere LNG is conveyed, or trough is provided. Multi-section elevated racks in the LNG storage area / berm area may evaluate running PFP only to the first level.
- The STV vaporizer area on critical steel members.
- Exposed steel coldbox supports foundations.

Any application of PFP shall consider risk of corrosion under PFP and associated inspection and maintenance requirements.

6.4 SPILL CONTAINMENT AND IMPOUNDMENT SYSTEMS

LNG spill impoundment is an important part of LNG facility design. The following is a brief description of the facilities included for Rio Puerco LNG.

All areas subject to LNG releases shall have LNG impoundment in line with guidance and requirements of NFPA 59A, 49 CFR 193 and associated written PHMSA guidance. This results in a number of key facility design features described in the following sections.

6.4.1 LNG Rundown Line

The LNG rundown line is subject to a 10-minute design spill. A graded (sloped), bunded trough runs under all LNG piping outside the LNG storage impoundment area that is capable of conveying LNG spills to an impoundment area that is shared with truck load. The trough and impoundment area are concrete.

This shared LNG impoundment area will be sized by the larger of the LNG rundown 10-minute design spill or the volume of an LNG trailer. The concrete impoundment includes fencing or rail system to prevent unintended entry and two (2) means of entry / egress. It is equipped with a sump pump capable of automatically pumping out storm water following precipitation. There is a pump run permissive set on low temperature to prevent operation in the event of an LNG release.

6.4.2 LNG Truck Load/Unload Station and Line

The LNG rundown line is subject to a 10-minute design spill during truck loading operations. For conservatism, because functionality of all LNG trailers cannot be known, the release size shall be considered a full LNG trailer (12,000 gallons) for truck unload operations.

A graded (sloped), bunded trough runs under all LNG piping outside the LNG storage impoundment area that conveys LNG spills to the shared impoundment area. The trough and impoundment area are concrete. The area at the loading station by the trailer doghouse will be graded towards the trough and bunding shall be applied as needed. The trough at the loading interface point will be covered in steel grating to allow personnel and vehicle access.

This shared LNG impoundment area will be sized by the larger of the LNG rundown 10-minute design spill or the volume of an LNG trailer. The concrete impoundment includes fencing or rail system to prevent unintended entry and two (2) means of entry / egress. It is equipped with a sump pump capable of automatically pumping out storm water following precipitation. There is a pump run permissive set on low temperature to prevent operation in the event of an LNG release. The truck tractor area will be in a separate bunded area to prevent any truck liquids (antifreeze, oil, diesel) from entering the LNG impoundment area.

6.4.3 LNG STV Vaporizers

The LNG STV are located inside the main LNG storage tank impoundment area to minimize the extent of LNG piping and equipment in the plant. The LNG rundown line and the LNG between the pumps and STV are subject to various 10-minute design spills conditions during all various operating modes and scenarios.

The STV area includes bunding and trough for conveyance of any LNG releases to a sub-impoundment area located in the main storage tank impoundment area. This sub-impoundment area is designed to contain a 10-minute design spill from any piping inside the LNG storage tank impoundment and is equipped with storm water sump pump with low temperature interlock as described above.

6.4.4 LNG Storage Tank Impoundment

The single containment LNG storage tank shall be supplied with impoundment in compliance with NFPA59A-2001.

6.4.5 Other Fluids

Bunding, impoundment, and other measures in the facility will comply with normal industry practices. This includes chemical storage areas, glycol storage and process equipment areas, diesel storage for the firewater pump, etc.

The facility does not include any flammable refrigerant storage.

7 FACILITIES DESCRIPTION

7.1 BUILDINGS

The control building will house the offices for the plant manager, plant staff and control room. The control room will include the control & operation panel for the entire facility. All start up and shutdown operation can be safely carried out from the control room.

The following buildings will be included in the scope.

- Main Control and Administration Building
- Warehouse
- Fire Water Pump House
- Compressor house for the BOG Compressors
- Refrigeration House that includes N_2 Refrigerant Compressor, N_2 Recovery Compressor, VFD and associated equipment for refrigeration system.
- Utility house to include Water Glycol heaters, air and Nitrogen facilities.

7.2 ELECTRICAL

7.2.1 Supply and Distribution

The LNG plant will require a new medium voltage power supply to the site including connection to adjacent power lines, new 4,160 VAC transformer, new 480 VAC transformer and switch gear.

All low voltage (480 VAC and below) electrical cabling from the MCC to the new production train is expected to be run aboveground on cable tray utilizing some of the existing tray from the MCC. The 4160 VAC power to the refrigerant compressor may be run underground if advantageous.

The following power is expected for the facility:

- 4160 VAC 3-phase 60 HZ power for the refrigerant compressor only.
- 480 V 3-phase 60 HZ for all other motors
- 120 V 1-phase 60 HZ for panels backed-up from UPS (the UPS is located in the Control Room).
- Power available for lighting shall be determined but shall be based on either partial phase from the 480 V supply or 120 V single phase (HOLD)
- Any step-down, such as to 24 V DC control power shall be completed within the relevant panel.

7.2.2 Back-up Power

The facility is equipped with an Uninterruptible Power Supply (UPS) that keeps control systems, emergency lighting, and select other loads operational during a power outage. The UPS will be equipped with testing functionality and shall automatically transfer to active if power is lost without disruption of PLCs, HMI, control panels, or other essential control systems.

7.2.3 Essential Power

A natural gas driven Essential Gas Generator (EGG) is provided for plant operations and send-out during black-out conditions. The EGG will be capable of:

- Automatic start-up upon operator command following power outage (e.g., full black-start capability).
- Continuous operations in HOLDING or VAPORIZATION mode. Shall be able to start and operate all control, lighting, facility essential loads, and all LNG send-out loads such as LNG pumps and Water-Glycol circulation pumps, BOG Compressor, etc. at full capacity.
- Is not synchronized to the grid. Testing can be completed in isolation from the grid. A transfer switch interlock will prevent operational (live) transition of loads from grid to generator (and back). Following a power outage, the EGG will operate and supply power until vaporization operations are completed to ensure reliable island-mode send-out operations regardless of electrical grid instability.

7.3 SITE IMPROVEMENTS AND SECURITY FENCING

The facility layout, roads, and security fencing shall comply with guidance of NFPA 59A-2001, 49 CFR 193, and Department of Homeland Security (DHS) requirements.

7.3.1 Roads and access

The road from Paseo del Norte will be improved to an asphalt road with gravel stone base on either side that will be extended onto the site to include a parking area, truck access to the LNG trailer loading / unloading bay, and parking area by the Main Control Room (MCR). Additional gravel roads will be implemented on the site to provide access to areas less frequently used such as around the LNG impoundment area, secondary roadway to the south of the facility, and to other site buildings.

7.3.2 Fencing

A perimeter fence will surround the plot area with no trespassing signage. This fencing will include manual vehicle and personnel gates where appropriate for access / egress. This fence will notify and restrict unauthorized access by livestock and people to establish a facility perimeter. The main gate will include a keylock station to open an automatic gate for both light duty and truck access. Visitors may alert the control room of their presence for identification and entry to the site (including camera and intercom).

The perimeter fencing includes a couple of facilities:

- The pipeline interconnect valve stations to Rio Puerco ML and distribution lines are located inside the perimeter fencing. They include additional security fencing and camera monitoring.
- The LNG processing facility (described below).

The LNG processing facility including all buildings, process areas and equipment. Access restrictions and security measures include:

- A high security fencing will be supplied around the LNG facility including intrusion detection system and full perimeter camera coverage.
- Access inside the fencing would be via the automated vehicle gate at the main facility entrance with card pad for NMGC personnel access along with intercom and camera.
- Gravel roads leaving the site shall be equipped with manually chain pad locked gates. Personnel may leave the site through exit push bar doorways strategically located around the security fence perimeter.

Some areas within the plant include additional fencing or other means to prevent access as typical with gas processing facilities. This includes areas such as:

- Fencing or rail to limit access to LNG sub-impoundment areas.
- Fencing around HV and MV electrical transformers and switchgear.
- Fencing separating LNG trailer and liquid Nitrogen truck loading areas from the process plant areas.

8 OTHER FUNCTIONAL REQUIREMENT

8.1 EQUIPMENT SIZING & SPARING

LNG facilities generally only apply equipment spares and parallel equipment processing trains where cost-effective. NMGC LNG facility will be a single train development with minimal installed spares except where specifically noted below, however, provisions shall be made in the plot for the addition of the future Storage Tank and parallel LNG train of similar capacity

- LNG Storage Tank 1 x 100%
- BOG Compressor: 2 x 100%
- Cold Box 1 x 100%
- Refrigeration Compressor 1 x 100%
- Refrigerant Compressor LO Pump: 2 x 100% installed
- Refrigerant Compressor LO Filter: 2 x 100% installed
- Instrument Air Compressor: 2 x 100%
- Instrument Air Dryer: 2 x 100%
- Dryer Particulate Filter: 2 x 100% installed
- LNG Pumps: 3 x 33%
  LNG Vaporizers: 3 x 33%

PSVs shall not be spared except with mandated LNG storage tank PSVs that will be installed as 2 x 100% with a single PSV on-line backed-up by a rupture disk set at least 10% higher pressure.

Control valves shall not have manual by-passes or installed spares unless the plant can be continuously operated with only periodic operator intervention (minimum attend once per two hours while in manual mode).

8.2 OTHER REQUIREMENTS

8.2.1 Design Margin

Margin shall be applied using best industry practice. Care will be taken to avoid taking "margin on margin" and unduly adding to facility cost or establishing equipment design conditions that are high compared to normal operating conditions. A typical allowance will be reflected in the CAPEX estimate.

8.2.2 Numbering Philosophy

Lisbon Group standard numbering will be applied for the initial costing exercise. As the project progresses into more detailed engineering, it is expected that:

- Equipment numbers will be assigned by NMGC.
- The instrument numbers will be assigned by NMGC.
- The P&ID numbers will be assigned by NMGC.
- The Equipment, Instrument and piping fitting symbols will be based on NMGC Legend and Symbols drawings.

8.2.3 Warranty

Unless otherwise specified, a reasonable warranty for all new equipment, instruments, machines, and critical components shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurring during the warranty period shall basically be repaired free of charge.

THE LISBON GROUP, LLC

Pre-FEED Report

Codes and Standards

CODES AND STANDARDS

Document Number:	S2102-B-002		
Revision:	A	B	0
Date:	7/03/2022	9/15/2022	
By:	JZ	JZ	
Checked:	MB	PP	
Approved:	-	MAB	

The following codes and standards are applicable to the project. If there is a conflict among different editions of the codes and standards referenced shall have the following prevailing hierarchy:

1) Federal Requirements:
    a. DOT 49 CFR 193
    b. NFPA 59a
2) State Requirements

Therefore, any conflicts within 49 CFR Part 193 or any other applicable codes & standards, the requirements in 49 CFR Part 193 shall prevail followed by NFPA 59a, followed by applicable state level requirements. For the removal of doubt, applicable state requirements have been indicated as such (State). Except for those requirements indicated (State) shall be assumed to be incorporated by reference within applicable Federal Regulations.

1.1 FEDERAL

- 49 CFR Part 193 – Liquefied Natural Gas Facilities: Federal Safety Standards
- NFPA 59A Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG) – 2001/2006/2013 as referenced in 49 CFR Part 193

1.2 MECHANICAL

- American Society of Mechanical Engineers (ASME), ASME Boiler and Pressure Vessel DIV 1 & 2 Code (1992, 2007, 2021)
    - Section II, Part A, B, C and D, Material Specifications
    - Section V, Non-Destructive Examination
    - Section VIII, Division I, - Rules for Construction of Pressure Vessels
    - Section IX, Welding and Brazing Qualification
- ASME B31.3, for facilities piping, 1996 & 2020 Edition
- ASME B31.8, for gas transmission and distribution piping, 1992 & 2020 Edition
- Plumbing Code (State)

  - International Building Code, Chapter 29-Plumbing Systems, 2012 Edition
  - International Residential Code, Part VII-Plumbing, 2012 Edition,
  - International Plumbing Code, 2012 Edition
- International Mechanical Code (IMC), 2012 Edition, (State)
- International Fuel Gas Code, 2012 Edition
- NFPA 54, National Fuel Gas Code, 1999 Edition.
- American Welding Society (AWS)[1]
- Tubular Exchanger Manufacturers Association (TEMA)
- ANSI B 16.5, Steel Pipe Flanges and Flanged Fittings American Institute of Steel Construction (AISC 13th Edition)
- Standards for Aluminum Plate-Fin Exchangers Manufacturer's Association (ALPEMA)
- API 6D, Specification for Pipeline Valves, 1994.
- API 520 - Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries
- API 521 - Guide for Pressure-Relieving and Depressuring Systems
- API 526 - Flanged Steel Safety-Relief Valves
- National Association of Corrosion Engineers (NACE)[1]

1.3 ELECTRICAL, INSTRUMENTATION AND CONTROLS

- NFPA 70 / National Electric Code (NEC), 1995 & 2011 Edition
- NFPA 70E Standard for Electrical Safety in the Workplace
- Institute of Electrical and Electronic Engineers (IEEE)[1]
- International Electro Technical Commission (IEC)[1]
- Industrial Cable Engineers Association (ICEA)[1]
- Underwriters Laboratories Inc. (UL)[1]
- International Society of Automation (ISA)

1.4 CIVIL STRUCTURAL

- International Building Code (IBC), 2012 Edition, not including Chapter 1, Administration, Chapter 11, Accessibility, Chapter 27, Electrical and Chapter 29, Plumbing Systems
- ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures – As referenced in 49 CFR Part 193, 1993 & 2005 Edition
- ACI 301, Specifications for Structural Concrete, 1999 Edition
- ACI 304.6R, Guide for Measuring, Mixing, Transportation and Placing of Concrete, 1991 Edition
- ACI 311.4R, Guide for Concrete Inspection, 2000 Edition
- ACI 318, Building Code Requirements for Reinforced Concrete, 1999 Edition
- ACI 318R, Building Code Requirements for Structural Concrete, 1999 Edition
- ACI 344R-W, Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures, 1988 Edition
- ACI 372R, Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures, 1997 Edition
- ACI 373R, Design and Construction of Circular Prestressed Concrete
- Structures with Circumferential Tendons, 1997 Edition

- ACI 506.2, Specification for Materials, Proportioning, and Application of Shotcrete, 1995 Edition
- American Institute of Steel Construction (AISC)

1.5 OTHER NATIONAL FIRE PROTECTION AGENCY (NFPA)

- NFPA 1 Fire Code – 2012 Edition
- NFPA 10, *Standard for Portable Fire Extinguishers*, 1998 Edition
- NFPA 11, Standard for Low-Expansion Foam, 1998 Edition
- NFPA 11A, Standard for Medium- and High-Expansion Foam Systems, 1999 Edition
- NFPA 12, Standard on Carbon Dioxide Extinguishing Systems, 2000 Edition
- NFPA 12A, Standard on Halon 1301 Fire Extinguishing Systems, 1997 Edition
- NFPA 13, Standard for the Installation of Sprinkler Systems, 1999 Edition
- NFPA 14, Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems, 2000 Edition
- NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, 1996 Edition
- NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, 1999 Edition
- NFPA 17, Standard for Dry Chemical Extinguishing Systems, 1998 Edition
- NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, 1999 Edition
- NFPA 22, Standard for Water Tanks for Private Fire Protection, 1998 Edition
- NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 1995 Edition
- NFPA 30, Flammable and Combustible Liquids Code, 2000 Edition
- NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, 1998
  Edition
- NFPA 58, Liquefied Petroleum Gas Code, 2001 Edition
- NFPA 59, Utility LP-Gas Plant Code, 2001 Edition.
- NFPA 72, National Fire Alarm Code, 1999 Edition.
- NFPA 101, Life Safety Code®, 2000 & 2012 Edition.
- NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials, 2000 Edition.
- NFPA 385, Standard for Tank Vehicles for Flammable and Combustible

1.6 MATERIAL STANDARDS

- American Society of Testing and Materials (ASTM)
- American National Standards Institute (ANSI)
- ASTM A 366, Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality, 1991 Edition
- ASTM A 416, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete, 1994 Edition
- ASTM A 421, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete, 1991 Edition

- ASTM A 615, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, 1995 Edition
- ASTM A 722, Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete, 1998 Edition
- ASTM A 821, Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks, 1993 Edition
- ASTM A 996, Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement, 2000 Edition
- ASTM C 33, Standard Specification for Concrete Aggregates, 1993 Edition
- ASTM E 380, Standard Practice for Use of the International System of Units (SI), 1993 Edition

THE LISBON GROUP, LLC

Pre-FEED Report

Environmental and Site Conditions

LISBON GROUP

Doc #	S2102-B-003 Rev. B
Name	Environmental and Site Conditions
Date	09/15/2022

ENVIRONMENTAL AND SITE CONDITIONS

Document Number:	S2102-B-003		
Revision:	A	B	0
Date:	7/30/2021	9/15/2022	
By:	JZ	JZ	
Checked:	MB	PP	
Approved:	-	MAB	
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1.1 ENVIRONMENTAL CONDITIONS

Table 1: Environmental and Site Conditions

Elevation above sea level	5,312 ft
Barometric Pressure	12.09 psi
Maximum Ambient Temperature	105 °F
Minimum Design Ambient	-20 °F
Design Cooling Dry Bulb (0.4% DB) • Air-Cooler Design • Power, Instrument Cable and Panels	95.6 ˚F
Design Cooling Dry Bulb, HVAC (1% DB)	93.4 °F
Design Heating Dry Bulb, HVAC (1% Heating DB)	22.4 °F
HVAC (Indoor design for process/utility/electrical)	35 °F to 100 °F
HVAC (Indoor Design for instrument/control rooms)	69 °F to 84°F
Maximum Relative Humidity	10%
Average Annual Relative Humidity	1%
Min Annual Relative Humidity	0%
Precipitation, Average Annual	13.1”
Precipitation, Highest Monthly Average, July	3.7”
Reference Albuquerque Intl., NM USA 2021 ASHRAE Handbook unless otherwise noted	

1. Rotating equipment power rating shall be specified based on the average ambient temperature.
2. Air cooler discharge temperature approach shall be specified considering the maximum site ambient temperature because it can impact product specification.

1.2 SITE CONDITIONS DESIGN CRITERIA

1.2.1 Wind

- Wind: Design Velocity

  150 mph (sustained) / 183 mph (3s gust) per 49 CFR 193.2067

  For the purposes of conducting structural engineering design calculations, the required 150 mph sustained wind velocity may be converted to 3-second gust wind speed the Durst curve conversion method in ASCE/SEI 7-05, Chapter C6. Using this method, a sustained wind velocity of 150 mph is equivalent to a 183 mph 3-second gust."

The average hourly wind speed in Albuquerque experiences ***significant*** seasonal variation over the course of the year.

The ***windier*** part of the year lasts for ***4.5 months***, from ***February 4*** to ***June 20***, with average wind speeds of more than ***8.0 miles per hour***. The ***windiest*** month of the year in Albuquerque is ***April***, with an average hourly wind speed of ***10.0 miles per hour***.

The ***calmer*** time of year lasts for ***7.5 months***, from ***June 20*** to ***February 4***. The ***calmest*** month of the year in Albuquerque is ***August***, with an average hourly wind speed of ***6.0 miles per hour***.

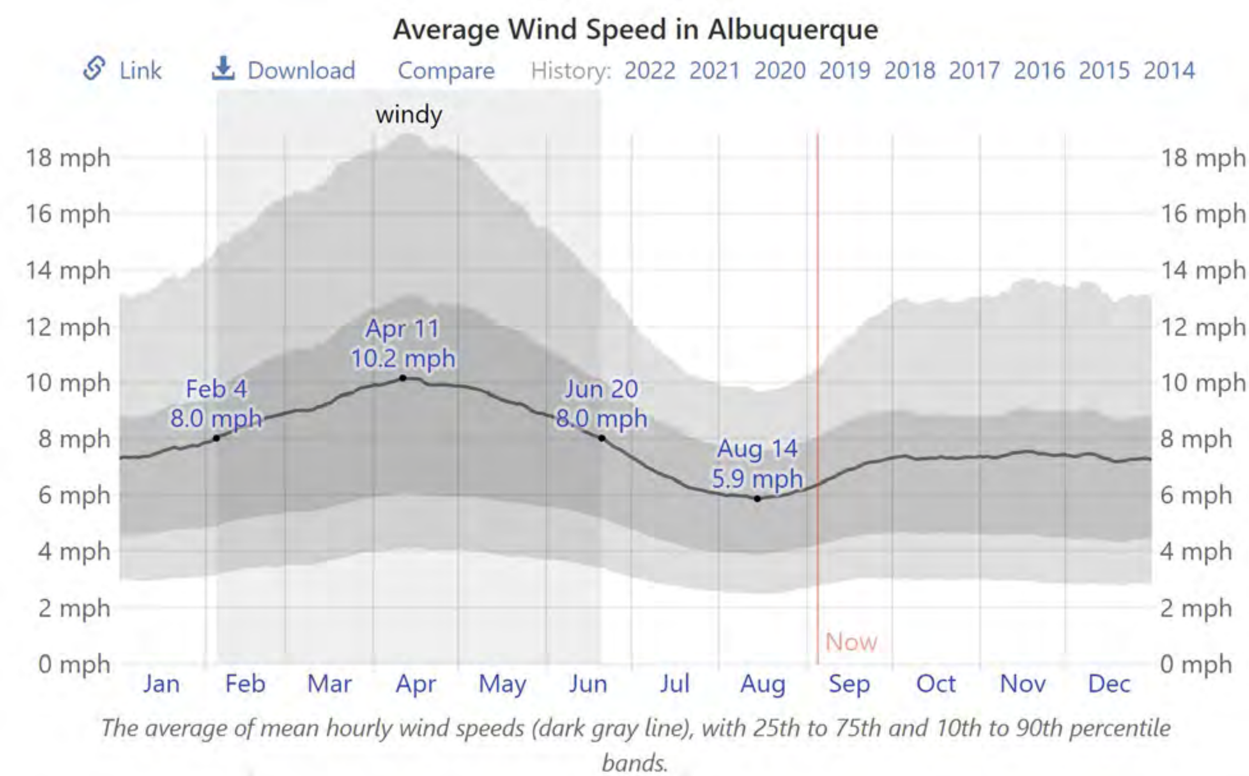
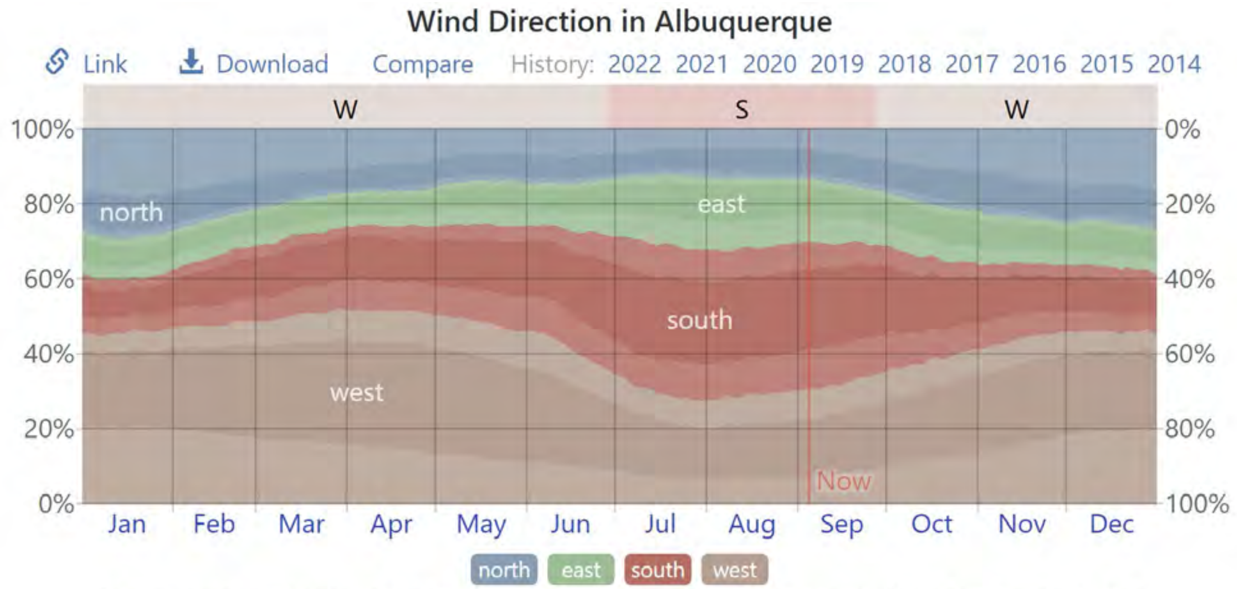


Figure 1: Wind Speed

The predominant average hourly wind direction in Albuquerque varies throughout the year.

The wind is most often from the *south* for *3.0 months*, from *June 28* to *September 27*, with a peak percentage of *41%* on *July 20*. The wind is most often from the *west* for *9.0 months*, from *September 27* to *June 28*, with a peak percentage of *46%* on *January 1*.



The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions, excluding hours in which the mean wind speed is less than 1.0 mph. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (northeast, southeast, southwest, and northwest).

Figure 2: Wind Direction

1.3 PRECIPITATION

The rainfall accumulated over a sliding 31-day period centered around each day of the year. Albuquerque experiences *some* seasonal variation in monthly rainfall.

The *rainy* period of the year lasts for *4.8 months*, from *June 17* to *November 10*, with a sliding 31-day rainfall of at least *0.5 inches*. The month with the most rain in Albuquerque is *August*, with an average rainfall of *1.3 inches*.

The *rainless* period of the year lasts for *7.2 months*, from *November 10* to *June 17*. The month with the least rain in Albuquerque is *January*, with an average rainfall of *0.2 inches*.

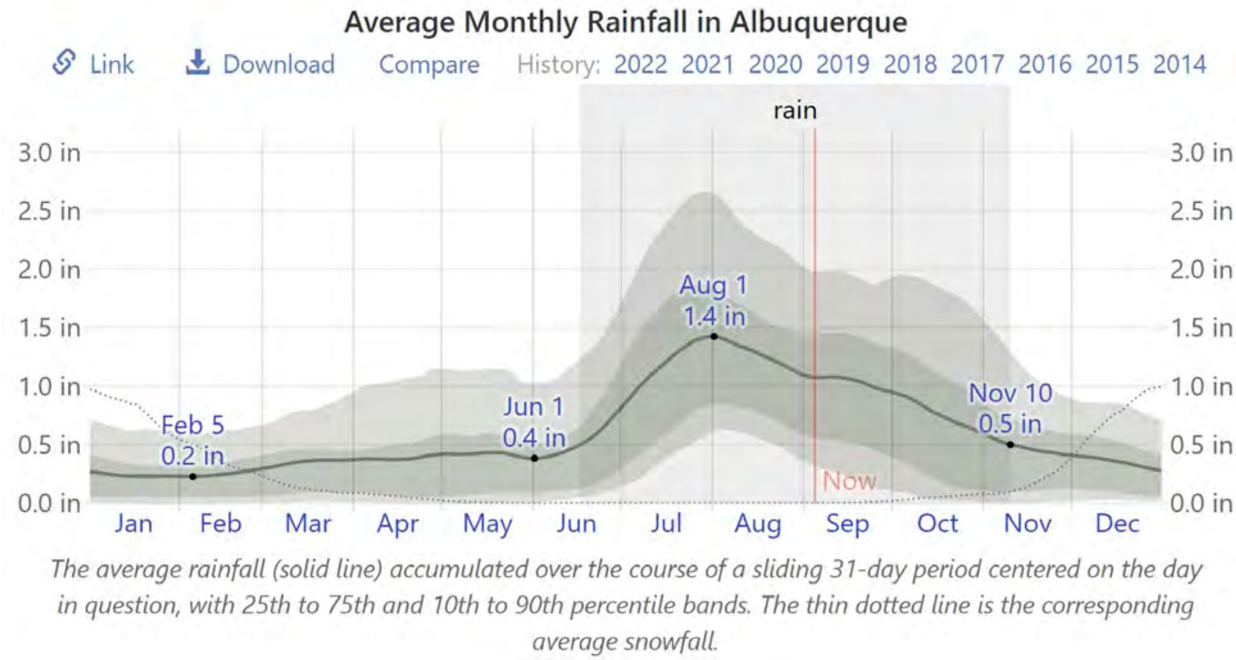


Figure 3: Precipitation

The Lisbon Group, LLC

Pre-FEED Report

Site Evaluation and Exclusion Zone Analysis

NEW MEXICO GAS COMPANY

Project Name: Rio Puerco LNG Plant

Document Name:	Site Evaluation and Exclusion Zone Analysis
Document Number:	N2101-TN-010
Revision:	B
Date:	9/19/2022

New Mexico
GAS COMPANY

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Document Name:	Site Evaluation and Exclusion Zone Analysis			
Document Number:	N2101-TN-010			
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Approved:	-	JZ		

Rev	Date	Description of Change
A	7/16/2022	Issued for Internal Review
B	9/19/2022	Issued for Client Review

Holds

No.	Description
1	

EXECUTIVE SUMMARY

This Technical Note describes the thermal radiation and dispersion exclusion zone analysis conducted to determine the suitability of the Rio Puerco LNG facility sited in accordance with the requirements of DOT 49 CFR 193.2057 and 193.2059.

Rio Puerco LNG facility's functional requirements include the following relevant to establishment of thermal radiation and dispersion exclusion zones:

- Store 1 BCF net (~12 million gallons of LNG) of natural gas.
- Liquefy ~10 MMscfd net feed gas using Mole Sieve pretreatment and nitrogen expander-based liquefaction.
- Design send-out of 195 MMscfd natural gas to the transmission pipeline(s) when required.
- Ability to load / unload LNG trailers.

The Rio Puerco LNG site is a 160-acre roughly square parcel located approximately ten miles northwest of Albuquerque in Ro Rancho adjacent to existing 24" and 16" transmissions lines and other favorable infrastructure.

DOT 49 CFR 193.2057 requires LNG facility siting to evaluate thermal radiation to minimize the potential of damaging effects of fire reaching beyond a property boundary. The thermal radiation exclusion distances for Rio Puerco LNG were calculated using the mandated LNGFire3 software in accordance with the environmental conditions, calculation methods and exclusion zone distances required by DOT 49 CFR 193.2057 and associated PHMSA and NFPA59A-2001 guidance. The analysis indicates Rio Puerco LNG site is expected to be suitable with respect to thermal radiation exclusion zones. The governing radiation exclusion zone distances is approximately 800 ft required between the LNG storage tank impoundment berm and the nearest property boundary.

DOT 49 CFR 193.2059 requires LNG facility sites to establishes a dispersion exclusion zone to minimize the potential of flammable gas mixtures and associated hazards from reaching beyond a property line that can be built upon. Dispersion exclusion zone distances were calculated for Rio Puerco LNG using DNV Phast vs. 6.7 software in accordance with the methods, requirements, and exclusion zone distances from DOT 49 CFR 193.2059 along with associated PHMSA guidance and NFPA59A-2001. The results indicate that, given prudent layout and design, the mandated vapor exclusion zones are expected to fall within the 160-acre Rio Puerco LNG property boundaries in accordance with requirements.

A summary of the relevant exclusion zone distances is seen below in Table 1 and the associated plot plans are seen in Appendix A and B.

Table 1. Governing Exclusion Zone Distances by Line / Impoundment

Description of Area	Radiation Exclusion Zone (ft)	Vapor Dispersion Exclusion Zone (ft)
Truck loading area and piping to main rundown line at top of LNG storage tank berm.	NA	**813.9 ft**
Piping between coldbox and LNG Storage Impoundment area.	NA	**755.6 ft**
Piping Between Tank Dome and top of Berm and on the tank done / pump recycle area.	NA	**607.3 ft**
Piping and equipment between the LNG tank dome and the STV vaporizers.	NA	**892.6 ft**
Shared Impoundment: Exclusion zone from inside edge of shared Truck Load / Rundown concrete pit.	133.8 ft	**892.4 ft.**
LNG Storage sub-Impoundment from inside top edge of sub-impoundment concrete pit	186.5 ft	**1069 ft**
LNG Storage Tank Impoundment from inside top edge of containment berm.	**798.4 ft**	NA

Based on the thermal radiation and dispersion exclusion zone analysis completed, the 160-acre Quail Ranch site for Rio Puerco LNG is considered a suitable site. Both exclusion zones are expected to meet the relevant PHMSA, DOT and NFPA requirements.

TABLE OF CONTENTS

1 ABBREVIATIONS

BCF	Billion (standard) cubic foot
BOG	Boil-off Gas
CFD	Computational Fluid Dynamics
CFR	Code of Federal Register
DOT	Department of Transportation
ESD	Emergency Shut Down
FAQ	Frequently Asked Question, PHMSA published set of CFR 193 interpretations
FEED	Front End Engineering and Design
FPRF	Fire Protection Research Foundation
F&G	Fire & Gas Detection
GTI	Gas Technology Institute
GPM	Gallons per Minute
H&MB	Heat and Material Balance
LNG	Liquefied Natural Gas
MCR	Main Control Room
MMscfd	Million Standard Cubic Feet per Day
NMGC	New Mexico Gas Company
NFPA	National Fire Protection Association
PHMSA	Pipeline & Hazardous Materials Safety Administration
SALS	Single Accidental Leak Source

2 PURPOSE

This Technical Note describes the vapor dispersion and radiation exclusion zone analysis conducted to determine the suitability of the Rio Puerco LNG facility sited on a 160-acre site near Albuquerque N.M. in accordance with the requirements with Federal Code DOT 49 CFR 193.2057 and 193.2059.

3 INTRODUCTION

New Mexico Gas Company (NMGC) operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout New Mexico. To improve gas reliability / cost-effectiveness, New Mexico Gas Company is proposing the installation of a new on-network LNG peak shaving facility to eliminate the need for currently contracted off-network underground storage capacity in West Texas. The functional requirements of the proposed LNG facility relevant to thermal radiation and dispersion include the following:

- Store 1 BCF net (~12 million gallons of LNG) of natural gas.
- Liquefy ~10 MMscfd net feed gas using Mole Sieve pretreatment and nitrogen expander-based liquefaction.
- Design send-out of 195 MMscfd natural gas to the transmission pipeline(s) when required.
- Ability to load / unload LNG trailers.

Rio Puerco LNG is connected to two NMGC interstate transmission pipelines that are subject to *49 CFR 192* making the LNG facility subject to *49 CFR 193 Liquefied Natural Gas Facilities: Federal Safety Standards*.

With respect to facility siting, *49 CFR 193* includes evaluation of radiation thermal exclusion zones and flammable gas dispersion exclusion zones in compliance with *NFPA 59A-2001 Standard for The Production, Storage, and Handling of Liquefied Natural Gas (LNG)* and associated additional requirements of 49 CFR 193 and Pipeline & Hazardous Material Safety Administration (PHMSA) written guidance. This technical note documents the analysis completed for the planned 160-acre Quail Ranch for the Rio Puerco LNG site.

3.1 SITE DESCRIPTION

The Rio Puerco site is a 160-acre parcel situated approximately ten miles to the northwest of Albuquerque in Ro Rancho adjacent to existing 24” and 16” transmissions lines and other favorable infrastructure. The property is undeveloped and is part of a larger master-planned area that is zoned for industrial and commercial uses (approximate site coordinates: 35°10'59.16"N, 106°47'50.95"W). This site is seen in Figure 1 and Figure 2 showing a photo of the site and the survey respectively.

Figure 1. 160-Acre Site Photo

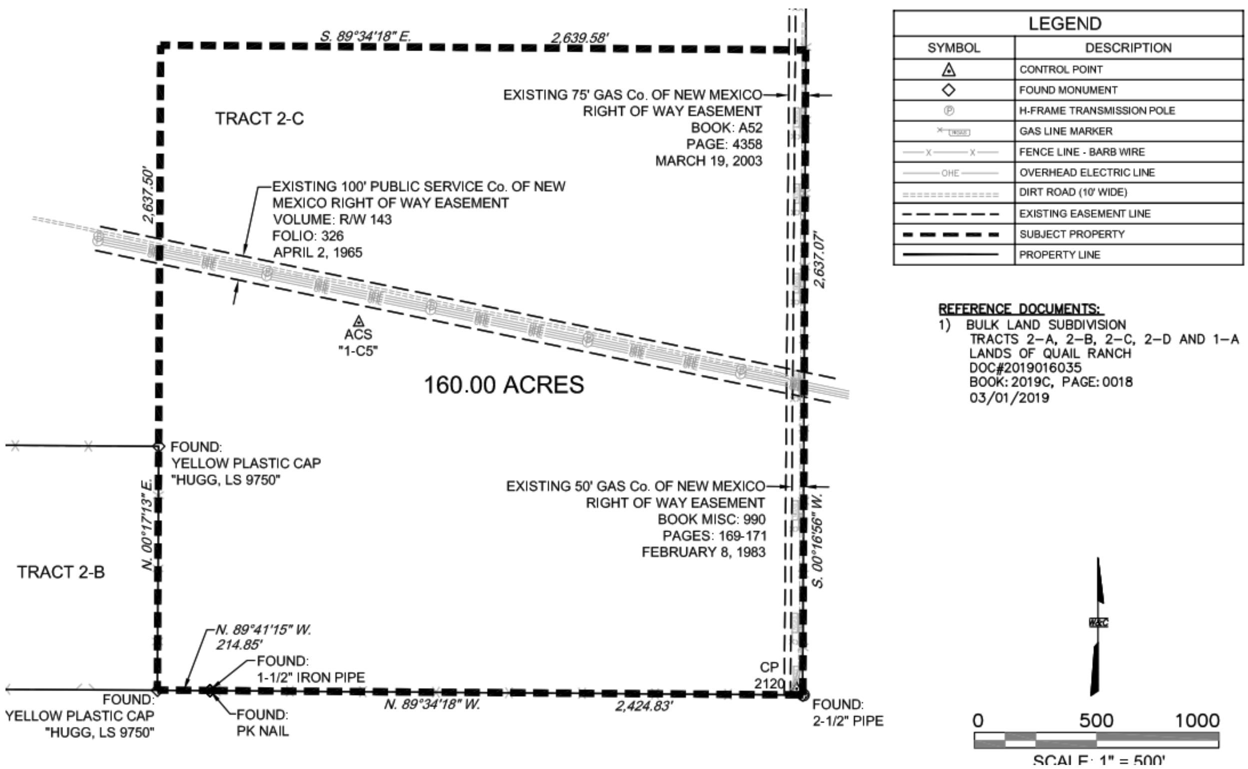


Figure 2. 160-acre site survey

3.2 FACILITY DESCRIPTION

The Rio Puerco LNG Facility has a number of features subject to 49 CFR 193 vapor dispersion and thermal radiation exclusion zones. These will be described in the follow section in more detail. Figure 3 show a block flow diagram for the facility with sections relevant to determination of the exclusion zones highlighted in red lines and shading.

49 CFR 193.2057 and 2059 defines the requirement to establish exclusion zone around LNG facilities based on rigorous consideration of various release scenarios. PHMSA guidance describes the sections of the plant that necessitate due consideration of thermal radiation and dispersion analysis that can include flammable refrigerant storage, flammable refrigerant process equipment, and all piping and equipment containing LNG. As seen in Figure 3 the following areas of the plant are relevant to analysis for establishment of exclusion zones:

1. The LNG rundown line between the LNG production facilities and the LNG storage tank. This is filled with LNG while the plant is operating in LIQUEFACTION mode.
2. The LNG truck load line between the LNG truck loading / unloading area and the LNG storage tank. This can contain LNG during LNG trailer loading / unloading activities.

3. The LNG storage area. The LNG storage tank normally has LNG presence once the facility is commissioned and started-up.
4. The LNG line to vaporization between the LNG pumps that are located in the LNG storage tank and the STV vaporizers that are located inside the LNG storage tank impoundment area.

The extent of hydrocarbons subject to determination of exclusion zones is minimized at Rio Puerco LNG by selection of an inert Nitrogen refrigerant and layout that keeps all LNG inside or within 75 foot of the LNG storage tank impoundment area in the center of the 160-acre plot described above.

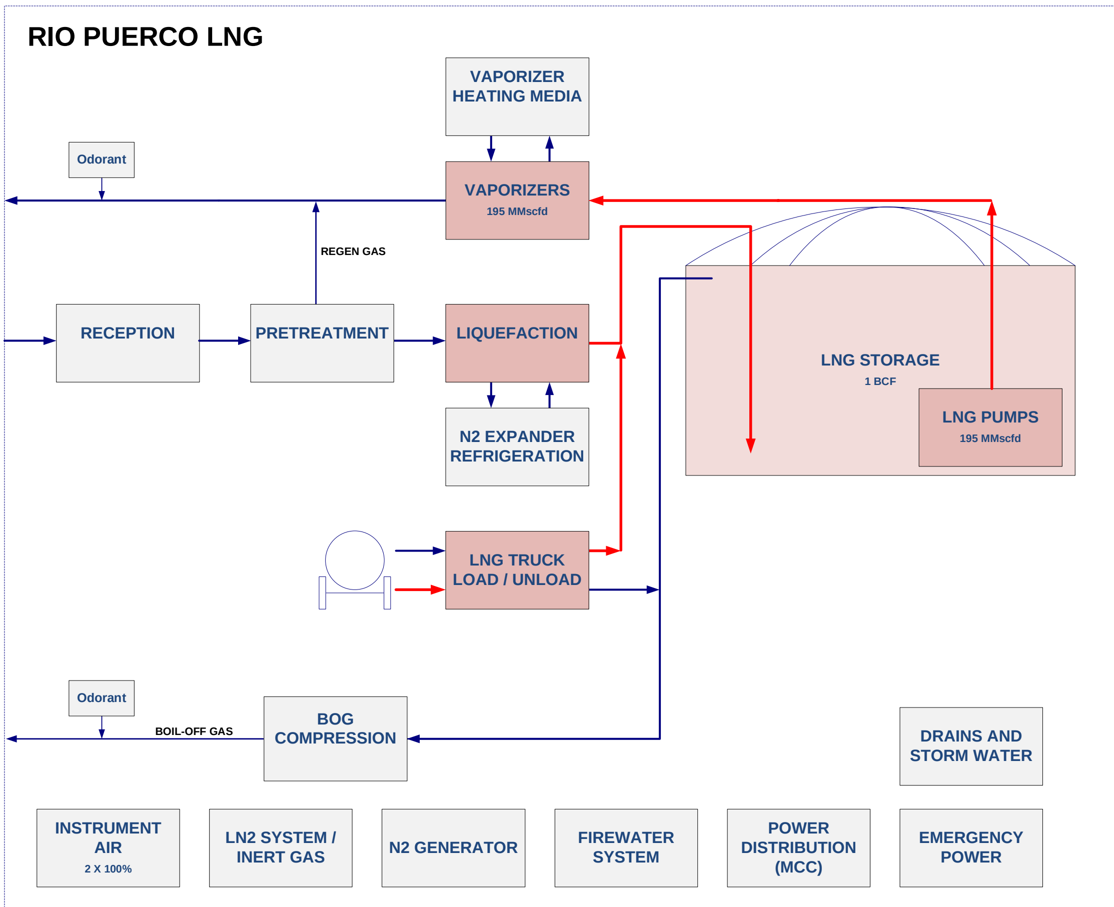


Figure 3. Rio Puerco LNG Block Flow Sketch Relevant to Exclusion Zones

Referring to Figure 3 the following unit operations are of particular interest are seen in Table 2.

Table 2. Characteristic Releases and Volumes for SALS

Description	**Fluid**	**Pressure (psig)**	**Flow (MMsfd) / gpm**	**Inventory (ft^3)**	**Line Size Range (in.)**	**Elevation Range (ft.)**
LNG Rundown Line outside the LNG impoundment area.	LNG	15 – 25 psig	10 MMscfd	59 ft^3	2" – 6"	3 ft – 12 ft
LNG Rundown Line inside the LNG impoundment area.	LNG	0-5 – 25 psig	10 MMscfd	59 ft^3	2" – 6"	12 ft – 100 ft
LNG Truck Load between loading station and LNG storage tank outside impoundment	LNG	30-50 psig	Variable, up to 200 gpm	1,926 ft^3	1" – 2"	3 ft – 15 ft
LNG Truck Load between LNG impoundment and LNG tank dome.	LNG	30-50 psig	Variable, up to 200 gpm	1,926 ft^3	1" – 6"	12 ft – 100 ft
LNG Storage Tank	LNG	0.5 psig	NA	1,604,167 ft^3	NA. No penetration below liquid level.	NA.
LNG pump discharge to LNG vaporizers	LNG	655 psig	195 MMscfd (normal) 273 MMscfd with pump run-out	70 ft^3	2" – 8"	5 ft – 100 ft

The values expressed in Table 2 are characteristic / type for the services only and alternative values may be used in Phast and LNGFire3 calculations as appropriate in-line with PHMSA guidelines and requirements.

4 THERMAL RADIATION EXCLUSION ZONE ANALYSIS

Thermal radiation exclusions zone calculations were conducted as part of the Rio Puerco facility siting. The analysis shared in this section was completed in alignment with the requirements defined and incorporated into law within the U.S. by DOT 49 CFR 193 and NFPA 59A 2001 (incorporated by reference).

4.1 THERMAL RADIATION EXCLUSION ZONE CODES AND STANDARDS

Given application of CFR193 to the facility the following is applicable to establishing thermal radiation exclusion zone distances for facility siting:

§ 193.2051 - SCOPE: *Each LNG facility designed, constructed, replaced, relocated or significantly altered after March 31, 2000 must be provided with siting requirements in accordance with the requirements of this part and of NFPA 59A (incorporated by reference, see § 193.2013). In the event of a conflict between this part and NFPA-59A-2001, this part prevails.*

CFR 193.2051 establishes the applicability of CFR193 and NFPA 59A-2001 incorporated by reference for Rio Puerco LNG.

§ 193.2007 - DEFINITIONS: *Exclusion zone means an area surrounding an LNG facility in which an operator or government agency legally controls all activities in accordance with § 193.2057 and § 193.2059 for as long as the facility is in operation.*

CFR 193.2007 defines exclusion zones relevant to thermal radiation for LNG facilities. Similar to vapor dispersion, this means that radiation intensity calculations are completed to establish exclusion zones that are under the legal control of NMGC. “Control” methods can include:

- Legal ownership or lease of property subject to the exclusion zone.
- Legal covenants restricting the use / development of land adjacent to the site extending into an exclusion zone.

In the case of the NMGC Rio Puerco site the intention is to keep vapor dispersion and radiation exclusion zones within the property boundary.

§ 193.2057 – Thermal radiation protection: *Each LNG container and LNG transfer system must have a thermal exclusion zone in accordance with section 2.2.3.2 of NFPA-59A-2001 (incorporated by reference, see § 193.2013) with the following exceptions:*

a) The thermal radiation distances must be calculated using Gas Technology Institute's (GTI) report or computer model GTI-04/0032 LNGFIRE3: A Thermal Radiation Model for LNG Fires (incorporated by reference, see § 193.2013). The use of other alternate models which take into account the same physical factors and have been validated by experimental test data may be permitted subject to the Administrator's approval.

b) *In calculating exclusion distances, the wind speed producing the maximum exclusion distances shall be used except for wind speeds that occur less than 5 percent of the time based on recorded data for the area.*

c) *In calculating exclusion distances, the ambient temperature and relative humidity that produce the maximum exclusion distances shall be used except for values that occur less than five percent of the time based on recorded data for the area.*

CFR 193.2057 mandates the thermal radiation calculations from Section 2.2.3.2 from NFPA 59A and establishes the accepted software and relevant ambient environmental conditions. Key requirements of this section include the following for LNG facility thermal radiation exclusion zones:

- GTI LNGFire3 or other suitable software taking into the account the same physical phenomena, shall be used for assessing thermal radiation of ignited LNG releases.
- The worst combination of ambient environmental conditions (ambient temperature, wind, and relative humidity) not exceeded 5% of the time shall be used in assessing radiation intensity levels.
- CFR 193.2057 refers to NFPA 59A-2001 Section 2.2.3.2 to establish radiation intensity values shall be used for establishing exclusion zones:
    1. 1600 Btu/hr/ft2 (5000 W/m2) at a property line that can be built upon for ignition of a design spill as specified in NFPA 59A-2001 Section 2.2.3.5.
    2. 1600 Btu/hr/ft2 (5000 W/m2) at the nearest point located outside the owner's property line that, at the time of plant siting, is used for outdoor assembly by groups of 50 or more persons for a fire over an impounding area containing a volume, V, of LNG determined in accordance with NFPA 59A-2001 Section 2.2.2.1
    3. 3000 Btu/hr/ft2 (9000 W/m2) at the nearest point of the building or structure outside the owner's property line that is in existence at the time of plant siting and used for occupancies classified by NFPA 101®, Life Safety Code®, as assembly, educational, health care, detention and correction or residential for a fire over an impounding area containing a volume, V, of LNG determined in accordance with NFPA 59A-2001 Section 2.2.2.1
    4. 10,000 Btu/hr/ft2 (30,000 W/m2) at a property line that can be built upon for a fire over an impounding area containing a volume, V, of LNG determined in accordance with NFPA 59A-2001 Section 2.2.2.1

Where Section 2.2.3.5 refers to a 10-minute design spill or SALS defined further by PHMSA FAQ[1] and Section 2.2.2.1 refers to a volume, V, equals the total volume of LNG in the container assuming the container is full.

[1] See Part DS DOT PHMSA FAQs

PHMSA offers some additional guidance in their FAQ with respect to SALS (DS FAQ) and radiation to include the effects of hazards other than those specifically defined in NFPA 59A (PHMSA FAQ H1).

4.2 THERMAL RADIATION EXCLUSION ZONE BASIS

Radiation modelling to establish thermal radiation exclusion zones for the Rio Puerco LNG site were completed using GTI's LNGFire3 software. The environmental conditions applied to the modelling are described below.

4.2.1 Environmental Conditions for Modelling

Weather conditions are prescribed within 49 CFR 193.2057 require conservative (worst case) environmental conditions to be applied to radiation conditions except that that prevail less than 5% of the time. The environmental have been applied to the thermal radiation analysis and are presented below in Table 3.

Table 3: Radiation Model Parameters Summary

Radiation Environmental Parameters			
Parameter	**Description**	**Value**	**Requirement**
Ambient temperature	Within LNGFire3, lower ambient temperatures increase radiation loads. A low ambient was selected. The relationship is weak, and no parametric analysis required.	30 °F	DOT 49 CFR 193.2057(c) Conservative temperature exceeded ~95% of the time.
Relative humidity	Within LNGFire3, lower relative humidity values increase radiation loads because there is less moisture in the air to absorb radiation. A low relative humidity was selected even through site humidity is typically higher at low ambient (during winter). The relationship with radiation is weak and no parametric analysis required.	20%	DOT 49 CFR 193.2057(c) Conservative relatively humidity exceeded ~95% of the time.
Wind Speed	Within LNGFire3, radiation intensity distances have a strong relationship with wind speed with intermediate wind speeds maximizing radiation. Parametric analysis was conducted over a range of wind speeds to identify maximum radiation loads	4.5-25 mph	DOT 49 CFR 193.2057(b) Parametric modelling to identify worst case within 5% < Wind Speed < 95% of the time.

4.2.2 Impoundment Areas

LNGFire3 requires input of LNG secondary impoundment surface areas to allow ignited pool fire radiation intensities to be measures. There are three LNG impoundment areas relevant to these calculations as follows in Table 4.

Table 4. Rio Puerco Impoundment Areas

Area	Description	Impounded Volume	Fire Dimensions
LNG Truck Load	Spills in the LNG loading area are collected in troughs and routed to an LNG secondary impoundment area. LNG trailers may not be equipped with automatic shutdown valve if leak point is at the doghouse or the LNG hose. Conservative volume of the entire contents of the LNG trailer (12,000 gallons) is applied as the SALS.	1,926 ft^3	20’ x 20’
LNG Rundown to Storage	The LNG rundown line to storage may leak inside or outside the LNG storage tank impoundment area. Leaks outside are collected in troughs running under piping and directed to a shared LNG impoundment are with the truck load. LNG release rate from the train for 10 minutes (84 US GPM) from the H&MB plus the volume of the rundown line define a maximum release size of 242.1 ft^3. The required truck load impoundment volume governs impoundment volume.	242.1 ft^3 required. 1,926 ft^3 applied from truck load (governing)	20’ x 20’
LNG Storage SALS sub-impoundment	Spills inside the LNG storage tank impoundment area are directed by grating and trough to a sub-impoundment area located in the corner of the LNG storage tank impoundment. The SALS determining the volume of this impoundment area is a 10-minute governing release from the high-pressure LNG pumped-up prior to vaporization through a 2” hole defined in FAQ DS2. This is a rate of 4560 US GPM for 10 minutes with 10% additional margin to arrive at 8,053 ft^3 SALS.	8,053 ft^3	30’ x 30’
LNG Storage Tank	The single-containment LNG storage tank secondary impoundment is designed for containing the full inventory of the tank when full = 1 BCF / 1.6 million	1,604,167 ft^3	400’ x 400’

Area	Description	Impounded Volume	Fire Dimensions
	cubic foot. This is modelled as a 12' tall impoundment berm with 400' x 400' dimensions.		

4.3 THERMAL RADIATION EXCLUSION ZONE RESULTS

In The following section shares the results of the vapor dispersion for the two potential sites.

Table 5. Thermal Radiation Exclusion Zone Distances

Area	1,600 BTU /ft^2/hr	3,000 BTU /ft^2/hr	10,000 BTU /ft^2/hr
LNG Truck Load and LNG Rundown Shared Impoundment (SALS)	133.8 ft	117.1 ft	91.9 ft
LNG Storage sub-impoundment (SALS)	186.5 ft	162.3 ft	125.2 ft
LNG Storage Tank Impoundment (V)	1495.9 ft	1200.7 ft	798.4 ft

The results expressed in Table 5 indicate:

- The 1,600 BTU/ft^2/hr radiation isopleth determines the thermal radiation exclusion zone for the LNG truckload / rundown impoundment area per NFPA 59A-2001 Section 2.2.3.2a(1). This impoundment area is currently located approximately 900 ft from a property boundary, well above the 133.8 ft required per this section.
- The 1,600 BTU/ft^2/hr radiation isopleth determines the thermal radiation exclusion zone for the LNG Storage sub-impoundment area per NFPA 59A-2001 Section 2.2.3.2a(1). This impoundment area is currently located approximately 1,200 ft from a property boundary, well above the 186.5 ft required per this section.
- The 10,000 BTU/ft^2/hr radiation isopleth determines the thermal radiation exclusion zone for the LNG Storage Tank Impoundment area per NFPA 59A-2001 Section 2.2.3.2a(4). This impoundment area is currently located approximately 970 ft from a property boundary, above the 798.4 ft required per this section.

Appendix B shows the relevant impoundment areas with associated thermal radiation exclusion zones superimposed on the site layout.

4.4 THERMAL RADIATION EXCLUSION ZONE DISCUSSION

The thermal radiation exclusion distances in Table 5 resultant from the calculation methods and exclusion zone distances from CFR 193.2057 and associated PHMSA and NFPA59A-2001 requirements incorporated by reference show the 160-acre Rio Puerco LNG site at Quail Ranch, Rio Rancho is suitable.

5 DISPERSION EXCLUSION ZONE ANALYSIS

LNG facility design and siting requires consideration of a range of LNG releases and possible vapor cloud formation. These requirements are defined and incorporated into law within the U.S. by DOT 49 CFR 193 which incorporates by reference NFPA 59A 2001 and that address the requirements for secondary impoundment and other facility design criteria to help ensure that people and installations outside LNG facilities are not exposed to unacceptable possible risk caused by LNG spills and associated flammable vapor clouds. The mandated assessment includes:

- The definition of a range of design spills and credible release scenarios.
- Treatment of and requirements for secondary LNG impoundment, safety systems, and other features that determine the potential size of an LNG release.
- The accepted software that can be used to assess the vapor dispersion.

5.1 DISPERSION CODES AND STANDARDS

Given application of CFR193 to the facility the following is applicable to establishing vapor dispersion exclusion zone distances for facility siting:

§ 193.2051 - SCOPE: *Each LNG facility designed, constructed, replaced, relocated or significantly altered after March 31, 2000 must be provided with siting requirements in accordance with the requirements of this part and of NFPA 59A (incorporated by reference, see § 193.2013). In the event of a conflict between this part and NFPA-59A-2001, this part prevails.*

CFR 193.2051 establishes the applicability of CFR193 and NFPA 59A-2001 incorporated by reference for Rio Puerco LNG.

§ 193.2007 - DEFINITIONS: *Exclusion zone means an area surrounding an LNG facility in which an operator or government agency legally controls all activities in accordance with § 193.2057 and § 193.2059 for as long as the facility is in operation.*

CFR 193.2007 defines exclusion zones relevant to vapor dispersion for LNG facilities. This means that vapor dispersion analysis calculations are completed, in accordance to a well-defined rule set, to establish exclusion zones that are under the legal control of NMGC. “Control” methods can include:

- Legal ownership or lease of property subject to the exclusion zone.
- Legal covenants restricting the use / development of land adjacent to the site extending into an exclusion zone.

In the case of the NMGC Rio Puerco site the intention is to keep vapor dispersion radiation exclusion zones within the property boundary.

§ 193.2059 - Flammable vapor-gas dispersion protection: *Each LNG container and LNG transfer system must have a dispersion exclusion zone in accordance with sections 2.2.3.3 and*

2.2.3.4 of NFPA-59A-2001 (incorporated by reference, see § 193.2013) with the following exceptions:

a. *Flammable vapor-gas dispersion distances must be determined in accordance with the model described in the GTI-04/0049, "LNG Vapor Dispersion Prediction with the DEGADIS 2.1 Dense Gas Dispersion Model"" (incorporated by reference, see § 193.2013)." Alternatively, in order to account for additional cloud dilution which may be caused by the complex flow patterns induced by tank and dike structure, dispersion distances may be calculated in accordance with the model described in the Gas Research Institute report GRI-96/0396.5 (incorporated by reference, see § 193.2013), "Evaluation of Mitigation Methods for Accidental LNG Releases. Volume 5: Using FEM3A for LNG Accident Consequence Analyses". The use of alternate models which take into account the same physical factors and have been validated by experimental test data shall be permitted, subject to the Administrator's approval.*
b. *The following dispersion parameters must be used in computing dispersion distances:*
   1) *Average gas concentration in air = 2.5 percent.*
   2) *Dispersion conditions are a combination of those which result in longer predicted downwind dispersion distances than other weather conditions at the site at least 90 percent of the time, based on figures maintained by National Weather Service of the U.S. Department of Commerce, or as an alternative where the model used gives longer distances at lower wind speeds, Atmospheric Stability (Pasquill Class) F, wind speed = 4.5 miles per hour (2.01 meters/sec) at reference height of 10 meters, relative humidity = 50.0 percent, and atmospheric temperature = average in the region.*
   3) *The elevation for contour (receptor) output H = 0.5 meters.*
   4) *A surface roughness factor of 0.03 meters shall be used. Higher values for the roughness factor may be used if it can be shown that the terrain both upwind and downwind of the vapor cloud has dense vegetation and that the vapor cloud height is more than ten times the height of the obstacles encountered by the vapor cloud.*
c. *The design spill shall be determined in accordance with section 2.2.3.5 of NFPA-59A-2001 (incorporated by reference, see § 193.2013).*

CFR 193.2059 establishes a number of the rules and requirements relevant to vapor dispersion calculations required for establishing relevant exclusion zones. In particular CFR 193 establishes a requirements to achieve an average gas concentration of 2.5% flammable gas in air (e.g., ~50% of LFL) at the property boundary.

In addition to the above requirements, PHMSA has given a number of written interpretations and guidance relevant to determining the dispersion exclusion zones described and CFR 193.2059 and NFPA 59A-2001 Section 2.2.3.3 as described below.

Phenomenon considered: PHMSA has added guidance and clarifications regarding the release and vapor generation phenomenon based on sustained research and modelling efforts by the Fire Protection Research Foundation (FPRF) and other organizations. Key outcomes include:

- Vapor dispersion analysis must examine the effects of jetting and flashing in calculating the vapor-gas dispersion exclusion zone for any appropriate LNG facilities, including pressurized piping or equipment, to comply with the Siting Requirements in Subpart B of 49 C.F.R. Part 193[2].
- Conveyance of LNG to impoundment and vapor generated in impoundment must be considered and the DEGADIS, if used, needs a suitable source term[3, 4].

Software: The requirement of due consideration of jetting and flashing phenomena, required improvement in vapor dispersion source term calculation. In response PHMSA provided guidance on source term evaluation and accepted two validated software models capable of modelling the source term[5].

The Rio Puerco dispersion exclusion analysis is completed with PHSMA accepted software Phast version 6.7. Phast's Unified Dispersion Model (UDM) is capable of modeling a range of features relevant to LNG facility assessment[6].

Design Spills (Single Accidental Leak Source or SALS): Design Spill analysis was completed in accordance with NFPA-59A-2001 Section 2.2.3.5 as incorporated by DOT 49 CFR 193.2059(c) by reference informed by guidance from DOT PHMSA[7].

- DOT 49 CFR 193.2059 requires: "The design spill shall be determined in accordance with section 2.2.3.5 of NFPA-59A-2001…"
- DOT 49 CFR 193.2059 requires: "Each LNG container and LNG transfer system must have a dispersion exclusion zone in accordance with sections 2.2.3.3 and 2.2.3.4 of NFPA-59A-2001"

The Phast software used for vapor dispersion in PreFEED calculates dispersion distances based on Gaussian engine rather than computations fluid dynamics (CFD) modelling that means that results do not account for site topography or structures such as the LNG impoundment berm or storage tank and cannot be used to calculate the positive impact of such structures, as well as mitigating measures such as vapor fences on dispersion distances. PHMSA has accepted another dispersion tool, FLACS, that can model these beneficial structures in subsequent engineering phases and the Phast results may be regarded as conservative.

[2] PHMSA Interpretation Response #PI-10-0005, 07/16/2010.
[3] PHMSA Interpretation Response #PI-10-0021, 7/07/2010.
[4] Hazards and Hazard Modelling, DOT PHMSA FAQ H7, https://www.phmsa.dot.gov/pipeline/liquified-natural-gas/lng-plant-requirements-frequently-asked-questions#ds1.
[5] Liquefied Natural Gas Facilities: Obtaining Approval of Alternative Vapor-Gas Dispersion Models, Docket No. PHMSA-2010-0226, 08/31/2010.
[6] Det Norske Veritas (U.S.A.) Inc., Petition for Approval of Alternative Vapor Gas Dispersion Model, PHMSA-2011-0075-0019, 06/15/2011.
[7] See Part DS DOT PHMSA FAQs

The PHMSA FAQ provides a number of clarifications on release scenario sizes, process condition, locations and orientation that are incorporated into vapor dispersion analysis and results.

5.2 DISPERSION BASIS

5.2.1 Evaluated Cases

A range of cases were taken from anticipated heat and material balance conditions for the site. The analysis cases are broken into two types:

1) Releases considering the relevant physical behavior of the release including spray, jetting, flashing of LNG releases. These were modelled using Phase pipe rupture and leak scenarios with various hole sizes depending on line size. As will be seen in the case map, a range of orientations, elevation and hole size was considered relevant to the facility design. These releases are intended to consider the momentum and flashing nature of LNG releases.
2) Releases conveyed to secondary impoundment. A second type of release considered are impoundment vaporization scenarios for impoundment areas that could be used to contain a 10-minute design spill. There are two different impoundment areas relevant. One that serves the truck load and LNG rundown LNG piping with a capacity of 12,000 gallons (the volume of one full LNG trailer) and one with a capacity of 45,600 gallons (associated with PHMSA SALS for vaporization piping).

Note that the sizing of the impoundment for the LNG storage tank SALS is taken as a 10-minute spill and is governed by the vaporization pump flow rates and pressures (e.g., sis not dependent on tank type or tank volume) in accordance with NFPA 59A-2001 Table 2.2.3.5.

Two types of releases will be considered for establishing the vapor dispersion exclusion zone relevant for Rio Puerco LNG as follows:

- **Jetting and flashing** from LNG containing equipment and piping. These types of releases govern the establishment of dispersion exclusion zones because they reflect momentum-driven releases toward property boundaries as well as phenomena such as droplet shear and flashing that can result in large quantities of vapor generation.
- **Conveyance and Impoundment** management of LNG releases result in lower momentum colder than air vapor releases that mix with and disperse relatively poorly with air. Although these dispersion distances rarely govern facility siting, they often influence design and location of secondary LNG impoundment areas.

5.2.2 Environmental Conditions for Modelling

Weather conditions are prescribed within DOT 49 CFR 193. 2059 have been applied to the vapor dispersion analysis and are presented below in Table 6.

Table 6: Vapor Dispersion Model Parameters Summary All Cases

Vapor Dispersion Weather Parameters			
Parameter	**Unit**	**Value**	**Requirement**
Average Gas Concentration in Air	%	2.5	DOT 49 CFR 193.2059(b)(1)
Atmospheric Stability (Pasquill Class)		F	DOT 49 CFR 193.2059(b)(2)
Wind Speed	mph	4.5	DOT 49 CFR 193.2059(b)(2)
Reference Height for wind speed	m	10	DOT 49 CFR 193.2059(b)(2)
Humidity	%	50	DOT 49 CFR 193.2059(b)(2)
Ambient Temperature (average ambient 2021 ASHRAE Handbook for Albuquerque)	°F	58.5	DOT 49 CFR 193.2059(b)(2)
Elevation for Contour (receptor) output	m	0.5	DOT 49 CFR 193.2059(b)(3)
Surface Roughness Factor	m	0.03	DOT 49 CFR 193.2059(b)(4)

As mandated in CFR 193.2059 and associated written guidance from PHMSA in the FAQ and other source, a wide range flashing and jetting cases were evaluated for the Rio Puerco site based on the conditions expressed in Table 2 and the PreFEED Heat and Material Basis documentation. This included evaluation of a range of release orientations, release heights, and other conditions to determine range of possible results and screen against plot plan constraints for the facility.

5.3 DISPERSION RESULTS

Vapor dispersion exclusion zone determination is often an interactive process where initial results may drive layout adjustments or design modifications to keep dispersion exclusion zones within the property. Key preliminary inputs include a layout that draws on experience and previous analysis coupled with integration a number of features into the design anticipating dispersion distances that can may be associated with PHMSA analysis requirements. Ultimately, essentially all sites reflect incorporation of some measures that are applied to bring LNG facility exclusion zones inside the property boundaries. These could be as simple as slight modifications to the facility layout through to installation of extensive safety-critical design features including vapor fences, spray guards and shrouds and line trenching.

A range of cases were evaluated in Phast vs. 6.7 parametrically covering conditions (release orientation, hole size, fluid pressure, etc.) likely to result in governing dispersion distances for each of the three areas: LNG truck load, LNG storage area (including vaporization), and LNG rundown. The analysis was primarily focused on jetting and spraying cases that typically govern exclusion zone distance, but also include cases evaluating conveyance and impoundment for the truck load and rundown impoundment and the LNG storage area sub-impoundment areas. The governing results and limitations will be shared in Table 7. These distances reflect good engineering design and application of the mitigating measures described in the right column.

Table 7. Dispersion Exclusion Zone Distances

Description of Area	Area	Exclusion Zone (ft)	Mitigating measures or recommendations
LNG Truck Load / Unload Flashing and Jetting (SALS)	Truck Load area and piping to LNG storage berm	813.9 ft	None. Recommended: Apply FLACS in FEED.
LNG Truck Load / Unload Flashing and Jetting (SALS)	Piping LNG Storage Impoundment up to tank dome	401.6 ft	None.
LNG Rundown Flashing and Jetting (SALS)	Piping between coldbox and LNG storage berm	755.7 ft	Minor. Run rundown line size as 6" or similar measure. Refine with FLACS in FEED to validate 3" piping distance with tank effects.
LNG Rundown Flashing and Jetting (SALS)	Piping between LNG storage berm and tank dome	607.3 ft	Minor. Run rundown line size as 6" or similar measure.
LNG vaporization Flashing and Jetting (SALS)	Tank dome and LNG piping to STV	892.6 ft	None. Apply good LNG piping engineering practice.
Truck Load convey and impoundment	Truck load impoundment pit	892.4 ft	Minimal. Based on 20' x 20' shared impoundment. Adjust as needed given layout constraints.
LNG Storage sub-impoundment (SALS)	S-W corner of LNG storage impoundment	1069 ft	Minimal. Based on 23.2' x 23.2" sub-impoundment. Adjust as needed given layout constraints – for reference 23' L x 23' W x 15' D requires 1284 ft exclusion zone.

Governing dispersion exclusion zone distances for most of the areas were in 800 - 900-foot range. Further analysis will be completed in subsequent engineering phases as the design is refined to continue to effectively manage dispersion distances. The LNG storage area sub-impoundment resulted in the longest dispersion distance and can be accommodated with the site by placing that impoundment well on the layout.

5.4 VAPOR DISPERSION EXCLUSION ZONE DISCUSSION

The dispersion exclusion zone distances in Table 7Table 5 are resultant from the calculation methods and exclusion zone distances from CFR 193.2059 and associated PHMSA and NFPA59A-2001 requirements. They indicate the 160-acre Rio Puerco LNG site at Quail Ranch, Rio Rancho is suitable. There are a couple of areas where the design will require modest increased costs to keep the dispersion exclusion zone on the site including:

1. The LNG rundown line between the coldbox and the tank dome will be run as 6". This is larger than it needs to be and likely can be reduced to 3" in subsequent engineering phases through application of FLACS CFD modelling to achieve a modest cost savings.
2. The LNG vaporization sub-impoundment area may be deeper than required to keep conveyance and impoundment vapor clouds on-site. This can likely be refined in subsequent engineering phases through the application of FLACS CFD modelling of the LNG impoundment berm.

6 DISCUSSION AND RECOMMENDATIONS

Thermal radiation exclusion distances were calculated using LNGFire3 in accordance with the requirements, calculation methods and exclusion zone distances mandated in CFR 193.2057, NFPA59A-2001, and associated PHMSA written guidance. The analysis shows the 160-acre Rio Puerco LNG site at Quail Ranch, Rio Rancho is suitable with respect to thermal radiation exclusion zone associated with the proposed LNG facility. A minimum of approximately 800 ft distance is required between the LNG storage tank impoundment berm and the nearest property boundary.

The dispersion exclusion zone distances were calculated in the approved Phast v6.7 software using the methods, requirements and exclusion zone distances mandated in CFR 193.2059, NFPA59A-2001 and associated requirements written PHMSA guidance. The analysis indicates the 160-acre Rio Puerco LNG site at Quail Ranch, Rio Rancho is suitable given prudent design and implementation. There are a couple of areas where the facility will require modest increased costs to maintain a dispersion exclusion zone within the property boundary that will include running the LNG rundown line as a 6" pipe and some deeper LNG impoundment areas. These can be optimized in subsequent design phase if modest cost savings are achievable.

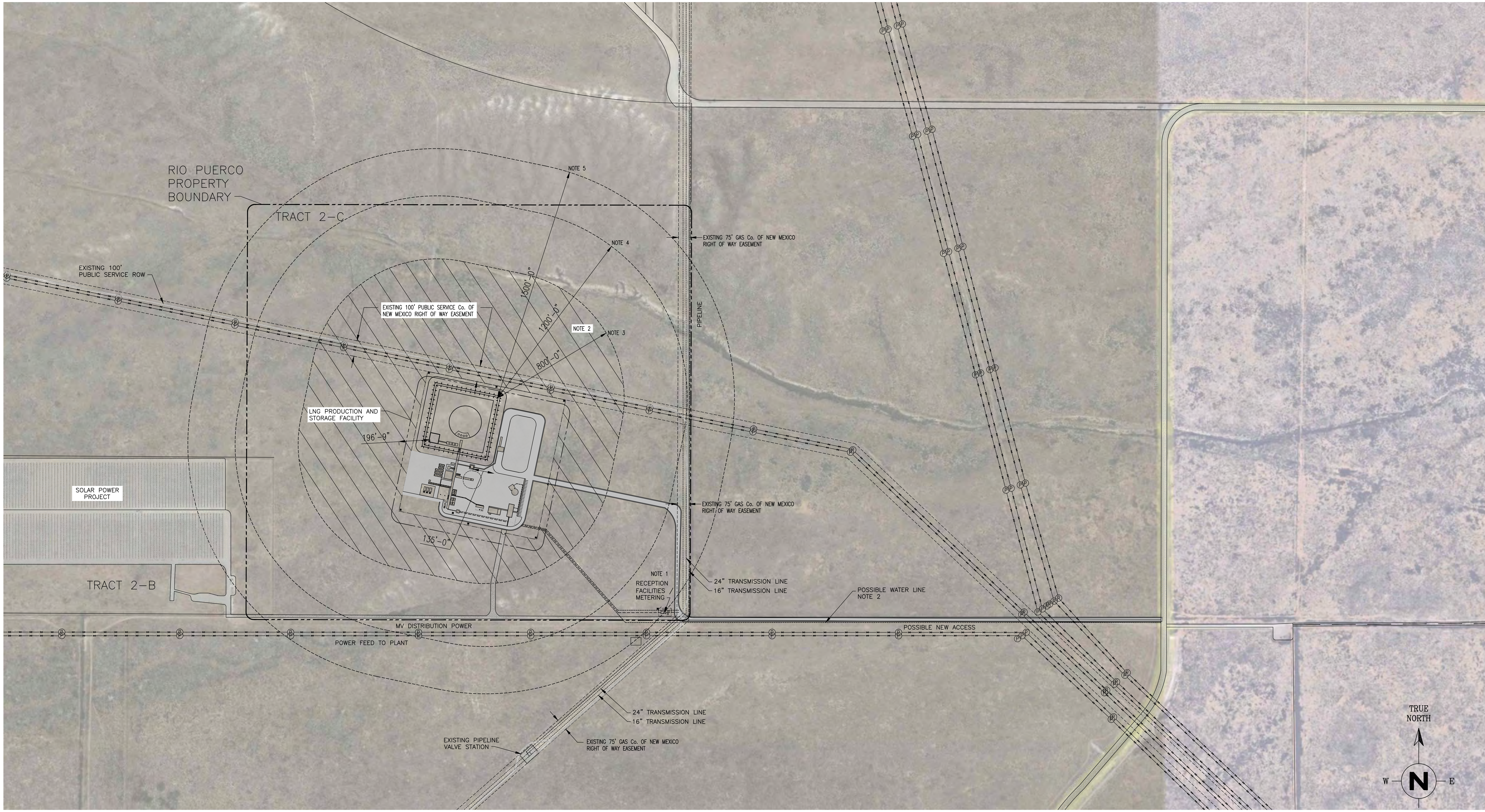
A summary of the relevant exclusion zone distances is seen below in Table 8 and the associated plot plans are seen in Appendix A and B.

Table 8. Governing Exclusion Zone Distances by Line / Impoundment

Description of Area	Radiation Exclusion Zone (ft)	Vapor Dispersion Exclusion Zone (ft)
Truck loading area and piping to main rundown line at top of LNG storage tank berm.	NA	**813.9 ft**
Piping between coldbox and LNG Storage Impoundment area.	NA	**755.6 ft**
Piping Between Tank Dome and top of Berm and on the tank done / pump recycle area.	NA	**607.3 ft**
Piping and equipment between the LNG tank dome and the STV vaporizers.	NA	**892.6 ft**
Shared Impoundment: Exclusion zone from inside edge of shared Truck Load / Rundown concrete pit.	133.8 ft	**892.4 ft.**
LNG Storage sub-Impoundment from inside top edge of sub-impoundment concrete pit	186.5 ft	**1069 ft**
LNG Storage Tank Impoundment from inside top edge of containment berm.	**798.4 ft**	NA

Based on the thermal radiation and dispersion exclusion zone analysis completed, the 160-acre Quail Ranch site for Rio Puerco LNG is considered a suitable site for the planned LNG facility.

APPENDIX A: THERMAL RADIATION EXCLUSION ZONE PLOT



THERMAL RADIATION EXCLUSION ZONE PLAN

SCALE: 1" = 300'

0 300' 600'
SCALE: 1" = 300'

NOTES:

1. THERMAL RADIATION EXCLUSION DISTANCES CALCULATED USING LNGFIRE3 IN ACCORDANCE WITH THE REQUIREMENTS, CALCULATION METHODS AND EXCLUSION ZONE DISTANCES MANDATED IN CFR 193.2057, NFPA59A-2001, AND ASSOCIATED PHMSA WRITTEN GUIDANCE.
2. CFR. 2057 THERMAL RADIATION EXCLUSION ZONE RELEVAN FOR RIO PUERCO LNG SITE.
3. 800 FOOT FROM INSIDE EDGE OF IMPOUNDMENT TO 10,000 BTU/HR/FT2 (30,000 W/M2) ISOPLETH. SHALL NOT CROSS PROPERTY LINE THAT CAN BE BUILT UPON FOR A FIRE OVER AN IMPOUNDING AREA CONTAINING FULL VOLUME LNG STORAGE TANK DETERMINED IN ACCORDANCE WITH NFPA 59A-2001 SECTION 2.2.2.1.
4. 1200 FOOT FROM INSIDE EDGE OF IMPOUNDMENT TO 3000 BTU/HR/FT2 (9000 W/M2) ISOPLETH. NO STRUCTURES CLASSIFIED BY NFPA 101, LIFE SAFETY CODE AS ASSEMBLY, EDUCATIONAL, HEALTH CARE, DETENTION AND CORRECTION OR RESIDENTIAL WITHIN THIS ISOPLETH IN ACCORDANCE WITH NFPA 59A-2001 SECTION 2.2.2.1.
5. 1500 FOOT FROM INSIDE EDGE OF IMPOUNDMENT TO 1600 BTU/HR/FT2 (5000 W/M2) ISOPLETH. NO OUTDOOR ASSEMBLY BY GROUPS OF 50 OR MORE PERSONS AT THE NEAREST POINT LOCATED OUTSIDE THE OWNER'S PROPERTY LINE THAT, AT THE TIME OF PLANT SITING WITHIN THIS ISOPLETH IN ACCORDANCE WITH NFPA 59A-2001 SECTION 2.2.2.1.

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
A	09/28/2022	SN	JZ	SM	MAB	ISSUED FOR INTERNAL COMMENTS

LISBON GROUP
New Mexico GAS COMPANY

PROJECT: NMGC RIO PUERCO LNG PROJECT

LAYOUT DRAWING
THERMAL RADIATION EXCLUSION ZONE PLAN

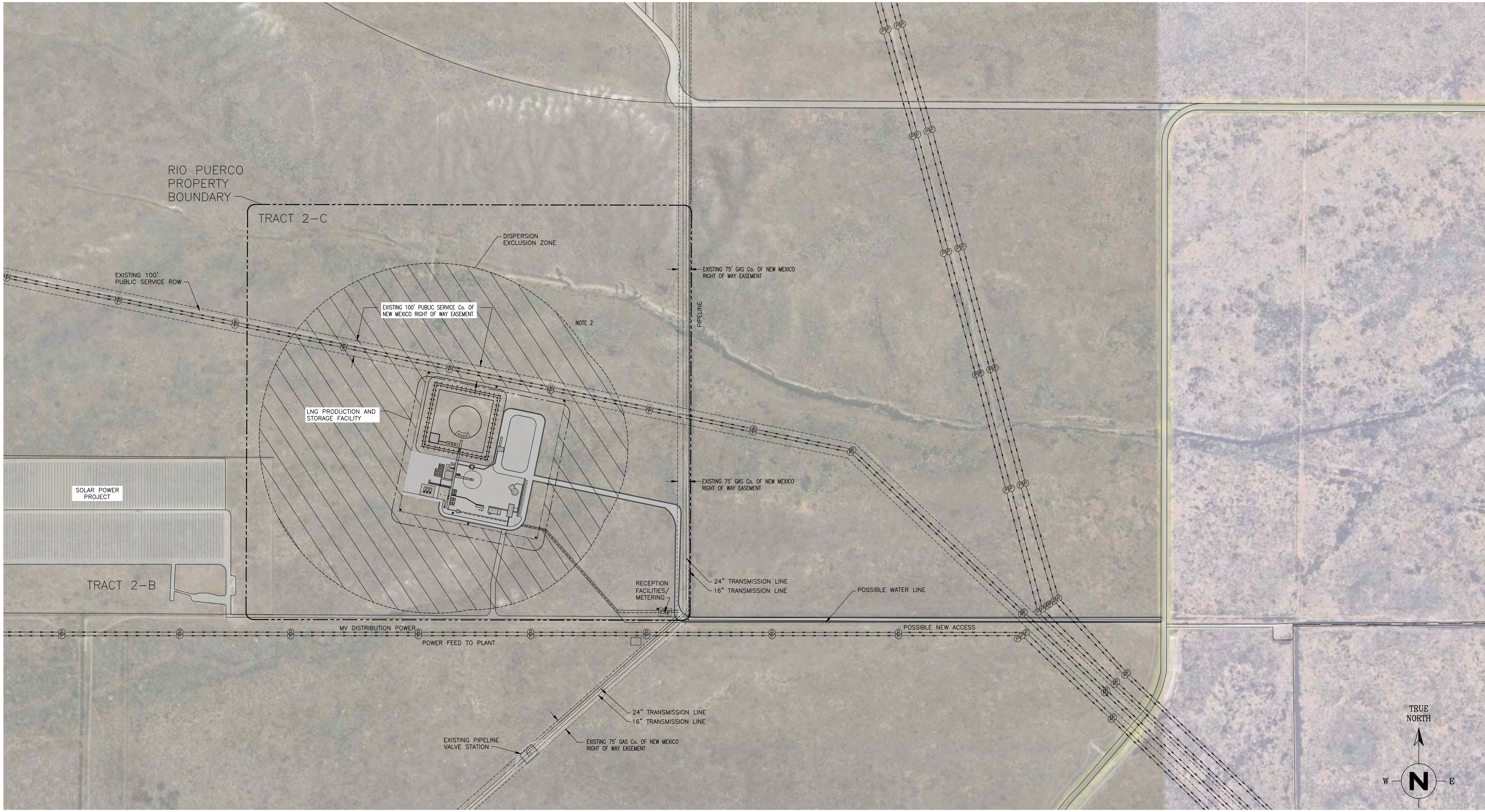
DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	N/A	N2101-L-403	A

DRAWING NO.:N2101-L-403 REVISION:A

L:\Mechanical Design\N2101 NMGC\N2101 New Mexico Gas Company\Orthos\DWGs\N2101-L-403 - THERMAL RADIATION EXCLUSION ZONE PLAN.dwg Son Nguyen 9/28/22 5:10pm

APPENDIX B: DISPERSION EXCLUSION ZONE PLOT

DRAWING NO.:N2101-L-404 REVISION:A



DISPERSION EXCLUSION
ZONE PLAN

SCALE: 1" = 300'

0 300' 600'
SCALE: 1" = 300'

NOTES:

1. DISPERSION EXCLUSION DISTANCES CALCULATED USING DNV PHAST V6.7 IN ACCORDANCE WITH THE REQUIREMENTS, CALCULATION METHODS AND EXCLUSION ZONE DISTANCES MANDATED IN CFR 193.2059, NFPA59A-2001, AND ASSOCIATED PHMSA WRITTEN GUIDANCE.
2. DISPERSION ZONE DISTANCE IS COMPOSITE OF VARIOUS POSSIBLE RELEASE SOURCES CONSIDERING JETTING AND SPRAYING AS WELL AS IMPOUNDMENT AND CONVEYANCE DISPERSION FROM ALL LNG CONTAINING EQUIPMENT AND PIPING. EXCLUSION ZONE LINE REFLECT 2.5% AVERAGE GAS COMPOSITION IN AIR PER CFR 193.2059.

REV.	DATE	DRWN.	BY	CHK.	APPR.	DESCRIPTION
A	09/28/2022	SN	JZ	SM	MAB	ISSUED FOR INTERNAL COMMENTS

LISBON GROUP

New Mexico GAS COMPANY

PROJECT: NMGC RIO PUERCO LNG PROJECT

LAYOUT DRAWING
DISPERSION EXCLUSION ZONE PLAN

DRAWING REFERENCE NO.	AREA	DRAWING NO.	REV.
N/A	N/A	N2101-L-404	A

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THE LISBON GROUP, LLC

Pre-FEED Report

Alternative Site Evaluation

NEW MEXICO GAS COMPANY

Project Name: Rio Puerco LNG Plant

Document Name:	Alternative Site Evaluation
Document Number:	N2101-TN-012
Revision:	B
Date:	9/19/2022

New Mexico
GAS COMPANY

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Document Name:	Alternative Site Evaluation			
Document Number:	N2101-TN-012			
Revision:	A	B		
Date:	7/16/2022	9/19/2022		
By:	MAB	MAB		
Checked:	JZ	PP		
Approved:	-	JZ		

Rev	Date	Description of Change
A	7/16/2022	Issued for Internal Review
B	9/19/2022	Issued for Client Review

Holds

No.	Description
1	

EXECUTIVE SUMMARY

This document describes the analysis completed to select the site for the Rio Puerco LNG facility between an existing NMGC company property and a 160-acre undeveloped parcel, both in Rio Rancho adjacent to existing transmission pipelines and approximately ten miles to the northwest of Albuquerque.

Two sites were evaluated for the development of an LNG facility:

- **Quail Ranch:** A greenfield, undeveloped 160-acre site.
- **Santa Fe Junction:** Co-located at the NMGC-owned Santa Fe Junction compressor station property.

Both properties offered good access to relevant transmission pipelines, road infrastructure, require limited site preparation (grading, cut / fill, and scrubbing), and other utilities. The Santa Fe Junction property is significantly smaller but was considered because it might allow a reduced cost facility due to synergies with existing operations on the site and reduced property acquisition costs.

Careful consideration of siting the Rio Puerco LNG Facility is important because its purpose is to store lots of natural gas as a very cold liquid (LNG) for cold weather or off-network pipeline curtailments. In the event of a leak (loss of containment), heavier than air vapors can be released that need large distances to mix with air and disperse. For this reason, LNG facilities siting considers vapor dispersion as defined in relevant federal codes, standards, and associated written guidance. Acceptability of the sites, especially Santa Fe Junction, is expected to be driven by compliance with LNG siting requirements defined in *49 CFR § 193.2059 Flammable vapor-gas dispersion protection* and associated sections of NFPA 59A-2001 incorporated by reference as will be further described after an introduction to the sites.

The results show that the 160-acre greenfield Quail Ranch site is acceptable and expected to be able to accommodate the planned LNG facility. Sound layout development, design practices regarding piping selection and impoundment and sub-impoundment are expected to be required as more detailed dispersion and thermal radiation analysis is completed for this site in alignment with *49 CFR § 193.2057 and 193.2059, NFPA 59a and associated guidance.* .\.

The Santa Fe Junction site struggled with approximately half of the scenarios considered for LNG production and vaporization operations. This is indicative that extensive mitigating measures would need to be applied for this site to make it acceptable such as vapor fences, extensive pipe-in-pipe piping of LNG rundown piping, non-optimized facility layout driven by vapor dispersion, and very deep secondary containment. Ultimately these mitigating measures would cost much more (over an order of magnitude more) than the alternative site property costs and is indicative that the site is too small for the size of LNG facility as planned.

The 160-acre Quail Ranch site will be is recommended for the LNG facility siting and will be incorporated into the PreFEED documentation and capital cost estimates.

TABLE OF CONTENTS

1 ABBREVIATIONS

API	American Petroleum Institute
ASHRAE	American Society for Health, Refrigeration, and Air-Conditioning Engineers
BCF	Billion Standard Cubic Feet
BOD	Basis of Design
BOG	Boil-off Gas
CFD	Computational Fluid Dynamics
FAQ	Frequently Asked Questions
FEED	Front End Engineering and Design
GPM	Gallons per Minute
HC	Hydrocarbon
HP	High Pressure
H&MB	Heat and Material Balance
LNG	Liquefied Natural Gas
MAOP	Maximum Allowable Operating Pressure
MMscfd	Million Standard Cubic Feet per Day
NFPA	National Fire Protection Association
PHMSA	Pipeline and Hazardous Materials Safety Administration
PLC	Programmable Logic Control
SALS	Single Accidental Leak Scenario

2 PURPOSE

This Technical Note describes the evaluation of two alternative sites for the Rio Puerco LNG Facility and recommendation for selection of the 160-acre Quail Ranch site incorporated into the PreFEED documentation and capital cost estimates.

3 INTRODUCTION

New Mexico Gas Company (NMGC) operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout New Mexico. To improve gas reliability / cost-effectiveness, New Mexico Gas Company is proposing the installation of a new on-network LNG facility to eliminate the need for currently contracted off-network underground storage capacity in West Texas. The functional requirements of the proposed LNG facility have been established based on cost-benefit analysis and include the following:

- Store 1 BCF net (~12 million gallons of LNG) of natural gas.
- Liquefy ~10 MMscfd net feed gas using Mole Sieve pretreatment and nitrogen expander-based liquefaction.
- Design send-out of 130 MMscfd natural gas to the transmission pipeline(s) when required (installed send-out capacity of 195 MMscfd).

This document describes the analysis completed to select the site for the Rio Puerco LNG facility between an existing NMGC company property (Santa Fe Junction) and a 160-acre undeveloped parcel (Quail Ranch), both in Rio Rancho adjacent to existing transmission pipelines and approximately ten miles to the northwest of Albuquerque.

4 SITE SELECTION BASIS

The following sections describes the basis for the screening including a description of both the sites, an introduction to vapor dispersion required for LNG facilities, and a description of what conditions were simulated for the vapor dispersion.

4.1 SITE DESCRIPTIONS

Two sites were evaluated for the development of an LNG facility:

- **Quail Ranch:** A greenfield, undeveloped 160-acre site.
- **Santa Fe Junction:** Further development of the NMGC ~45-acre Santa Fe Junction compressor station property.

Both properties offered good access to relevant transmission pipelines, road infrastructure, require limited site preparation (grading, cut / fill, and scrubbing), and other utilities. Santa Fe Junction is significantly smaller but may offer a reduced cost facility because of synergies with existing operations on the site and reduced property acquisition costs.

Careful consideration of the Rio Puerco LNG Facility is important because its purpose is to store lots of natural gas a very cold liquid (LNG) for cold weather / high gas demand events. In the event of a leak (loss of containment), heavier than air vapors can be released that need large distances to mix with air and disperse. For this reason, LNG facilities siting must consider vapor dispersion studies as defined in relevant federal codes, standards, and associated written guidance. Acceptability of the sites, especially Santa Fe Junction, is expected to be driven by compliance with LNG siting requirements defined in 49 CFR § 193.2059 Flammable vapor-gas dispersion protection and associated sections of NFPA 59A-2001 incorporated by reference as will be further described after an introduction to the sites.

4.1.1 Quail Ranch: 160-acre greenfield parcel

NMGC has identified a 160-acre parcel for the LNG plant and performed a preliminary site assessment. The property is situated west of Albuquerque, New Mexico, approximately two miles north of the Double Eagle II Airport in Bernalillo County adjacent to a solar farm development and approximately 3,000 ft west of Paseo del Norte Blvd. NE.

The property is undeveloped and is part of a larger master-planned area that is zoned for industrial and commercial uses (approximate site coordinates: 35°10’59.16”N, 106°47’50.95”W). The site is acceptable with respect to the airport in compliance within 49 CFR § 193.2155 and 14 CFR Section 1.1. There are currently no churches, schools, hospitals, or other assembly points for large groups of people adjacent to the property relevant to siting. There are no residential properties or offsite residential buildings immediately adjacent to the plot area.

This site is seen in Figure 1 and Figure 2 showing a photo of the site and the survey respectively.

Figure 1. 160-Acre Site Photo

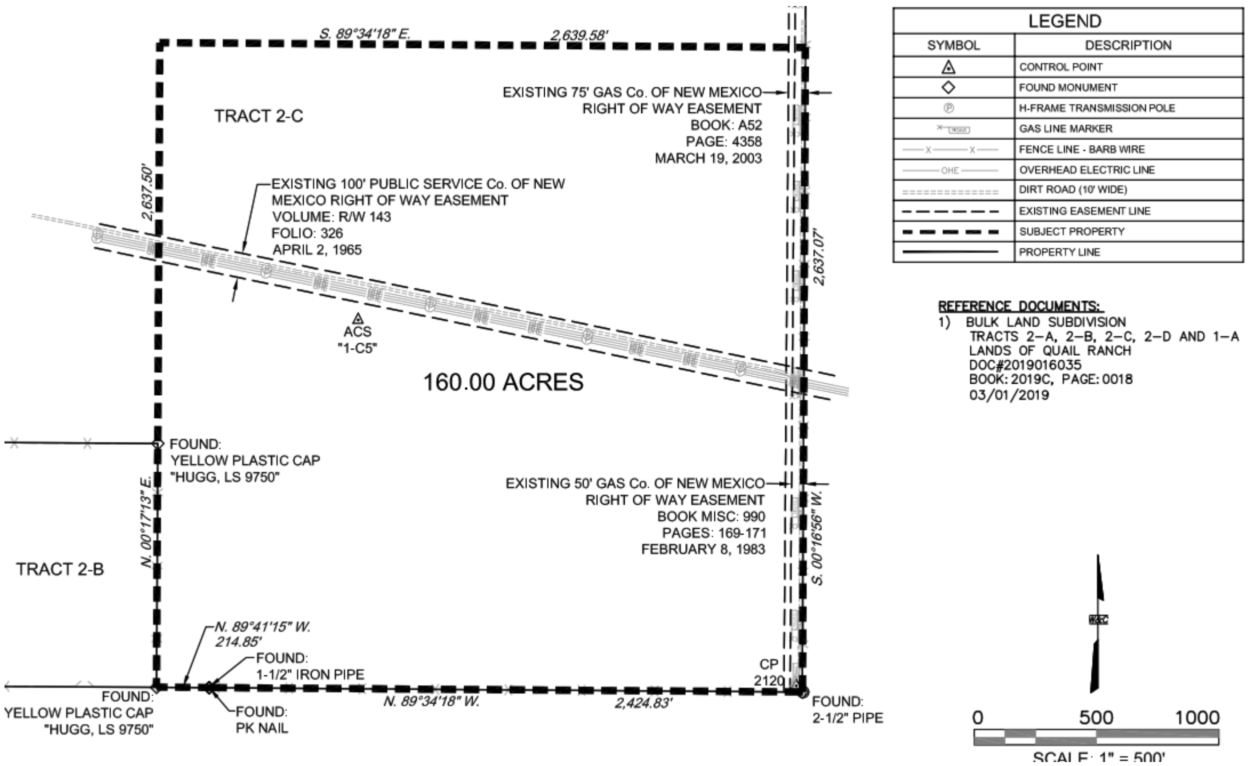

Figure 2. 160-acre site survey

The site offers good access to pipelines, roads, and power.

Pipelines: 16” & 24” Rio Puerco pipeline flows through the east boundary of the property.

Roads: The site offers close proximity to Interstate Highway I-40 and I-25 is approximately 0.5 miles to the paved Paseo Del Norte Blvd.

Power: The site offers good access to MV and HV transmission lines running through the site and along the southern boundary.

4.1.2 Santa Fe Junction: 90-acre parcel surrounding Espejo Compression station

NMGC has a compression station for the boosting transmission gas pressures and managing flow to a range of pipelines. The compression station is located at the center of a 90-acre land, which is solely owned by NMGC approximately 3.5 miles north of the 160-acre site. The site includes pipelines, compression station houses three reciprocating compressors, a control room, warehouse, site office and ancillary systems, security fencing, etc. This site is pictured in Figure 3 and drawn in Figure 4.

Figure 3. Espejo Compressor Station at Santa Fe Junction Site

LISBON GROUP

New Mexico GAS COMPANY

Doc #	N2101-TN-012 Rev. B
Name	Alternative Site Evaluation
Date	9/19/2022

Figure 4. Espejo Compressor Station and Santa Fe Junction Drawing

4.2 VAPOR DISPERSION

LNG facility design and siting requires consideration of a range of LNG releases and possible vapor cloud formation. These requirements are defined and incorporated into law within the U.S. by DOT 49 CFR 193 which incorporates by reference NFPA 59A 2001 and that address the requirements for secondary impoundment and other facility design criteria to help ensure that people and installations outside LNG facilities are not exposed to unacceptable possible risk caused by LNG spills and associated flammable vapor clouds. The mandated assessment includes:

- The definition of a range of design spills and credible release scenarios.
- Treatment of and requirements for secondary LNG impoundment, safety systems, and other features that determine the potential size of an LNG release.
- The accepted software that can be used to assess the vapor dispersion.

4.2.1 Vapor dispersion requirements

LNG vapor dispersion analysis is directed at identifying an exclusion zone based that is defined in Section 2.2.3.3 of NFPA-59A-2001 as follows:

> "The spacing of an LNG tank impoundment to the property line that can be built upon shall be such that, in the event of an LNG spill specified in 2.2.3.5 [of NFPA-59A-2001], an average concentration of methane in air of 50% of the lower flammability limit (LFL) does not extend beyond the property line that can be built upon."

The conditions for the assessment are rigorously defined by NFPA 59A, CFR 193, and an PHMSA supporting information to allow LNG facility dispersion analysis to comply with the siting intent of the regulators. The following is defined:

4.2.2 Results Interpretation and Mitigating Measures

Once preliminary vapor dispersion results are in for the required process conditions, there is an opportunity to decrease the required plot areas through the application of mitigating measures. Mitigating measures are analysis, layout, equipment selection, and design features that can be selected to decrease the property needed to comply with vapor dispersion requirements. The following are some typical mitigating measures that can be taken to allow decrease the property required for an LNG facility:

1. **More detailed analysis of vapor dispersion can be completed.** The Phast software used for site selection is a screening-level tool (e.g., conservative to support good decisions). More detailed computational models can be built if required. FLACS is a CFD model that can use Phast or other source term and model the presence of structures, directionality, and terrain to improve the level of detail of analysis and typically reduces required distances.
2. **Add passive measures to decrease dispersion-driven distances.** For instance, running LNG lines in trenches and installing spray and deflection shields around piping can decrease momentum-driven releases and associated required distances. Vapor fences can also be added in conjunction with CFD (FLACS) modelling.
3. **Reduce the size of releases.** The range of release sizes that need to be considered are a function of piping size and features. Problematic sections of piping can be planned as larger, more robust piping that is no longer considered a credible failure point or can be run as double pipe arrangements that can be treated preferentially.
4. **Change equipment, process selections or operating conditions.** The choice of storage tank type, liquefaction technology and other key decisions can impact dispersion distances. For instance, selection of dual N_2 expander refrigeration technology is favorable because the refrigerant releases are not flammable and therefore do not pose a dispersion hazard beyond property boundaries.

4.2.3 Screening Assessment Basis

Software: The site screening exercise was completed using DNV-GL's Process Hazard Analysis Software Tool (PHAST version 6.7), a vapor dispersion modelling software approved by DOT PHMSA for LNG facility analysis. PHAST's Unified Dispersion Model (UDM) is capable of modeling a range of features relevant to LNG facility assessment.

Design Spills (Single Accidental Leak Source or SALS): Design Spill analysis was completed in accordance with NFPA-59A-2001 Section 2.2.3.5 as incorporated by DOT 49 CFR 193.2059(c) by reference informed by guidance from DOT PHMSA[1].

- DOT 49 CFR 193.2059 requires: "The design spill shall be determined in accordance with section 2.2.3.5 of NFPA-59A-2001…"
- DOT 49 CFR 193.2059 requires: "Each LNG container and LNG transfer system must have a dispersion exclusion zone in accordance with sections 2.2.3.3 and 2.2.3.4 of NFPA-59A-2001"

A range of cases were taken from anticipated heat and material balance conditions for the site. The analysis cases are broken into two types:

1) Releases considering the relevant physical behavior of the release including spray, jetting, flashing of LNG releases. These were modelled using Phase pipe rupture and leak scenarios with various hole sizes depending on line size. As will be seen in the case map, a range of orientations, elevation and hole size was considered relevant to the facility design. These releases are intended to consider the momentum and flashing nature of LNG releases.
2) Releases conveyed to secondary impoundment. A second type of release considered are impoundment vaporization scenarios for impoundment areas that could be used to contain a 10-minute design spill. There are two different impoundment areas relevant. One that serves the truck load and LNG rundown LNG piping with a capacity of 12,000 gallons (the volume of one full LNG trailer) and one with a capacity of 45,600 gallons (associated with PHMSA SALS for vaporization piping).

Note that the sizing of the impoundment for the LNG storage tank SALS is taken as a 10-minute spill and is governed by the vaporization pump flow rates and pressures (e.g., sis not dependent on tank type or tank volume) in accordance with NFPA 59A-2001 Table 2.2.3.5.

Ambient Conditions for Modelling

Weather conditions are prescribed within DOT 49 CFR 193. 2059 have been applied to the vapor dispersion analysis and are presented below in Table 1.

Table 1: Vapor Dispersion Model Parameters Summary All Cases

Vapor Dispersion Weather Parameters			
Parameter	**Unit**	**Value**	**Requirement**
Average Gas Concentration in Air	%	2.5	DOT 49 CFR 193.2059(b)(1)

[1] See Part DS DOT PHMSA FAQs

Vapor Dispersion Weather Parameters			
Parameter	**Unit**	**Value**	**Requirement**
Atmospheric Stability (Pasquill Class)		F	DOT 49 CFR 193.2059(b)(2)
Wind Speed	mph	4.5	DOT 49 CFR 193.2059(b)(2)
Reference Height for wind speed	m	10	DOT 49 CFR 193.2059(b)(2)
Humidity	%	50	DOT 49 CFR 193.2059(b)(2)
Ambient Temperature (average ambient 2021 ASHRAE Handbook for Albuquerque)	°F	58.5	DOT 49 CFR 193.2059(b)(2)
Elevation for Contour (receptor) output	m	0.5	DOT 49 CFR 193.2059(b)(3)
Surface Roughness Factor	m	0.03	DOT 49 CFR 193.2059(b)(4)

5 VAPOR DISPERSION RESULTS

A range of over fifty screening cases were considered reflecting conditions likely to result in large dispersion distances generated from the SALS, process conditions, and line sizes relevant for the facility. The results were screened against a rough distance available at each site for dispersion based on Quail Ranch and Santa Fe Junction based on survey, satellite images and other available information. The distances available for dispersion are quite different between the two sites:

- For the roughly rectangular 160-acre site with cross with an E-W width of ~2425’ and a N-S length of ~2637’, allowing for adequate space for earthworks, tanks, equipment and piping and logical arrangement of the site.
- Evaluation of the available undeveloped property in the Santa Fe junction area showed that distances available for dispersion are considerably less and are reflected in the tables with the following color coding.

The distances considered in the screening exercise anticipate a reasonable layout and are seen below in Table 2.

Table 2. Site Screening Distance Criteria

Shading	Meaning	Greenfield 160-acre Site	Santa Fe Junction Site
YES	Generally acceptable and no additional mitigating measures expected.	< 800 ft.	<400 ft.
YES	Expected to be accommodated with care and limited mitigating measures.	800-900 ft.	400-500 ft.
NO	Expected to be accommodated with CFD analysis, careful layout and some mitigating measures.	900-1150 ft.	500-650 ft.
NO	Not recommended. May not be feasible or very expensive to accommodate.	> 1150 ft.	> 650 ft.

As described above, initial screening of release cases usually results in some scenarios that will need to be adjusted or mitigated as the design is refined and analysis re-worked in more detail on the selected site. The percentage of releases that need either attention or mitigation can work as a good site screening evaluation method. A smaller or unusually shaped site will typically have a higher percentage of scenarios that are expected to fall close to the property boundary and those that exceed the available dispersion distances and will require mitigation (at increased design effort and capital cost).

The screening results are summarized in Table 3 that compares to two site and shares a breakdown of:

- Percentage of Cases that resulted in dispersion zones close to the property boundary.
- Percentage of Cases that required additional analysis or some form of mitigating measure.
- Percentage of Cases that are expected to require significant, expensive or difficult to implement mitigating measures.

Qualitative screening success criteria are provided for each category and the table cells are shaded in the appropriate color. The cases that are difficult to mitigate (the bottom row) are the most important screening criteria and shading is completed manually rather than by percentage. It is possible that these make a site unacceptable because it is too small to accommodate the LNG facilities.

Table 3. LNG Rundown and Production SALS Cases

Description	Success Criteria	Quail Ranch	Santa Fe Junction
Total Number of Cases		**53**	**53**
Cases near property boundary / in need of attention	<33% Good (Green) 33%-67% Tolerable (Yellow) >67% Fail (Amber)	30%	57%
Cases in needing some type of additional analysis or mitigating measure	<20% Good (Green) 20%-50% Tolerable (Yellow) >50% Fail (Amber)	15%	36%
Cases requiring significant, expensive, or difficult to implement mitigating measures	Case-by-case assessment.	0%	13%

The results seen in Table 3 indicate that Quail Ranch is generally acceptable. No cases were identified that are expected to be very difficult or very expensive to implement. A number of release cases will require attention as this site layout is fully developed to keep the 50% LFL dispersion contour on the property boundary.

The Santa Fe Junction site had roughly twice as many releases requiring attention and requiring mitigation as the Quail Ranch site. It also had a number of release scenarios that could not be readily mitigated without excessive cost. This, coupled with a high number of the other cases in the “tolerable” range, is a good indication that site is too small for the planned LNG facility.

6 DISCUSSION AND RECOMMENDATIONS

The results show that the 160-acre greenfield Quail Ranch site is acceptable and expected to be able to accommodate the planned LNG facility. Sound layout development, design practices regarding piping selection and impoundment and sub-impoundment are expected to be required as more detailed dispersion and thermal radiation analysis is completed for this site in alignment with *49 CFR § 193.2057 and 193.2059, NFPA 59a and associated guidance.*

The Santa Fe Junction site struggled with approximately half of the scenarios considered for LNG production and vaporization operations. This is indicative that extensive mitigating measures would need to be applied for this site to make it acceptable such as vapor fences, extensive pipe-in-pipe piping of LNG rundown piping, non-optimized facility layout driven by vapor dispersion, and very deep secondary containment. Ultimately these mitigating measures would cost much more (over an order of magnitude more) than the alternative site property costs and is indicative that the site is too small for the LNG facility as planned.

The 160-acre Quail Ranch site is recommended.

THE LISBON GROUP, LLC

Pre-FEED Cost Estimates

NEW MEXICO GAS COMPANY

Project Name: Rio Puerco LNG Plant

Document Name:	PreFEED Cost Estimates
Document Number:	N2101-S-902
Revision:	B
Date:	07/14/2022

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Document Name:	PreFEED Cost Estimates		
Document Number:	N2101-S-902		
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Approved:	-	MAB	

Rev	Date	Description of Change
A	07/11/2022	Issued for Internal Review
B	07/14/2022	Issued for Client Comment
0		Issued for Final Submittal

Holds

No.	Description

TABLE OF CONTENTS

1 ABBREVIATIONS

AACE	American Association of Cost Estimators
AHJ	Authority Having Jurisdiction
BCF	Billion Cubic Feet
BOG	Boil-off Gas
BPCS	Basic Process Control System
CAPEX	Capital Expense
CB&I	Chicago Bridge & Iron
CFR	Code of Federal Regulations
CSU	Commissioning and Start-up
EPC	Engineering, Procurement and Construction
ESD	Emergency Shutdown
FGS	Fire & Gas System
FTE	Ful-time Equivalent
HT	High Temperature (expander)
IR	Infrared
kWh	Kilowatt-hour
LG	Lisbon Group
LNG	Liquefied Natural Gas
LT	Low Temperature (expander)
MCC	Motor Control System
MCR	Main Control Room
MMscfd	Million Standard Cubic Feet per Day
MS	Mole Sieve
Mscfd	Thousand Standard Cubic Feet per Day
MW	Megawatt
NMGC	New Mexico Gas Company
N2	Nitrogen
OPEX	Operating Expenditure
PFD	Process Flow Diagram
PSA	Pressure Swing Adsorption
QA/QC	Quality Assurance / Quality Control
scfm	Standard Cubic Feet per Min
SIS	Safety Instrumented System
STV	Shell & Tube Vaporizer
UPS	Uninterruptible Power Supply
VFD	Variable Frequency Drive

2 PURPOSE

This document describes the cost estimating basis for the planned Rio Puerco LNG peak shaving facility for NMGC in Rio Rancho, New Mexico. It includes sections for both the Capital Expenditure (CAPEX) and Operating Expenditure (OPEX) estimating relevant for the AACE Class 4 preFEED estimate.

3 INTRODUCTION

Lisbon Group (LG) is completing a preFEED evaluation of an planned LNG facility in Rio Rancho New Mexico for New Mexico Gas Company (NMGC), a member of the Emera family of energy companies. NMGC is headquartered in Albuquerque and is the largest natural gas utility in New Mexico. NMGC operates and maintains over 12,000 miles of natural gas distribution and transmission pipelines and serves approximately 530,000 customers throughout the state and is looking into an LNG peak shaving facility as an alternative to their currently contracted underground gas storage capacity of 2.7 BCF in West Texas (leased capacity from Kinder Morgan). This underground storage capacity is off network for NMGC making it relatively expensive and historically unreliable resulting in, or contributing to, some network outage and expensive spot market gas purchases in recent years.

A range of decision-making study work was completed during Q1/Q2 in 2022 to arrive at a preferred configuration and location for the LNG facility. The plan is for the facility to improve gas reliability / cost-effectiveness with installation of an LNG peak shaving facility to the west of Albuquerque with the following capabilities:

- Located on the 160 Acre Rio Rancho site next to an existing solar generation facility and to the west of Paseo del Norte to the west of Albuquerque.
- Receives and sends-out gas from either of the existing 16” or 24” transmission lines running along the east side of the plot.
- Liquefy 10 MMscfd net gas using either a N2 expander or single mixed refrigerant liquefaction process following clean-up / pretreatment using molecular sieve beds to remove water and carbon dioxide.
- Store 1 BCF net (~12 million gallons of LNG) of natural gas in a single containment LNG storage tank with a maximum height of 100 ft.
- Send-out 130 MMscfd of gas using 3 x 50% shell and tube vaporizers (STV) coupled with 3 x 50% water-glycol heaters and 3 x 50% LNG send-out pumps. Although spared send-out capacity is 130 MMscfd, the send-out system will be designed to send-out the 195 MMscfd (all 3 vaporization trains operating and no spare capability). A sensitivity at higher capacity send-out is also presented in these estimates.
- Utilities and ancillary systems to manage boil-off gas, support safe, secure, and reliable plant operations, retain send-out capabilities through power outage, and other facility functions are also included the facility design.

A model of the Rio Puerco facility is seen below in Figure 1 showing the vaporizer building the foreground and the LNG storage tanks and truck loading in the background.

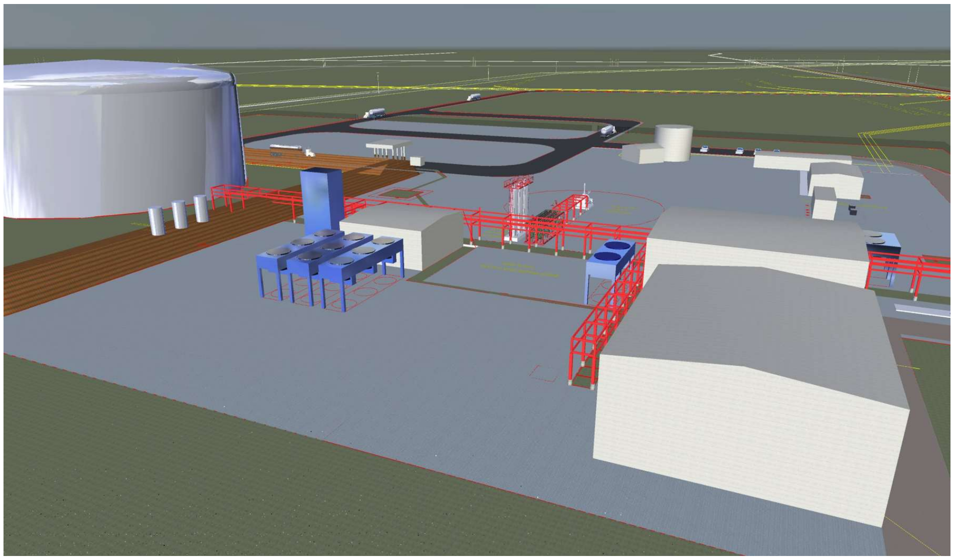

Figure 1. Rio Puerco LNG Facilities

For the purposes of the estimate:

- **Case 1** refers to the functional requirements described above with 3 x 50% vaporization capacity achieving 130 MMscfd (and 195 MMscfd send-out capacity installed).
- **Case 2** refers to the functional requirements described above with 3 x 50% vaporization capacity achieving 190 MMscfd (and 285 MMscfd send-out capacity installed).

During the first half of 2022 a datasheet-based enquiries were submitted to suppliers for a range of equipment and subsystems to allow key decision making and develop and understanding of the facility capital and operating costs shared in this document. This included the LNG storage tank, the liquefaction process, assessment of the pretreatment arrangement, LNG pumps, LNG vaporization type, BOG compressor and send-out destination, and other factors. These vendor and supplier responses are reflected in the estimates discussed in this document and reflected in the CAPEX.

This document describes the basis for the AACE Class IV cost estimate for Send-out of 130 MMscfd natural gas to the transmission pipeline(s) when required.

OPEX of a Peak Shaving facility is normally dominated by labor costs, electrical power costs, and annual maintenance and materials costs over the major maintenance cycle for the facility. These will be calculated, along with fuel gas, for decision making purposes. Other contributors to OPEX include water supply, telephone, data service, garbage service, etc. which are very small compared to the major contributors mentioned above. OPEX estimates intended for comparative purpose for making decisions regarding LNG storage tank capacity and facility functionality.

4 CAPEX ESTIMATING BASIS

4.1 ESTIMATING METHODOLOGY

The CAPEX estimate was developing using a blend of equipment factoring and parametric estimating models coupled with semi-detailed unit costs with assembly (equipment and component) level line items depending on the importance of the estimate component and uncertainty. Most of the large facility subsystems and components were costed from very similar projects completed by LG within the past 24 months or are based on qualified vendor response.

The LG estimate is broken into three primary sections:

- *Plant & Facility Subtotal* that is build-up with the equipment line items, units operations, and special site improvements within the LNG facility.
- *Consumables and Spare Parts* that includes all the first fill of catalyst and chemicals, commissioning oils and fluids, commissioning spares, capital spares, spare parts for the first 24 months of operations.
- *Services and Third-Party Contracts* include large line-items that can be procured through single contracts (like the LNG storage tank), transport costs, and commissioning & start-up costs (CSU).

Paramount to the uncertainly in LG estimate is the quality of information entered in the *Plant & Facility Subtotal*. This is because on most projects these some subsequent costs related to services and spare parts are factored off this Plant & Facility costs and also because this is normally the largest single bucket in the cost estimate.

The *Plant & Facility Subtotal* is a build-up of:

- Process Systems – this is the largest single components and includes liquefaction, pretreatment, BOG compression, etc.
- Utility Systems – this includes all the utility systems such as emergency power, air, nitrogen, electrical distribution, and firewater.
- On Plot Piping, Electrical Interconnects, and Additional BOP Systems includes the buried pipelines, the MCC and power distribution, Transformers, FGS, ESD SIS and BPCS.
- Site Improvements includes costs for the special foundations (like the LNG storage tank), roads, fencing, buildings, etc.

For the NMGC PreFEED approximately 80% of the Process Systems and Utility Systems costs reflected study specific costs or very similar facility costs less than 24 months old in our LG cost database. This is considered to have a positive effect on CAPEX uncertainty and is beyond what is typically required for AACE Class 4.

Examples of the equipment cost applied in CAPEX estimate are as follows:

- **LNG Storage Tank** – project specific costs from CB&I, Matrix, and Cashman with Datasheet and Geotech. Contractor cost applied: $53.5 million (exclusive of in-tank pumps and site prep and structural fill). Largest single item.
- **Liquefaction Process** – project specific cost from Chart and Cosmodyne. Cosmodyne 10 MMscfd liquefaction process selected $9.8 million modules only, $21 million installed with interconnecting piping. Second largest single item.
- **Shell & Tube Vaporizers** – project specific costs from Chart, Nikisso (Cryoquip), and Chicago Boiler. Third largest cost $6.2 million installed Plant & Facilities Subtotal Cost.
- **In-tank LNG pumps** – project specific costs.
- **Air Compressors and N2 Generators -** Project specific costs.
- **BOG Compression –** Project specific costs.
- **Mole Sieve Pretreatment** – Detailed design project. 12.3 MMscfd 2021.
- **Vaporizer Water-Glycol Heaters** – Similar capacity, FEED project 2019 costs.
- **Firewater Pump House** – Similar capacity FEED equipment costs, 2020.

Much of the development of the process and utility installed costs, other site costs not included in the build-up are captured. The on-plot piping is build-up based on either similar project estimates or in-mile estimates depending on the first. For the relatively short interconnecting pipes, in-mile was applied for the Rio Puerco CAPEX. Electrical Interconnects, and Additional BOP Systems includes the buried pipelines, the MCC and power distribution, Transformers, FGS, ESD SIS and BPCS were estimated based on project experience and engineering judgement.

Site improvements including the special foundations (like the LNG storage tank), roads, fencing, buildings, etc. were bult-up by referenced unit costs and quantity estimates.

Following the Plant & Facilities Subtotal build-up, *Consumables and Spare Parts* are estimated. For Rio Puerco this included the first fill of the mol sieve catalyst, glycol, compressor oils, turbo expander oils, spare center sections for the HT and LT expanders along with an allowance of 2% of the direct *Plant & Facilities Subtotal* for commissioning spares and spare parts for the first 24 months of operations.

Services and Third-Party Contracts for Rio Puerco includes the following large line-items:

- LNG Storage Tank: $53.5 million (based on CB&I estimate)
- Power Substation: $2.025 million (estimate, utility executed / NMGC owned)

Additional costs include FEED and detailed engineering, transportation costs, Commissioning and Start-up costs, and LNG Storage Tank Commissioning & Start-up Costs.

These three sections of the cost estimate are summed to arrive at a Plant Subtotal that can have Owner's Costs and Contingency applied to arrive at the estimated facility costs.

4.2 ESTIMATE CLASS AND ACCURACY

The estimate provided is intended to meet the requirements of AACE Class 4 and has applied extensive base equipment and package costs based on recent study specific vendor responses as well as recent projects with similar features at other peak shaving facilities. As such the project level of definition, understanding of the project, and associated cost components is well advanced for AACE Class 4 (e.g., total preparation effort is greater than the standard AACE range) and approaches AACE Class 3 in many areas. Table 1 provides a summary of the AACE estimate classification along with the LG's targeted estimating uncertainty with Class 4 highlighted green.

Due to the level of definition and familiar subject matter for the estimator, the Accuracy Range is placed close to low end for AACE Class 4 and within typical AACE Class 3 range.

Estimate Class: **AACE Class 4**

Accuracy Range: **-20% / +25%.**

Commensurate with the level of detail and accuracy range, the estimate for Rio Puerco LNG used techniques typically applicable to both Class 3 and Class 4 estimates. Class 4 estimating methodology typically relies heavily on equipment factoring and / or parametric estimating models based on previous project. As a CAPEX estimate transitions to Class 3 level of accuracy, it increasingly relies on semi-detailed unit costs with assembly (equipment and component) level line items. LG used cost our cost database, study specific enquiry responses, and recent projects completed through detailed design and FEED including those related to STV vaporization, BOG compression, and MS-only pretreatment completed within the past two years.

With respect to liquefaction, LG applied cost from two leading suppliers (Chart and Cosmodyne) of 10 MMscfd N2 liquefaction processes and applied installation costs and other lessons learned from a recent 8.3 MMscfd liquefier relocation and installation in West Texas to arrive at reasonable direct package costs, piping costs, and installation factors.

Table 1. AACE Class Estimating Table

	Primary Characteristic	***Secondary Characteristic***		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a]
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

5 ESTIMATE ASSUMPTIONS

5.1 SITE DESCRIPTION

NMGC has identified a 160-acre parcel for the LNG plant and performed a preliminary site assessment. The property is situated west of Albuquerque, New Mexico, approximately two miles north of the Double Eagle II Airport in Bernalillo County. The property is undeveloped and is part of a larger master-planned area that is zoned for industrial and commercial uses (approximate site coordinates: 35°10'59.16"N, 106°47'50.95"W) and is seen in Figure 2.

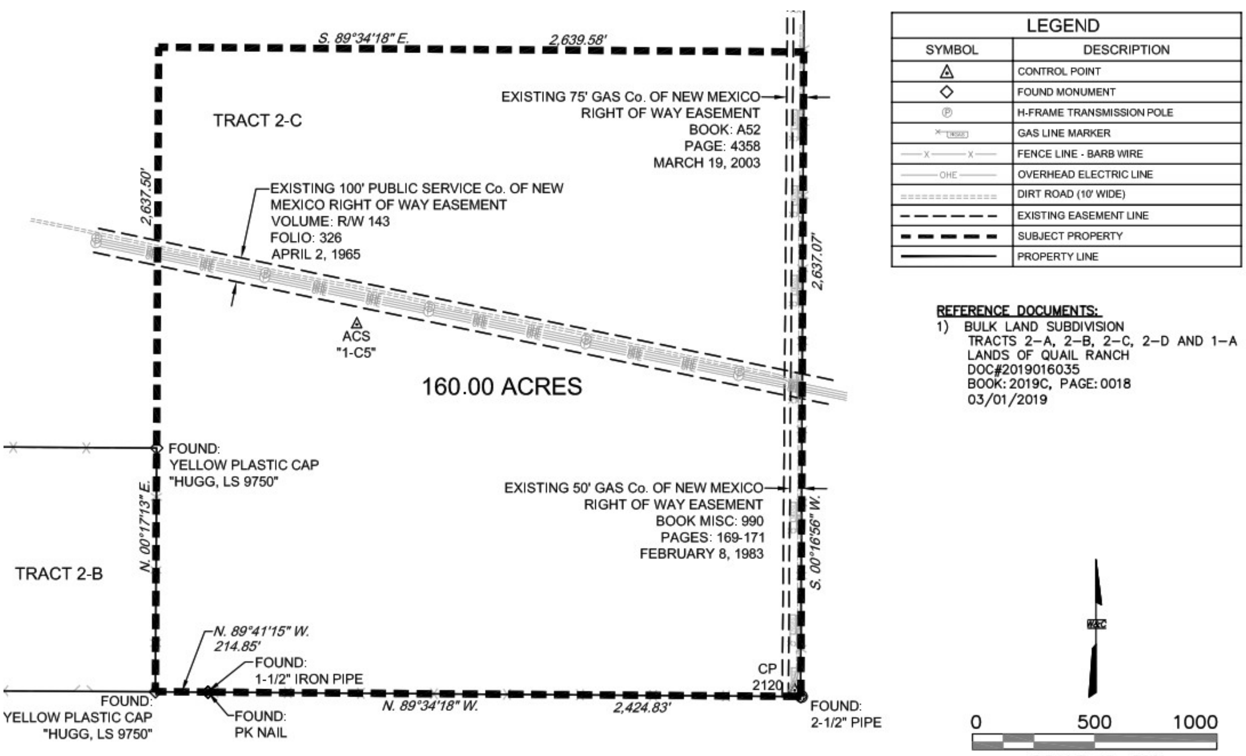

Figure 2. 160 Acre Rio Puerco Site

The CAPEX estimates reflect a qualitative assessment of the site based on a visit in Q1 2022, parcel documentation, a geotech study was carried out in 2012 for LNG Tank Installation by Western Technologies Inc., and reasonably assumptions regarding adjacent roads, infrastructure, etc.

The CAPEX estimate includes a land acquisition cost exclusive of fees, taxes, and associated owner’s costs.

5.1.1 Gas Pipeline access for site

Feed gas will be from the existing 16" & 24" Rio Puerco pipelines which run along the 50' easement on the east the property. Buried pipelines convey feed gas, send-out gas, and distribution gas between the existing pipeline along the site's eastern boundary to the LNG facility. The CAPEX estimate includes:

- Tie-ins to both pipelines within the property.
- Manual isolation valve and metering stations for each of the pipelines in a fenced area adjacent to the pipeline tie-in point.
- Approximately 1,200' of on-property buried steel piping to the fences LNG facility for the high-pressure feed gas line, high pressure tail gas line, and low pressure compressed boil-off gas (BOG) line that flows to distribution.
- Emergency shutdown valve, operational gas metering, and gas analysis within the LNG facility for each of the lines.
- Odorization for the send-out line and the compressed BOG line.
- can be accomplished easily, the valve station is located within quarter mile from the site fence. The vaporized gas will be injected into the Rio Puerco pipeline and distributed via the NMGC transmission system to Albuquerque, Santa Fe, and northern New Mexico.

The CAPEX estimate excludes the cost of the off-plot distribution gas pipeline. We estimate this is a 6" buried carbon steel pipeline with a MAOP of 150 psig.

5.1.2 Roads to the plot

The CAPEX estimate includes a cost allowance for a 23 ft wide asphalt road with 3 ft of prepared gravel on both shoulders between the 160-acre plot bottom SE corn and Paseo del Norte to provide paved access to the site. This is installed after construction when heavy traffic will damage it and provides the required the permanent, all-weather accessible road access to the site. On-plot roads are described below.

The CAPEX estimate also reflects gravel road upgrades on the plot, along the pipe ROW on the eastern property boundary and to Paseo del Norte from the NE corner of the plot.

5.1.3 Fencing

A light duty fence will be installed around the entire perimeter of the 160-acre plot. This will keep out livestock and post private property boundary notices but will not include security and intrusion detection functions required for the inner security fence around the plant. The 160-acre site will have a manual gate that can be closed at the SE main entrance to the facility on the asphalt road and NE gravity road. Security fencing around the facility is described in section 0.

5.1.4 Power Connection

There are multiple options for power connection to the facility with HV transmission lines running across the plot and MV lines running along the southern plot boundary. There is a $2.025 million line item in the CAPEX estimate to allow for the power company to install a NMGC-owner substation just inside the plot along the southern property boundary. On-plot power routing and distribution from the substation is described below.

5.1.5 Other interfaces

Other interfaces are currently excluded from the CAPEX estimate including:

1) Municipal water. An allowance for a well, treatment and on-site storage for water is included in the utility estimates. Potable water is assumed to be delivered to the site.
2) Communications. This cost is expected to be negligible relative to the CAPEX estimate and has been neglected in preFEED.
3) Sewage arrangements have not been confirmed and no allowance for septic system or sewage lines are reflected in the estimate.

5.2 PROCESS DESCRIPTION (CASE 1)

The gas processing systems are described / drawn in several other deliverables and the details are beyond the scope of the estimating documentation. The following section only addressed anticipated questions regarding what is reflected in the estimates.

The estimates are intended to include everything required to design, procure, construct, commission, and start-up an LNG facility with the following functional requirements:

- Receive the feed gas, remove any suspended liquids / solids, and then remove the water, carbon dioxide, and odorant from the gas so it can be liquefied using a three-bed molecular sieve pretreatment system. The beds are periodically heated using a direct-fired heater to be regenerated with a slipstream of gas that then must be returned through the send-out line. During liquefaction:
    - Roughly 4 MMscfd of “spent” regeneration gas leaves the facility though the send-out line that must be blended at Santa Fe Junction because it may be off-spec with the CO_2 that the pretreatment system is removing from the gas going to liquefaction.
    - The regen gas is also at a slightly lower pressure than the feed gas line (roughly 30-50 psig) to avoid a regen gas compressor.
- The CAPEX and OPEX estimates reflect liquefaction of 10 MMscfd of gas using a N2 expander liquefaction process. LG has recommended that the liquefaction system be left open for FEED, but both technology suppliers recommended N2 expander for 10 MMscfd liquefaction. The CAPEX estimate for the plant includes refrigerant generation, recovery, and compression. The OPEX also reflects N2 refrigerant liquefaction cycle power consumption.
- The estimates reflect a 1 BCF net (~12 million gallons) single containment LNG storage tank with a maximum height of 100 ft. The storage tank includes three 24” pump wells for the in-tank pumps, plus a fourth spare 24” pump well so a future pump may be installed without taking the storage tank out of service should it be needed. The storage tank and associated foundation costs for the LNG storage tank reflect the larger footprint of a maximum 100’ tall tanks.

- Send-out 130 MMscfd of gas using 3 x 50% shell and tube vaporizers (STV) coupled with 3 x 50% water-glycol heaters and 3 x 50% LNG send-out pumps. Although spared send-out capacity is 130 MMscfd, the send-out system will be designed to send-out the 195 MMscfd (all 3 vaporization trains operating and no spare capability). A sensitivity at higher capacity send-out is also presented in these estimates.
- BOG results from heat leak into the LNG storage tank as well as operational mode, barometric pressure, and other physical processes and must be recovered. The estimates reflect heating the cold BOG with a glycol pre-heater prior to compression in 2 x 100% screw or reciprocating compressors to a pressure of approximately 120 psig for send-out through a line to distribution. This line is odorized prior to leaving the plot.
- The facility includes the ability to load or unload LNG trailers to allow timely commissioning of the storage tank during initial cooldown and loading trailers for pipeline maintenance / inspection / outage management. Truck loading is expected to be rare, and a single bay is provided along with a scale for gravimetric loading.

The model of the mole sieve beds for pretreatment is seen below in Figure 3.

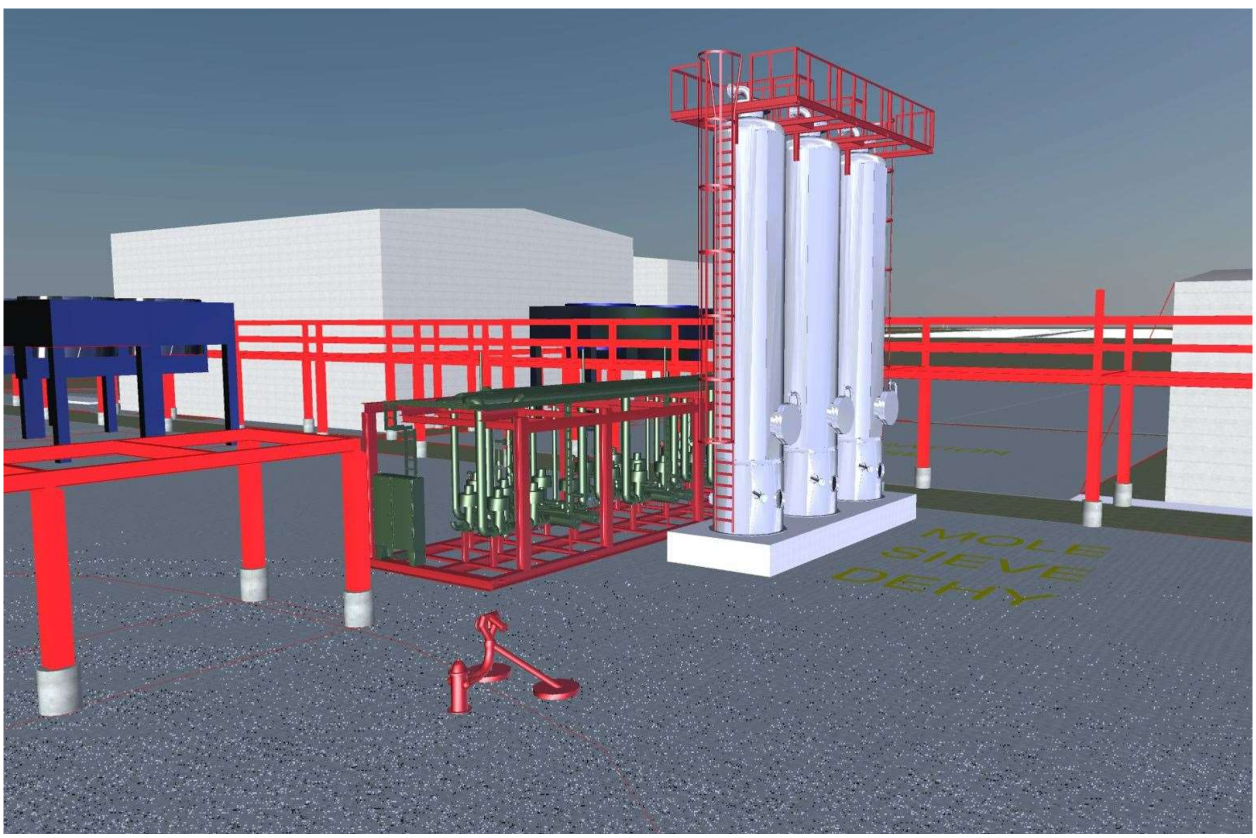

Figure 3. Mole Sieve Pretreatment Towers and Valve Skid

5.3 UTILITY DESCRIPTIONS

The facility utilities are described in the Basis of Design, UFDs, and several other study deliverables only a brief description will be included. The estimates reflect the following systems:

- Fire water system complete with a firewater water pump house, pressurized ring main, and various monitors, and hydrants. This system is assumed to be fed by an on-site well, but a connection to municipal water is also possible.
- An instrument air package consisting of Screw Compressors (2 x 100%), Drier to meet the dew point temperature of -40 F and Instrument Air receiver (15 mins hold up) will be provided. The nominal supply pressure of 120 psig and a minimum pressure of 80 psig will be considered.
- N2 generation by means of an air compressor, carbon bed and PSA dry N2 generator capable of achieving 99.9% N2. The CAPEX does not include LN2 storage or ambient vaporizer to supply nitrogen for purging the plant equipment, piping and the cold box as back-up.
- The fuel gas will be sourced from the feed gas line. A let down pressure control valve will be used to maintain the fuel gas header pressure requirement. The nominal supply pressure of 55 psig and a minimum pressure of 40 psig will be considered.
- The estimates include the transformers and MCC on-site to take MV power from the substation, stepdown and distribute to electrical consumers. 4160 VAC 3-phase 60 HZ power is used for the refrigerant compressor only. Most other motors and consumers within the process facilities use 480 V 3-phase 60 HZ power.
- All required emergency power generation, control system UPS, and other emergency power is included to comply with the statutory LNG facility requirements and be able to operate continuously in HOLDING or VAPORIZATION mode during black-out / power grid outage conditions.

Excluded from the utilities are:

1) Connection to municipal water supply as described above.
2) Connection to municipal sewage as described above.
3) A common vent or flare system. Selection of mole sieve pretreatment coupled with N2 expander liquefaction and spare capacity in the BOG compressor system means that the facility does not vent any hydrocarbons during normal plant operations (including start-up, shutdown, turndown operations for LIQUEFACTION mode, VAPORIZATION mode, and STAND-BY mode. Relevant pressure relief valves will be vented to safe location.

5.4 CIVILS, SITE IMPROVEMENTS AND SECURITY

The facility is intended to include all the buildings, lights, fencing, security measures, control systems, roads, etc. required for reliably and secure operation of the LNG facility.

5.4.1 Earthworks, foundations, and impoundment areas

The CAPEX estimate includes the earthworks, foundations and impoundment areas required for the facility. Significant features include:

1. The LNG storage tank as a large (210' diameter) and requirements for 110% tank volume in secondary impoundment consisting of dirt / earthworks berm. The storage tank foundation, foundation insulation and heating system costs are included in the tank costs from the manufactures (CB&I, Matrix, and Cashman) based on the supplied Geotech report. The site earthworks and tank foundation prep and structural fill are separately estimated.
2. Within the LNG impoundment area there is a requirement to manage storm water / surface water with deeper a concrete sub-impoundment area that decreases vapor cloud size associated with accidental spills from the vaporization or tank areas. This is sized for a 10-minute design (prescribed in 49 CFR193 documentation) spill and includes a sump pump with shut-off if cold or gas is detected.
3. There is an LNG impoundment area that captures the LNG rundown line to storage, coldbox, and LNG truck load. This is similarly arranged (although smaller) to the sub-impoundment in the LNG storage tank area. It is intended to capture liquids for accidental liquid releases associated with a 40 CFR 193 prescribed design spill.
4. All foundations are included. All in foundations for this site are on the order of $10-12 million for equipment, buildings, pipe racks, firewater tank, LNG storage tank, secondary impoundment, etc. The majority of these are reflected in equipment cost bulk factoring with large or stand-alone ones captured as line-items.

Site work also includes asphalt and gravel roads on the site, a parking area for 22 vehicles in front of the MCR / admin building, an asphalt LNG trailer pull-through area, concrete walk-ways through the facility and other features typically associated with an LNG or gas processing facility.

The area within the secure fenced LNG plant area sis scrubbed, graded and back-filled with a stone-base finish.

5.4.2 Facility Security Fencing

A high security fencing is supplied around the LNG facility. Access inside the fencing is via the automated vehicle gate at the main facility entrance with card pad for NMGC personnel access along with intercom and camera. Gravel roads leaving the site shall be equipped with manually chain pad-locked gates. Personnel may leave the site through exit push bar doorways strategically located around the security fence perimeter.

5.4.3 Buildings

The following buildings are reflected in the CAPEX estimate:

- Main Control and Administration Building
- Warehouse
- Fire water pump house

- Compressor House for the BOG compressors.
- Refrigeration House that includes N2 refrigerant compressor, N2 recovery compression, VFD and associated equipment for the refrigeration system.
- Utility House housing the water-glycol heaters, air and N2 utilities.

5.4.4 Security

The fencing includes a number of security features in the estimates including:

- Video monitoring of the entire fence line, each entrance, and other strategic locations.
- IR security monitoring and intrusion detection.
- Continuity monitoring.

5.5 HIGH VAPORIZATION CASE (CASE 2)

This case is identical to Case 1 except that the LNG pump, STV vaporizers, and 3 x 50% trains of glycol heating and circulation are larger to allow for fully spared send-out of 190 MMscfd of gas. This case also includes an increase in send-out gas pipeline capacity so, provided all the equipment is available (e.g., no equipment outage for maintenance / repair and grid power available) this case could send-out approximately 285 MMscfd.

5.6 CURRENCY, ESCALATION AND COST DATABASE CORRECTIONS

The following is relevant for the CAPEX estimates:

- The CAPEX estimate is completed in end Q2 2022 United States dollars. No future escalation is applied.
- Costs taken from LG cost database may be historic or may not match the Rio Puerco capacity well. The is addressed by escalating costs to Q2 2022 using a 6% rate from the purchase or quote date.

5.7 EXECUTION STRATEGY

Execution strategy and contractor selection has a significant impact on CAPEX estimating. The CAPEX estimate reflects the following:

- NMGC Owner's Engineering Team well qualified with LNG.
- Let EPC to strong contractor with good infrastructure experience and capability in the region without specializing in LNG:
    - Direct procurement and novation of LNG send-out pumps to EPC.
    - Direct procurement and novation of LNG storage tank contract to EPC.

This approach is expected to assist with cost-control because most of the larger LNG-focused EPC have high cost-base and strong backlog / order books. Engagement of the EPC with the strategy and buy-in to the novated tank and pump contracts commercial terms / risks and responsibilities are an important to the strategies success.

Alternative contracting strategies may be development through workshops / discussion with NMGC and engagement with contractors that will are expected to achieve similar CAPEX such as:

- Split contracts for LNG Tank and rest of facility with both contracts held by NMGC.
- Structure / positioning the FEED to support the execution / contracting strategy above but leave single contract EPC open as an option. This may stimulate one of the LNG-focused EPCs for more competitive pricing.

For clarity the CAPEX estimate does not reflect letting a single contract to an LNG-focused EPC without some effort to split the two largest contracts to stimulate competition. This is because there are only a couple LNG-focused EPC and the backlog of each is well understood by their competition.

5.8 OWNER'S COSTS

Owner's costs expected to be capitalized by NMGC are included in the CAPEX estimate. These are highly operator specific and are highlighted as a line item for the site acquisition costs and a percentage for other Owner's Costs that is applied to the Plant Subtotal (including all directs and indirects associated with the procurement, construction, commissioning and start-up of the facility.

Site Acquisition Owner's Costs: $2 million

Owner's Cost (deterministic): 8% of Plant Subtotal (exclusive of site acqui. costs).

Capitalized Owner's Costs are an area of the estimate where LG see's underestimation. Including site costs, estimated Owner's costs are ~9.5% that is considered reasonable for a lean operator / smaller organization executing a peak shaver or small-scale LNG facility.

Owner's costs are intended to reflect a number of aspects of the project carried by NMGC including:

- 49 CFR 193 compliance operating program development for Operations, Maintenance and Security.
- Owner's team costs, Project Management Team, and additional studies prior to FEED.
- Permitting and compliance costs including demonstration of compliance with NFPA 59A, 49 CFR 193, witness testimony, legal fees, etc.
- Limited NMGC back-office and management support, documentation review, technical authority support, procurement, etc.
- Insurance, special licenses, etc.

Owner's costs may currently be underestimating the following costs depending on NMGC strategy / expectations:

- **Capitalized OPEX.** NMGC may choose to mobilize an operating team to the LNG facility during commissioning because it is an excellent time to lean about the installation while control panels, compressor, the LNG storage tank, etc. are still opened-up and undergoing installation, final checks, etc. It is an excellent time to educate the operations team, but this comes with a significant labor cost for 6-9 months. Currently Owner's costs reflect ~3 FTE for a Plant Manager, Maintenance Supervisor, and lead E&IC Tech.
- **3rd Party Certification or Due Diligence.** The Owner's cost reflects a nominal value for 3rd party certification and due diligence consistent with a lean operator's approach. If the AHJ or NMGC management is expected to install an additional layer of QA/QC and facility certification Owner's Costs should be increased by ~$0.5-3.0 million.

- **Parent Company Overheads.** Owners non-time writing personnel, senior management, legal, commercial etc. cost may be underestimated within the Owner's Cost bucket depending on NMGC processes.
- **Project Financing.** Project Financing costs are neglected from the estimate.

5.9 CONTINGENCY

CAPEX Estimating Contingency is amount of money included in an estimate to allow for:

- Incomplete project definition at the time of the estimate.
- Uncertain elements, such as commodity cost volatility.

Contingency an integral part of the project CAPEX and is applied to bring the capital cost estimate up to the required accuracy. For all estimates, the level of contingency is assessed based upon the level of definition or detail available, market and historical data, contracting strategy, and the apportionment of risk and local knowledge. The level of contingency reduces as project definition improves.

Contingency will either be estimated by applying a percentage factor to the sum of the total direct and indirect cost, or by adding an agreed lump sum. LG applies contingency as a percentage applied to the estimated Plant Subtotal that consist of summary of all directs and indirects (that we refer to as the sum of Plant & Facilities Subtotal, Consumables & Spare Parts Subtotal, and Services and 3rd Party Contracts Subtotal).

Within our estimating methodology, contingency typically transitions from deterministic contingency to probabilistic contingency between AACE Class 4 and AACE Class 3 estimate when a meaningful breakdown in risk and uncertainly components can be applied. For AACE Class 4 estimates with well-defined project scope LG contingency range is 14-20%. In advance of client agreement on contingency methodology and risk factors the estimate reflects deterministic contingency of:

- 20% for all project scope except the LNG storage tank.
- 14% for the LNG storage tank contract value.

20% contingency is LG's standard preFEED contingency for gas and LNG plants undertaking minimal novelty / risk. This is applied at this project phase for greenfield small-scale LNG facilities and peak shaving plants even though the technology risk is minimal and scope well defined. When probabilistically built-up contingency is applied, a modest reduction in contingency may be possible due to well defined project scope, but limited specialist contractors and dependency on high nickel steels, and regulatory / project opposition make it difficult to justify much tighter ranges.

The LNG storage tank contingency of 14% was applied because the costs was supplied with Geotech data as a single line item with the middle-cost storage tank progressed in the CAPEX estimate (CB&I). Additionally, the two leading suppliers are currently building / recently built four virtually identical tanks storage tanks (2 x 1 BCF storage tanks for CB&I and 1.2 BCF and a 1 BCF storage tank for Matrix).

The CAPEX spreadsheet facilitates adjustment of continency through the highlighted cell in the CAPEX spreadsheet.

Contingency is not intended to cover disasters or events such as major scope changes, wars, pandemics, unusual economic situations, extreme weather conditions, force majeure, strikes, etc.

5.10 EXCLUSIONS

Explicitly stating exclusions is important to ensure cost items do not inadvertently fall between interfaces. The following list of exclusions are relevant for the facility:

- Off plot piping, including the piping for the compressor BOG to distribution are excluded.
- Sewage and municipal water connections are excluded.
- Communications, telephone, and internet connections are excluded.
- Any required off-plot lighting or improvements beyond the asphalt road to Paseo del Norte are excluded. Any required turning upgrades and traffic control on Paseo del Norte are also excluded.
- Removal of unforeseen / un-identified unground obstructions have not been accounted for. A full survey of the site was not available and Geotech report was not sufficiently comprehensive to ensure subsurface obstructions.
- Royalties or process guarantees are excluded unless stated otherwise.
- Statutory Authority and Utility company costs and permits are excluded.
- Permits and licenses, including environmental licenses are not explicitly included.
- Purchase of utilities and feedstock during commissioning.
- Forward escalation.
- Taxes and duties (except for those specially called out). Excludes 5.125% NM state sales tax and 2.56% Rio Rancho sales tax. Sales tax and other local taxes to be determined / applied by NMGC or further discussed.

6 CAPEX RESULTS

The CAPEX estimates expressed in Q2 2022 US$ thousands is seen in Table 2. The estimate shows the Case 1 (Base Case) estimate for the facility is just under $180.9 million. The additional costs associated with 195 MMscfd send-out capacity (with full sparing) is approximately $8 million with a CAPEX estimate of $188.4 million.

Table 2. Rio Puerco AACE Class 4 CAPEX Estimates

		Case 1		Case 2
Interconnecting Pipelines and Reception		$ 1,751		$ 2,017
Liquefaction Subtotal		$ 26,388		$ 26,388
Vaporization		$ 13,252		$ 17,248
BOG Compression and Storage Tank Support		$ 10,491		$ 11,405
Facilities, Buildings, and Utilities		$ 19,358		$ 19,023
Plant & Facilities Subtotal		**$ 71,239**		**$ 76,081**
Consumables and Spares		$ 1,888		$ 1,956
Services		$ 15,673		$ 16,597
LNG Storage Tank Contract		$ 53,500		$ 53,500
Plant Subtotal		**$ 142,300**		**$ 148,134**
Site Acquistion		$ 2,000		$ 2,000
Owner's Costs	8%	$ 11,384		$ 11,851
LNG Tank Contingency	14%	$ 7,490		$ 7,490
Other Continency	20%	$ 17,760		$ 18,927
Total CAPEX ($ thou.)		**$ 180,935**		**$ 188,401**

The Case 1 (Base Case) estimate range is $144.7 - $226.2 million based on the accuracy range of -20% / +25% costing estimate. This result is seen in Table 3.

Table 3. CAPEX Range Given -20% / + 25% Estimate

CAPEX Range ($ thou.)	Case 1	Case 2
Expected CAPEX ($ thou.)	**$ 180,935**	**$ 188,401**
Min CAPEX (-20%)	**$ 144,748**	**$ 150,721**
Max CAPEX CAPEX (+25%)	**$ 226,168**	**$ 235,502**

6.1 CAPEX BENCHMARKING

The facility costs were benchmarked against similar known facilities to gain confidence in the bottom-line number. Each facility is a little unique and different, but benchmarking is a valuable method to validate results and sense check estimates. Benchmarking from five relevant projects with simple containment LNG storage tanks and similar liquefaction processes in the LG cost database were referenced for benchmarking. These projects are either currently in execution or have completed within the past 30 months. Methodology was completed as follows:

- Similar project costs were compared. It only a portion of the facility costs are known that portion was compared to the LG equivalent LG component.
- Historical project costs were escalated from sanction date using 6% inflation rate.
- Capacities correction was completed by scaled with the power of 0.65 regardless of equipment or plant element type to give a rough estimate.

This created a small, but highly relevant population of LNG facility costs for comparison.

HOLD-1: Results of benchmarking under development.

7 OPEX ESTIMATING BASIS

OPEX estimates were developed for Case 1. Case 2 OPEX estimates will be effectively the same provided that the net annual send-out is similar with the extra installed capacity rarely being used. This assumption agrees with NMGC historical withdrawal rates from the Kinder-Morgan underground storage that historically rarely exceed 130 MMscfd.

7.1 OPERATING COSTS ESTIMATING KEY ASSUMPTIONS AND GIVENS

Operating costs are the facility are expected to be dominated by:

- Labor Costs
- Electricity Costs
- Annual Maintenance Costs excluded from labor (3rd party support, specialty equipment and materials).

Each of these components were separately estimated using relevant regional information, power tariffs, etc. Fuel gas costs were also applied. These are supplied in a OPEX workbook that can be adjusted by NMGC and edited to reflect know conditions (such as labor rates).

Within the OPEX spreadsheet there is also a line item for Other NMGC OPEX. This is intended to capture other operating costs NMGC may want to have reflected in the annual OPEX budget.

Note that LG has excluded Country Tax / Local annual license and taxes to Rio Rancho. County tax can be a significant contributor to OPEX and is often subject to negotiation to the mutual benefit of the proponent and community with respect to taxes, jobs creation, and infrastructure development.

Key Exclusion: Annual local licensing and taxes excluded from OPEX estimate.

7.2 LABOR COST ESTIMATES

Labor costs usually account for 20-35% of an LNG peak shaver's annual operating budget depending on manning strategy and owner labor costs. The labor cost estimate is built-up based on personnel staffing coupled with unit costs by discipline. A core assumption build into the labor costs is a self-execution model performed by NMGC where operators are direct hire and the asset is operated by NMGC.

Head count for the facility (for both cases) is 10 FTE personnel as seen below in Table 4 showing typical peak shaver job descriptions, unit costs and quantities. 10 operators staffing a peak shaver is on the lean side, but certainly achievable provided that vacation, in-office and training days are scheduled preferentially during the summer months (June / July / August) when power is more expensive, and the plant will be operated in HOLDING mode. This mode requires the least personnel because only the utilities and BOG compression are operating most of the time.

Note that labor costs are excluding back-office support and an FTE assigned to the Plant Engineer role.

Table 4. Labor Operating Costs

OPEX SUMMARY ($ thou.)	Base Case		Notes
Labor Costs	**Unit Cost**	**Staffing**	**Notes**
Plant Manager FTE	$ 208,778	1	*Average Plant Manager in Albuquerque. Range $103-$186K.*
Plant O&M Supervisor / Plant Engineer FTE	$ 119,015	1	*Average Operations Supervisor in Alb. Range $60.7K through $105K.*
Lead I&E Technician FTE	$ 107,103	1	*Lead Instru. Tech. $76.5K in Albuquerque. Average $60.042. Range $44.6-76.5K*
Lead Maintenance Mechanic FTE	$ 94,132	1	*Lead Maint. Mech. $67.2K in Albuquerque. Average $54.9K. Range $40.1-67.2K*
O&M Staff (FTE, Operators / 2 x 7 manning)	$ 92,615	6	*71,133 / year Average. Range $51.2 through $87.7. June 2022. SalaryExpert.com*
Admin (FTE)	$ 61,121	0	*Average cost of Admin Assistant in Albuquerque. Range $32.2-53.2K.*
Security (FTE)	$ 61,121	0	*Set to same cost as Admin.*
Labor Costs Subtotal ($ thou.)	**$**	**1,085**	

An FTE contingent of 10 plant staff achieves a minimum of ~2 FTE coverage during the day shift and single operator at night anticipating 24 / 7 on-site presence. The following assumptions are typical:

- O&M Operators working 4 x 12 hrs schedule and
- Plant Manager and Maintenance, Mechanical and EIC Leads primarily on a Monday-Friday schedule with some rolling coverage.
- No allowance for security, admin or plant engineering assumed provided from centralized NMGC capability as needed.
- Base case estimates 10 plant personnel.

Labor costs has been from SalaryExpert.com for actual job descriptions in Albuquerque area with 40% burden rate. Applied average costs for Plant Manager and Operations Supervisor and top-range cost for EIC and Mechanical Techs reflecting level of expertise required. Actual labor cost needs to be provided by the NMGC.

Annual operating costs are estimated as $1.085 million per year.

7.3 ELECTRICAL POWER COSTS

Electrical power cost for LNG peakshavers often represents ~20-30% of their annual OPEX budget. Facility operating costs are typically dominated by two items:

- High liquefaction electricity costs that come with significant demand and usage charges while the system (including the refrigerant compressor) is operational.
- Consistent hotel and BOG compression costs associated with HOLDING mode that prevails most of the year, including through the June / July / August months when power is most expensive.

Base Case reflects Mole Sieve pretreatment, 10 MMscfd liquefaction rate using Cosmodyne N2 Expander liquefaction, 1 BCF single containment LNG storage tank, 130 MMscfd vaporization using 3 x 50% in-tank pumps and 3 x 50% STV vaporizers with BOG compressed to and returned to transmission line.

- Power cost estimated based on provided power tariff and considering elevated power costs during June / July / August months as well as Peak / Offpeak usage costs.
- Power consumption estimated for decision making purposes and broken into nominal HOLDING, VAPORIZATION, and LIQUEFACTION seasons.
- Vaporization Season from Nov. 15 - March 15 annually. Liquefaction can occur in any month, but 30 days assumed to be available during Vaporization season. Leaves ~180 days available for liquefaction out of peak power costs.
- Power costs from NMGC provided "Energy Costs.xls" and checked against power tariff dated Jan. 1, 2019.
- HOLDING mode only during the June / July / August higher cost months. Demand changes $16.49 / kW all months except June / July / August with cost of $23.69 / kW. Average usage power cost $0.01856 / kW*hr all months except June / July / August that are $0.02088.
- HOLDING loads reflect nominal BOG based on 0.05% boil-off per day (typical tank guarantee value).

Table 5. Rio Puerco Annual Electrical Power Costs

OPEX SUMMARY ($ thou.)		**Case 1 130 MMscfd Send-out**	**Case 2 195 MMscfd Send-out**	***Notes***
Power Costs				
Holding Load (kW)	*kW*	*480*	*480*	*Estimated power demand - primary load is BOG compressor.*
Days in Operating Mode	Days	*218*	*218*	*Calculated remaining number of days in this mode per year.*
Liquefaction Load (kW)	*kW*	*5,440*	*5,440*	
Days in Operating Mode	Days	*138*	*138*	*Calculated actual required number of days in this mode per year including BOG losses.*
Vaporization Load (kW)	*kW*	*1,300*	*1,710*	*Set to the same based on assumption excess send-out capacity is rarely used.*
Days in Operating Mode (@ full capacity)	Days	*9.0*	*9.0*	*Enter estimated number of days in this mode per year.*
Months Vaporization Occurs		2	2	*Enter number of months vaporization occurs in typical year.*
Months Liquefaction Occurs		6	6	*Round-up and extra month for demand charge calculations*
Months Holding Mode-Only		4	4	*Resultant.*
Annual Usage Charges ($ thou.)		$ 396.0	$ 398.7	*Power costs are sourced from the Energy Costs.xlsx file, received from NMGC and dated 04/05/2022.*
Annual Demand Charges ($ thou.)		$ 583	$ 584	*Power costs are sourced from the Energy Costs.xlsx file, received from NMGC and dated 04/05/2022.*
Annual Billing Costs ($ thou.)		$ 7	$ 7	*Power costs are sourced from the Energy Costs.xlsx file, received from NMGC and dated 04/05/2022.*
Power Cost Subtotal ($ thou.)		**$ 986**	**$ 989**	*Estimated plant annual power costs.*

Annual estimated power costs for both cases is approximately $890,000 / year.

7.4 FUEL GAS COST

Fuel gas estimated based on firer heaters and associated loads at $5 / MMBTU (adjustable). This modest annual OPEX figure is included in the OPEX spreadsheet and results in roughly $2,000 / year in OPEX.

7.5 ANNUAL MAINTENANCE COSTS

Annual maintenance estimated as percentage of *Plant and Facility Subtotal* reflecting non-facility labor and specialty support and materials associated with average annual maintenance across the facility major maintenance cycle. The estimated annual maintenance costs are seen in Table 6.

Table 6. Annual Maintenance OPEX Estimate

OPEX SUMMARY ($ thou.)		Case 1 130 MMscfd Send-out	Case 2 195 MMscfd Send-out	Notes
Maintenance Costs				
Annual 3rd Party Maintenance Costs ($ thou.)	1.00%	$ 712.39	$ 760.81	*Estimated as percent of Plant & Facility Subtotal*
Maintenance Parts and Consumables ($ thou.)	0.75%	$ 534.29	$ 570.61	*Estimated as percent of Plant & Facility Subtotal*
Other Annual Main. Costs ($ thou.)		$ -	$ -	*Allowance for other NMGC recognized OPEX items*
Maintenance Cost Subtotal		$ 1,247	$ 1,331	*Estimated annual maintenance costs*

7.6 OPEX ESTIMATE

The estimated total annual OPEX costs are reflected in Table 7. It shows an annual OPEX of $3.4 million for Case 1 and $3.5 million for Case 2. As previously discussed, the major contributors are Labor, Maintenance and Power.

Electric power costs account for 28.6% of the annual OPEX. This highlights how important it is to confirm to the electric rates and take advantage of off-peak rates for liquefaction.

Table 7. PreFEED OPEX Estimate for Rio Puerco

OPEX SUMMARY ($ thou.)	Case 1 130 MMscfd Send-out	Case 2 195 MMscfd Send-out	Notes
Labor Costs Subtotal ($ thou.)	$ 1,085	$ 1,085	
Power Cost Subtotal ($ thou.)	$ 986	$ 989	*Estimated plant annual power costs.*
Fuel Gas Cost ($ thou.)	$126	$126	*Only Fuel Gas included in OPEX costs.*
Maintenance Cost Subtotal	$ 1,247	$ 1,331	*Estimated annual maintenance costs*
Total Annual OPEX ($ thou.)	$ 3,444	$ 3,532	***Annual OPEX***

LISBON GROUP

New Mexico GAS COMPANY® AN EMERA COMPANY

Doc #	N2101-S-902 Rev. B
Name	PreFEED Cost Estimates
Date	07/14/2022

APPENDIX A: PREFEED RIO PUERCO ESTIMATE WORKBOOK

See PreFEED Rio Puerco Estimate Workbook_RevB.xls

PreFEED Rio Puerco Estimate Workbook_Rev B S 7/14/2022

CAPEX SUMMARY ($ thou.)		Case 1 130 MMscfd Send-out	Case 2 195 MMscfd Send-out	Notes
Interconnecting Pipelines and Receipt Equipment and Piping		1,751	2,047	[illegible]
Liquefaction / LNG Production Equipment and Piping		26,000	26,000	[illegible]
Vaporization Equipment and Piping		19,252	17,240	[illegible]
BOG Compression and Storage Tank Support		10,491	11,405	[illegible]
Facilities, Buildings, and Utilities		13,950	13,829	[illegible]
Plant & Facilities Subtotal		$ 71,255	$ 76,881	
Consumables and Spares		1,000	1,356	[illegible]
Services		15,673	16,597	[illegible]
LNG Storage Tank Contract		59,500	59,500	[illegible]
Plant Subtotal		$ 142,300	$ 148,134	
Site Acquisition		$ 2,000	$ 2,000	[illegible]
Owner's Costs	[illegible]	$ 11,304	$ 11,851	[illegible]
LNG Tank Contingency	[illegible]	$ 7,450	$ 7,450	[illegible]
Other Contingency	[illegible]	$ 17,760	$ 18,927	[illegible]
Total CAPEX ($ thou.)		$ 180,935	$ 188,401	
Total CAPEX Delta from Base Case ($ thou.)			$ 7,467	[illegible]

OPEX SUMMARY ($ thou.)		Case 1 130 MMscfd Send-out	Case 2 195 MMscfd Send-out	Notes
Labor Costs	Unit Cost	FTE	FTE	[illegible]
Plant Manager FTE	$ [illegible]	1	1	[illegible]
Plant O&M Supervisor / Plant Engineer FTE	$ [illegible]	1	1	[illegible]
Lead I&E Technician FTE	$ [illegible]	1	1	[illegible]
Lead Maintenance Mechanic FTE	$ [illegible]	1	1	[illegible]
O&M Staff (FTE, Operators / 2 x 7 manning)	$ [illegible]	6	6	[illegible]
Admin (FTE)	$ [illegible]	0	0	[illegible]
Security (FTE)	$ [illegible]	0	0	[illegible]
Labor Costs Subtotal ($ thou.)		$ 1,005	$ 1,005	
Power Costs				
Holding Load (kW)	kW	400	400	[illegible]
Days in Operating Mode	Days	210	210	[illegible]
Liquefaction Load (kW)	kW	5,400	5,400	
Days in Operating Mode	Days	[illegible]	[illegible]	[illegible]
Vaporization Load (kW)	kW	1,300	1,710	[illegible]
Days in Operating Mode (@ full capacity)	Days	5.0	5.0	[illegible]
Months Vaporization Occurs		2	2	[illegible]
Months Liquefaction Occurs		6	6	[illegible]
Months Holding Mode-Only		4	4	[illegible]
Annual Usage Charges ($ thou.)		$ 336.0	$ 338.7	[illegible]
Annual Demand Charges ($ thou.)		$ 583	$ 584	[illegible]
Annual Billing Costs ($ thou.)		$ 7	$ 7	[illegible]
Power Cost Subtotal ($ thou.)		$ 386	$ 383	[illegible]
Material Balance	**Gas Unit Cost $ / MMBtu**			
Holding Mode				
BOG Tail Gas (MMscfd)	$ 5.00	(0.40)	(0.40)	[illegible]
Fuel Gas (MMscfd)	$ 5.00	0.00	0.00	[illegible]
Production Mode				
Feed Gas (MMscfd)	$ 5.00	14.45	14.45	
Regen Tail Gas (MMscfd)	$ 5.00	(4.00)	(4.00)	[illegible]
BOG and HHC Tail Gas (MMscfd)	$ 5.00	(0.06)	(0.06)	[illegible]
Fuel Gas (MMscfd)	$ 5.00	0.05	0.05	[illegible]
Vaporization Mode				
Vaporized Gas (MMscfd)	$ [illegible]	(130.00)	(130.00)	Send-out
BOG Tail Gas (MMscfd)	$ [illegible]	(0.56)	(0.56)	[illegible]
Fuel Gas (MMscfd)	$ 5.00	1.05	1.05	[illegible]
Annual BOG to Make-up (MMscfd / year)		(220.40)	(220.36)	[illegible]
Gas Cost Subtotal ($ thou.)		($12,022)	($11,996)	[illegible]
Fuel Gas Cost ($ thou.)		$126	$126	[illegible]
Maintenance Costs				
Annual 3rd Party Maintenance Costs ($ thou.)	[illegible]	$ 712.33	$ 760.81	[illegible]
Maintenance Parts and Consumables ($ thou.)	[illegible]	$ 534.25	$ 570.61	[illegible]
Other Annual Main. Costs ($ thou.)		$ -	$ -	[illegible]
Maintenance Cost Subtotal		$ 1,247	$ 1,331	[illegible]
Total Annual OPEX ($ thou.)		$ 3,444	$ 3,532	*Annual OPEX*

PreFEED Rio Puerco Estimate Workbook_Rev B Spreadsheet **7/14/2022**

CAPEX SUMMARY ($ thou.)		Case 1 130 MMscfd Send-out	Case 2 195 MMscfd Send-out	Notes
Interconnecting Pipelines and Reception Equipment and Piping		1,751	2,017	Includes buried on-plot lines, ESDV, analysis, metering, and odorization.
Liquefaction / LNG Production Equipment and Piping		26,388	26,388	Pretreatment, liquefaction and associated support systems (e.g. MR storage).
Vaporization Equipment and Piping		13,252	17,248	Includes in-tank pumps, vaporizers, boilers, and directly associated ancillaries.
BOG Compression and Storage Tank Support		10,491	11,405	Includes LNG storage tank foundation, BOG compression, BOG heater, and directly related systems.
Facilities, Buildings, and Utilities		19,358	19,023	Includes everything else in the plant including utilizes and site improvements.
Plant & Facilities Subtotal		**$ 71,239**	**$ 76,081**	
Consumables and Spares		1,888	1,956	Includes allowance for spare parts, first fill of mole sieves, heating media, oils and other chemicals.
Services		15,673	16,597	Includes FEED engineering, transportation, commissioning and start-up services.
LNG Storage Tank Contract		53,500	53,500	Line-item for LNG storage tank contract.
Plant Subtotal		**$ 142,300**	**$ 148,134**	
Site Acquisition		$ 2,000	$ 2,000	Site acquisition costs.
Owner's Costs	8%	$ 11,384	$ 11,851	Includes permitting, Owner's Team, 3rd party studies pre-sanction, insurance, and other OC.
LNG Tank Contingency	14%	$ 7,490	$ 7,490	Contingency applied to LNG storage tank.
Other Continency	20%	$ 17,760	$ 18,927	Contingency applied to project costs excluding LNG storage tank contract.
Total CAPEX ($ thou.)		**$ 180,935**	**$ 188,401**	
Total CAPEX Delta from Base Case ($ thou.)			**$ 7,467**	Cost relative to Base Case.

OPEX SUMMARY ($ thou.)		Case 1 130 MMscfd Send-out	Case 2 195 MMscfd Send-out	Notes
Labor Costs	**Unit Cost**	FTE	FTE	40% Burden rate applied to all. Average Albuquerque salaries from SalaryExpert.com June 2022.
Plant Manager FTE	$ 208,778	1	1	Average Plant Manager in Albuquerque. Range $103-$186K.
Plant O&M Supervisor / Plant Engineer FTE	$ 119,015	1	1	Average Operations Supervisor in Alb. Range $60.7K through $105K.
Lead I&E Technician FTE	$ 107,103	1	1	Lead Instru. Tech. $76.5K in Albuquerque. Average $60.042. Range $44.6-76.5K
Lead Maintenance Mechanic FTE	$ 94,132	1	1	Lead Maint. Mech. $67.2K in Albuquerque. Average $54.9K. Range $40.1-67.2K
O&M Staff (FTE, Operators / 2 x 7 manning)	$ 92,615	6	6	71,133 / year Average. Range $51.2 through $87.7. June 2022. SalaryExpert.com
Admin (FTE)	$ 61,121	0	0	Average cost of Admin Assistant in Albuquerque. Range $32.2-53.2K.
Security (FTE)	$ 61,121	0	0	Set to same cost as Admin.
Labor Costs Subtotal ($ thou.)		**$ 1,085**	**$ 1,085**	
Power Costs				
Holding Load (kW)	kW	480	480	Estimated power demand - primary load is BOG compressor.
Days in Operating Mode	Days	218	218	Calculated remaining number of days in this mode per year.
Liquefaction Load (kW)	kW	5,440	5,440	
Days in Operating Mode	Days	138	138	Calculated actual required number of days in this mode per year including BOG losses.
Vaporization Load (kW)	kW	1,300	1,710	Set to the same based on assumption excess send-out capacity is rarely used.
Days in Operating Mode (@ full capacity)	Days	9.0	9.0	Enter estimated number of days in this mode per year.
Months Vaporization Occurs		2	2	Enter number of months vaporization occurs in typical year.
Months Liquefaction Occurs		6	6	Round-up and extra month for demand charge calculations
Months Holding Mode-Only		4	4	Resultant.
Annual Usage Charges ($ thou.)		$ 396.0	$ 398.7	Power costs are sourced from the Energy Costs.xlsx file, received from NMGC and dated 04/05/2022.
Annual Demand Charges ($ thou.)		$ 583	$ 584	Power costs are sourced from the Energy Costs.xlsx file, received from NMGC and dated 04/05/2022.
Annual Billing Costs ($ thou.)		$ 7	$ 7	Power costs are sourced from the Energy Costs.xlsx file, received from NMGC and dated 04/05/2022.
Power Cost Subtotal ($ thou.)		**$ 986**	**$ 989**	Estimated plant annual power costs.
Material Balance	**Gas Unit Cost $ / MMBtu**			
Holding Mode				
BOG Tail Gas (MMscfd)	$ 5.00	(0.48)	(0.48)	Negative value shows flow out of plant.
Fuel Gas (MMscfd)	$ 5.00	0.00	0.00	Only Fuel Gas included in OPEX costs. Other values for NMGC reference only.
Production Mode				
Feed Gas (MMscfd)	$ 5.00	14.43	14.43	
Regen Tail Gas (MMscfd)	$ 5.00	(4.00)	(4.00)	This is low BTU gas that must be blended at Santa Fe Junction.
BOG and HHC Tail Gas (MMscfd)	$ 5.00	(0.86)	(0.86)	Gas either sent-out in combined flow to Santa Fe Junction for blending or distribution.
Fuel Gas (MMscfd)	$ 5.00	0.05	0.05	Only Fuel Gas included in OPEX costs. Other values for NMGC reference only.
Vaporization Mode				
Vaporized Gas (MMscfd)	$ 15.00	(130.00)	(130.00)	Send-out
BOG Tail Gas (MMscfd)	$ 15.00	(0.56)	(0.56)	BOG to Distribution
Fuel Gas (MMscfd)	$ 5.00	1.85	1.85	Only Fuel Gas included in OPEX costs. Other values for NMGC reference only.
Annual BOG to Make-up (MMscfd / year)		(228.18)	(228.36)	Primarily driven by heat leak at 0.05% tank volume per day.
Gas Cost Subtotal ($ thou.)		**($12,022)**	**($11,996)**	Not applied to OPEX estimates. Values for NMGC reference only.
Fuel Gas Cost ($ thou.)		**$126**	**$126**	Only Fuel Gas included in OPEX costs.
Maintenance Costs				
Annual 3rd Party Maintenance Costs ($ thou.)	1.00%	**$ 712.39**	**$ 760.81**	Estimated as percent of Plant & Facility Subtotal
Maintenance Parts and Consumables ($ thou.)	0.75%	**$ 534.29**	**$ 570.61**	Estimated as percent of Plant & Facility Subtotal
Other Annual Main. Costs ($ thou.)		$ -	$ -	Allowance for other NMGC recognized OPEX items
Maintenance Cost Subtotal		**$ 1,247**	**$ 1,331**	Estimated annual maintenance costs
Total Annual OPEX ($ thou.)		**$ 3,444**	**$ 3,532**	***Annual OPEX***

Notes:

1. Base Case reflects Mole Sieve pretreatment, 10 MMscfd liquefaction rate using Cosmodyne N2 Expander liquefaction, 1 BCFD single containment LNG storage tank, 130 MMscfd vaporization using 3 x 50% in-tank pumps and 3 x 50% STV vaporizers with BoG compressed to, and returned to distribution line.

2. Shaded cells are intended for NMGC to input values as appropriate as appropriate (e.g. actual labor costs, number of vaporization days, gas costs, etc.).

3. Vaporization Season from Nov. 15 - March 15 annually. Liquefaction can occur in any month, but 30 days assumed to be available during Vaporization season. Leaves ~180 days available for liquefaction out of peak power costs.

4. Power costs from NMGC provided "Energy Costs.xls" and checked against power tariff dated Jan. 1, 2019. HOLDING mode only during the June / July / August higher cost months. Demand changes $16.49 / kW all months except June / July / August with cost of $23.69 / kW. Average usage power cost $0.01856 / kW*hr all months except June / July / August that are $0.02088.

5. All values, including CAPEX estimates, exclude 5.125% NM Sales tax and Rio Rancho 2.56% sales tax on services, shipping, and installation of tangible goods. Treatment of taxes to be agreed with NMGC.

NEW MEXICO GAS COMPANY, INC.

LNG SCENARIO SPREADSHEETS

December 2021

Northwest

		6am Linepack	Forcasted Day-Ahead Swing Need	Day-Ahead Purchases	Day-Ahead Storage	Intraday Purchases	Intraday Storage	Notes
Wednesday	12/1/2021	88	23,350	-	(10,000)	-	-	
Thursday	12/2/2021	81	35,248	-	(24,000)	10,000	-	Reversed 20k Inj by ID3
Friday	12/3/2021	69	18,687	-	-	-	-	
Saturday	12/4/2021	67	16,981	2,000	-	-	-	
Sunday	12/5/2021	82	4,050	2,000	-	-	-	
Monday	12/6/2021	96	(1,968)	2,000	-	-	3,133	
Tuesday	12/7/2021	107	(3,097)	-	-	-	-	
Wednesday	12/8/2021	86	5,205	2,000	-	31,905	-	
Thursday	12/9/2021	67	23,325	-	-	-	-	
Friday	12/10/2021	80	(67,307)	90,000	-	-	(20,000)	
Saturday	12/11/2021	99	(78,463)	20,000	70,000	20,000		
Sunday	12/12/2021	80	(42,730)	20,000	33,000	-	20,000	
Monday	12/13/2021	78	(9,019)	20,000	-	20,000	15,000	
Tuesday	12/14/2021	76	12,578	-	-	30,000	-	
Wednesday	12/15/2021	90	(75,458)	107,000	-	-	(50,000)	
Thursday	12/16/2021	114	(72,502)	93,000	-	-	(15,000)	
Friday	12/17/2021	108	(85,152)	107,500	-	-	(25,000)	
Saturday	12/18/2021	107	(112,549)	80,000	55,000	-	-	Backed off w/d by 20k by ID3
Sunday	12/19/2021	108	(110,007)	80,000	50,000	-	(3,000)	Backed off w/d by 36k by ID3
Monday	12/20/2021	114	(91,932)	80,000	31,000	-	-	Backed off w/d by 31k by ID3
Tuesday	12/21/2021	106	(69,564)	80,000	-	-	(30,000)	
Wednesday	12/22/2021	114	(37,815)	5,000	30,000	-	-	Backed off w/d by 23k by ID3
Thursday	12/23/2021	107	(4,169)	7,000	-	-	-	
Friday	12/24/2021	93	(26,914)	7,000	30,000	-	-	Backed off inj by 30k by ID3
Saturday	12/25/2021	99	(9,978)	7,000	30,000	-	-	Backed off inj by 22k by ID3
Sunday	12/26/2021	92	(29,498)	7,000	-	-	-	
Monday	12/27/2021	102	(43,790)	7,000	-	-	60,000	
Tuesday	12/28/2021	105	(58,269)	70,000	-	-	(20,000)	
Wednesday	12/29/2021	110	(76,857)	96,000	-	-	(16,000)	
Thursday	12/30/2021	113	(50,016)	76,500	-	-	(51,000)	
Friday	12/31/2021	125	(45,388)	76,500	-	-	(35,000)	

Positive=Storage W/d
Negative=Storage INJ

Positive Need=Long
Negative Need=Short

NEW MEXICO GAS COMPANY, INC.

LNG SCENARIO SPREADSHEETS

December 2021

				Day of Flow					LNG Inventory	Target
		Adjusted Linepack	Day-Ahead Purchase	LNG Withdrawal	LNG Injection	Intraday Purchase	Market Sale	Net LNG	900,000	750,000
Wednesday	12/1/2021	88	-	-	(10,000)	-	-	(10,000)	910,000	
Thursday	12/2/2021	75	-	-	-	6,000	-	-	910,000	
Friday	12/3/2021	63	-	-	-	-	-	-	910,000	
Saturday	12/4/2021	61	2,000	-	-	-	-	-	910,000	
Sunday	12/5/2021	76	2,000	-	-	-	-	-	910,000	
Monday	12/6/2021	87	2,000	-	-	-	-	-	910,000	
Tuesday	12/7/2021	98	-	-	-	-	-	-	910,000	
Wednesday	12/8/2021	77	2,000	-	-	31,905	-	-	910,000	
Thursday	12/9/2021	58	10,000	-	-	-	-	-	910,000	
Friday	12/10/2021	81	70,000	-	-	-	-	-	910,000	
Saturday	12/11/2021	100	20,000	40,000	-	50,000	-	40,000	870,000	
Sunday	12/12/2021	81	20,000	18,000	-	35,000	-	18,000	852,000	
Monday	12/13/2021	79	20,000	-	-	35,000	-	-	852,000	
Tuesday	12/14/2021	77	-	-	-	30,000	-	-	852,000	
Wednesday	12/15/2021	91	75,000	-	(10,000)	-	-	(10,000)	862,000	
Thursday	12/16/2021	122	60,000	-	(10,000)	-	-	(10,000)	872,000	
Friday	12/17/2021	98	80,000	-	(10,000)	-	-	(10,000)	882,000	
Saturday	12/18/2021	98	80,000	35,000	-	-	-	35,000	847,000	
Sunday	12/19/2021	99	80,000	14,000	-	-	-	14,000	833,000	
Monday	12/20/2021	105	80,000	-	-	-	-	-	833,000	
Tuesday	12/21/2021	97	70,000	-	(10,000)	-	-	(10,000)	843,000	
Wednesday	12/22/2021	115	10,000	-	(10,000)	-	-	(10,000)	853,000	
Thursday	12/23/2021	81	10,000	-	-	-	-	-	853,000	
Friday	12/24/2021	70	30,000	-	-	-	-	-	853,000	
Saturday	12/25/2021	85	30,000	-	-	-	-	-	853,000	
Sunday	12/26/2021	106	30,000	-	-	-	-	-	853,000	
Monday	12/27/2021	101	30,000	37,000	-	-	-	37,000	816,000	
Tuesday	12/28/2021	111	40,000	-	-	-	-	-	816,000	
Wednesday	12/29/2021	106	75,000	-	-	-	-	-	816,000	
Thursday	12/30/2021	104	45,000	-	(10,000)	-	-	(10,000)	826,000	
Friday	12/31/2021	126	45,000	-	(10,000)	-	-	(10,000)	836,000	
				144,000		187,905				

Positive=Storage W/d
Negative=Storage INJ

Positive Need=Long
Negative Need=Short

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

ELECTRONICALLY SUBMITTED AFFIRMATION OF TOM C. BULLARD

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

In accordance with 1.2.2.10(E) NMAC, Tom C. Bullard, Vice President-Engineering, Gas Management & Technical Services for New Mexico Gas Company, Inc., upon being duly sworn according to law, under oath, deposes and states under penalty of perjury under the laws of the State of New Mexico: I have read the foregoing Direct Testimony and Exhibits, and they are true and accurate based on my personal knowledge and belief.

SIGNED this 15th day of December 2022.

/s/Tom C. Bullard
Tom C. Bullard
Vice President-Engineering, Gas
Management & Technical Services
New Mexico Gas Company, Inc.

<u>BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION</u>

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

DIRECT TESTIMONY AND EXHIBITS

OF

JOHN J. REED

December 16, 2022

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DIRECT TESTIMONY OF
JOHN J. REED
NMPRC CASE NO. 22-_____-UT

I. INTRODUCTION AND QUALIFICATIONS

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is John J. Reed. My business address is 293 Boston Post Road West, Suite 500, Marlborough, Massachusetts 01752.

Q. BY WHOM AND IN WHAT CAPACITY ARE YOU EMPLOYED?

A. I am Chairman and Chief Executive Officer of Concentric Energy Advisors, Inc. ("Concentric"). Concentric is a management consulting firm specializing in financial and economic services to the energy industry.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL BACKGROUND AND EXPERIENCE AND STATE WHETHER YOU HAVE PREVIOUSLY TESTIFIED BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION ("NMPRC" OR THE "COMMISSION").

A. I have more than 45 years of experience in the North American energy industry. Prior to my current position with Concentric, I have served in executive positions with various consulting firms and as Chief Economist with Southern California Gas Company, North America's largest gas distribution utility. I have provided expert testimony on financial and economic matters on more than 200 occasions before the Federal Energy Regulatory Commission ("FERC"), the Canada Energy Regulator ("CER"), numerous provincial and state utility regulatory agencies, various state and federal courts, and before arbitration panels in the United States and Canada. I previously filed testimony before the Commission in Case Nos. 1835 (1983), 12-00350-UT, and 13-00390-UT. A copy of my résumé and a listing of the testimony I have sponsored is included in NMGC Exhibit JJR-1.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING?

A. I am testifying on behalf of New Mexico Gas Company, Inc. ("NMGC" or the "Company").

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?

A. The purpose of my Direct Testimony is to address aspects of NMGC's application for a Certificate of Public Convenience and Necessity[1] ("CCN") authorizing the Company to construct, operate, and own a new liquefied natural gas ("LNG") storage facility located outside of Albuquerque near Rio Rancho, New Mexico ("LNG Facility"). My Direct Testimony presents Concentric's evaluation of the benefits of the LNG Facility, an analysis of the economics of the LNG Facility relative to alternatives, and consideration of the LNG Facility in light of the current energy transition.[2]

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1 "No public utility shall begin the construction or operation of any public utility plant or system or of any extension of any plant or system without first obtaining from the commission a certificate that public convenience and necessity require or will require such construction or operation." NM Stat § 62-9-1-A and "It is the declared policy of the state that the public interest, the interest of consumers and the interest of investors require the regulation and supervision of public utilities to the end that reasonable and proper services shall be available at fair, just and reasonable rates and to the end that capital and investment may be encouraged and attracted so as to provide for the construction, development and extension, without unnecessary duplication and economic waste, of proper plants and facilities and demand-side resources for the rendition of service to the general public and to industry." NM Stat § 62-3-1-B

2 I served as the Responsible Officer for Concentric's engagement, and was supported by the work of Mr. Gregg Therrien, Vice President, and Ms. Melissa Bartos, Vice President, both of whom are experienced in natural gas supply and infrastructure issues; they were in turn supported by other staff members at Concentric. The opinions presented here are my own but are based on the work of our entire team.

Q. DO YOU HAVE PRIOR EXPERIENCE IN REVIEWING NEW NATURAL GAS INFRASTRUCTURE AND OFFERING EXPERT TESTIMONY ON THIS TOPIC?

A. Yes, over the past 32 years, I have conducted many similar reviews and have provided expert testimony on this topic on several occasions. I have conducted analyses and offered testimony on the need for new natural gas facilities, the composition of gas supply portfolios, the use of LNG, propane gas and other peak-shaving facilities, the economics of gas storage options and the incorporation of environmental policies into energy resource planning and development. My analyses which resulted in testimony being filed on these topics are included in the list of prior testimony filed as NMGC Exhibit JJR-1.

Q. WHAT IS YOUR EXPERIENCE THAT SPECIFICALLY RELATES TO GAS SUPPLIES, TRANSPORTATION, STORAGE, AND PEAK-SHAVING ALTERNATIVES FOR LOCAL GAS DISTRIBUTION COMPANIES ("LDCs")?

A. I have worked for several investor-owned LDCs on gas supply contracting, pipeline economics and rates, storage issues and regulatory proceedings over the past 40 years. This includes having led the Northern Distributor Group ("NDG") for more than four years, which at the time was an association of more than 16 LDCs that received firm service on the Northern Natural Pipeline system. For the years in which I led the NDG, I managed all of the regulatory interventions, rulemaking participation, supply analyses, supply contracting, and storage analyses that NDG members undertook with regard to the Northern Natural system. This included gas supply contract negotiations and renegotiations, gas purchasing practice audits and prudence reviews, pipeline tariff revisions, and extensive involvement in several pipeline rate filings, which led to several appearances before the FERC and state regulators on behalf of NDG members. I have worked for the Wisconsin Distributor Group and LDCs in Michigan, Colorado, Nebraska, Iowa, New Mexico, Arizona, Nevada, Utah, California and many other states and have significant experience on the El Paso Natural Gas ("EPNG") and Transwestern Pipeline ("TW") systems. I have also worked for pipelines, merchant and regulated storage owners/operators/developers, electric generators and large industrial companies on the topics of gas supply and storage contracting, the need for new natural gas infrastructure, the market for new and existing storage facilities and efficient utilization of existing natural gas infrastructure. Finally, I have also worked for the Public Utilities Commission of Texas and the U.S. Securities and Exchange Commission on the topic of investigations of natural gas purchasing and storage use by public utilities.

Q. PLEASE SUMMARIZE THE CONCLUSIONS OF YOUR DIRECT TESTIMONY.

A. NMGC faces the need for enhanced reliability for natural gas supplies delivered to its LDC operations, and as noted by the Commission, the need for enhanced protection from extreme price spikes in order to avoid very large bill impacts for its customers. A contributing factor to both needs has been the experience with *force majeure* outages at the Keystone Storage Facility ("Keystone Storage") in west Texas, which NMGC has under contract for high-deliverability storage service into the interstate pipelines which serve NMGC. Gas supplier and pipeline *force majeure* events have also contributed to these needs, as has NMGC's "supplier backstop" responsibility in cases of delivery failures for NMGC's transportation customers. Meteorological and natural gas market conditions are expected to make the frequency and severity of these events greater over the foreseeable future. As a consequence, as previously disclosed to the Commission and interested parties, NMGC has evaluated its options to meet the need to provide more reliable and more affordable service to its customers. The development of an LNG liquefaction, storage and vaporization facility on NMGC's system has emerged as the most viable and cost-effective alternative for meeting these needs, and the Company has developed a design, cost estimate and development schedule for such a facility. My Direct Testimony concludes that the development of such a facility is consistent with the State of New Mexico's energy and environmental policy objectives, is capable of meeting the LDC's operational requirements that will arise from relinquishing all or part of Keystone Storage contract that is currently in effect, will improve the reliability and flexibility of gas supplies to NMGC and will significantly improve NMGC's ability to respond to extreme price spikes in natural gas markets on an affordable basis. Based on my conclusions, I recommend that the Commission approve NMGC's request for a CCN to construct the proposed LNG Facility.

II. BACKGROUND

Q. AT A HIGH LEVEL, WHY IS THE COMPANY PROPOSING TO BUILD THE LNG FACILITY?

A. NMGC has experienced multiple occasions during which natural gas that the Company had contracted for and was planning to deliver to customers was unavailable during winter events, causing concerns about reliability and economic impacts for customers. As a result of these winter gas supply failures, NMGC was forced to curtail service to customers in February 2011 and NMGC was forced to make emergency purchases of significantly more expensive replacement gas in February 2021. During both of these events, national and regional producers and the Company's leased storage facility, Keystone Storage, had declared force majeure events, which contributed to the gas supply shortages experienced by the region. In addition, interstate pipelines that the Company relies on were experiencing strained conditions and placed various limitations on NMGC's ability to transport natural gas, which included EPNG declaring system wide critical operating conditions from February 15-17, 2021 and TW issuing a critical notice on February 15, 2021. As a result of these events the Company, at the behest of the Commission, has reviewed several alternative gas procurement strategies to limit the operational and financial impacts of upstream gas curtailments, with a strong emphasis on increasing local control over physical gas delivery. One aspect of this local control strategy is proposing to build the LNG Facility as a replacement for some or all of the Keystone Storage lease to improve the reliability and affordability of natural gas supplies necessary to serve NMGC's customers during winter events.

Q. HAVE THE COMPANY'S GAS SUPPLY FAILURES BEEN LIMITED TO THE FEBRUARY 2011 AND FEBRUARY 2021 WINTER STORM EVENTS?

A. No. While the gas supply failures during the February 2011 and February 2021 events were extreme, the Company has experienced numerous additional failures. For example, the Company has experienced some level of gas supply failures on 44% of the days in the last two years (September 1, 2020 through August 31, 2022). Many of these failures were small, but the Company experienced material gas supply failures (i.e., greater than 1,000 Dth/day) on 12% of the days during this period, which on average is once every nine days.

These failures encompass issues with production, interstate pipeline transportation, and underground storage, and include gas supply failures for gas purchased by NMGC for its system sales customers as well as gas supply failures by third-party marketers for NMGC's on-system transportation customers.[3]

Q. IS EXPERIENCING MATERIAL GAS SUPPLY FAILURES AN AVERAGE OF ONCE EVERY NINE DAYS TYPICAL FOR GAS UTILITIES?

A. No. In my experience, this frequency of supply, storage and transportation failures is far above the norm for gas distribution utilities. While each region of the country is different in terms of weather, performance standards and contracting practices, I have never seen this level of supply unreliability in any other market, including other markets in supply producing regions. A more common level of performance would be to have no more than a few material supply cuts in a year, and no more than a very few storage or pipeline force majeure events in a decade. Even during the once-in-a-century level of disruption that occurred during Winter Storm Uri, I am aware of major LDCs in the central U.S. that had no interstate pipeline or storage failures and supply failures that were limited to minor levels of the LDC's overall supply portfolio. The fact that the supply and infrastructure offerings available to NMGC have experienced this level of unreliability requires a much

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[3] NMGC acts as a backstop supplier for transportation customers, meaning if a transportation customer's gas is not delivered by its third-party marketer, NMGC will provide gas to the transportation customer as long as doing so will not endanger the system. The transportation customer can return the gas in-kind later within the same month or pay for the gas pursuant to the Company's balancing provisions. (NMGC Tariff, First Revised Rule No. 28 - Balancing (x), April 19, 2016).

more aggressive stance for the LDC in terms of controlling its own supply infrastructure as a means of insuring adequate reliability.

Q. PLEASE DESCRIBE KEYSTONE STORAGE.

A. Keystone Storage is an underground high-deliverability salt cavern natural gas storage facility located near Kermit, Texas that began service in 2002 and has been owned by Kinder Morgan, Inc. since 2014. Keystone Storage is located in the Permian Basin and has pipeline connections to EPNG, TW, and Northwest Natural Gas ("NNG"). It has a total capacity of approximately 8.6 billion cubic feet ("Bcf") (with a working gas capacity of approximately 6.565 Bcf), a maximum injection capability of 200,000 thousand cubic feet per day ("Mcf/day"), and a maximum withdrawal capability of 400,000 Mcf/day. Keystone Storage operates under market-based rate authority from the Federal Energy Regulatory Commission ("FERC") and has firm storage contracts with six customers, as summarized in Table 1.

Table 1: Keystone Storage Firm Storage Contracted Capacity by Customer (MMBtu)[4]

	2021-Q3	2021-Q4	2022-Q1	2022-Q2
NEW MEXICO GAS COMPANY, INC.	2,700,000	2,700,000	2,700,000	2,700,000
SALT RIVER PROJECT	1,000,000	600,000	600,000	866,666
EL PASO ELECTRIC COMPANY	400,000	400,000	400,000	400,000
ARIZONA PUBLIC SERVICE COMPANY	400,000	333,333	300,000	366,666
HARTREE PARTNERS, LP	250,000	250,000	250,000	250,000
TUCSON ELECTRIC POWER COMPANY	200,000	200,000	200,000	200,000
TOTAL	**4,950,000**	**4,483,333**	**4,450,000**	**4,783,332**

Q. PLEASE DESCRIBE THE COMPANY'S CONTRACT WITH KEYSTONE STORAGE.

A. NMGC's (then Public Service Company of New Mexico) initial contract with Keystone Storage started July 1, 2006 with NMGC having 1,000,000 MMBtu of reserved firm storage capacity at Keystone Storage with a maximum injection rate of 25,000 MMBtu/day and a maximum withdrawal rate of 50,000 MMBtu/day. NMGC paid a monthly demand charge of $120,625, which increased 3% each year, an injection rate of $0.01/MMBtu plus 1.5% fuel, and a withdrawal rate of $0.01/MMBtu.[5] NMGC signed two additional firm storage contracts with Keystone Storage which added a total of 1,200,000 MMBtu of capacity, maximum injections of 40,000 MMBtu/day, and maximum withdrawals of

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4 Kinder Morgan Keystone Gas Storage, FERC Form-549D: https://eformspublic.ferc.gov/form549D/form549D_search.aspx

5 Keystone Gas Storage Facility, "Schedule 'A' Confirmation for Gas Storage Services," Agreement Number: 024, Customer Name: Public Service Company of New Mexico, Confirmation Number: 001, April 11, 2006.

110,000 MMBtu/day as of August 1, 2008[6] and added 500,000 MMBtu of capacity, injections of 14,500 MMBtu/day, and withdrawals of 29,000 MMBtu/day as of April 1, 2011.[7] These contracts were extended and eventually rolled into one contract with a commencement date of September 1, 2013 that remains in place today.[8]

Therefore, as currently contracted NMGC holds 2,700,000 MMBtu of reserved firm storage capacity at Keystone Storage with a maximum injection rate of 75,000 MMBtu/day, and a maximum withdrawal rate of 190,000 MMBtu/day. The injection rates ratchet down to as low as 55,000 MMBtu/day based on inventory levels and the withdrawal rates ratchet down to as low as 65,000 MMBtu/day based on inventory levels and month. Withdrawal rates in the peak winter months of December through February range from 125,000 MMBtu/day to 190,000 MMBtu/day. Starting September 1, 2013, NMGC paid a monthly demand charge of $450,000, an injection rate of $0.01/MMBtu plus 1.5% fuel, and a withdrawal rate of $0.01/MMBtu.[9] NMGC extended its contract with Keystone Storage through August 31, 2025, with an option for NMGC to extend through August 31, 2027 for the same capacity levels, injection and withdrawal maximum amounts, ratchets, and injection and withdrawal rates. The only difference is that from September 1, 2021 through August 31, 2023 the demand charge is $567,000 per month, from September 1,

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[6] Keystone Gas Storage Facility, "Schedule 'A' Confirmation for Gas Storage Services," Agreement Number: 024, Customer Name: Public Service Company of New Mexico, Confirmation Number: 002, January 12, 2008.

[7] Keystone Gas Storage Facility, "Schedule 'A' Confirmation for Gas Storage Services," Agreement Number: 024, Customer Name: New Mexico Gas Company, Confirmation Number: 003, March 29, 2011.

[8] New Mexico Gas Company, "Notice to Extend Term of Gas Storage Services Agreement No. 024," March 22, 2010.

[9] Keystone Gas Storage Facility, "Schedule 'A' Confirmation for Gas Storage Services," Agreement Number: 024, Customer Name: New Mexico Gas Company, Confirmation Number: 004, October 5, 2011.

2023 through August 31, 2025 the demand charge is $621,000 per month, and if extended, from September 1, 2025 through August 31, 2027 the demand charge will be $729,000 per month.[10]

Q. WHAT WILL HAPPEN AFTER THE END OF THE CURRENT KEYSTONE STORAGE CONTRACT?

A. That has not yet been determined. NMGC is not obligated to purchase Keystone Storage services after August 31, 2025, and neither party is obligated beyond August 31, 2027. Presumably if NMGC desired to continue to contract for services from Keystone Storage beyond the end of the current contract, a negotiation will occur to determine size and cost of a new contract. It is premature to identify the cost of a potential future contract with Keystone Storage, although I note that Keystone Storage's contractual rates are increasing at a rapid rate for the remainder of the current contract. The results of the negotiation will significantly depend upon market conditions for storage, as well as the capacity being requested and the term of the contract at the time the negotiation occurs. As discussed above, NMGC paid $450,000/month for the first eight years of the current contract, $567,000/month for the next two years, $621,000/month for the following two years, and will pay $729,000/month if the contract is extended through the maximum term, so NMGC's Keystone Storage contract costs have been increasing significantly.

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[10] Keystone Gas Storage Facility, "Schedule 'A' Confirmation for Gas Storage Services," Agreement Number: 024-MSTRKGS, Customer Name: New Mexico Gas Company, Inc., Confirmation Number: 210972-FSSKGS, June 27, 2021

Q. WHAT MARKET CONDITIONS MAY AFFECT FUTURE KEYSTONE STORAGE CONTRACT COSTS?

A. Recent gas market price volatility and reliability concerns have created additional market interest in flexible salt dome storage, like Keystone Storage, and multiple salt dome storage projects have recently been announced as a result.

For example, Tres Palacios filed an application at FERC on October 12, 2022, to add 6.5 Bcf of working natural gas storage capacity to its salt dome facility in Matagorda County, Texas. In its application, Tres Palacios noted that during a non-binding open season from October 2021-December 2021 it received more than a dozen bids for a total of over six times its proposed expansion capacity. According to the application, "[t]he proposed increase in storage capacity will help satisfy market demand for incremental natural gas storage in the previously developed area located near the storage facility. The project also is needed to provide critical natural gas grid reliability, and to help reduce price volatility and physical supply and demand imbalances in the Gulf Coast natural gas market."[11]

In addition, on September 23, 2022, LA Storage LLC received approval to build the Hackberry Storage Projects located in Cameron and Calcasieu Parishes, Louisiana, which was proposed on January 29, 2021. The Hackberry Storage Project is a high-deliverability natural gas storage facility with approximately 20 Bcf of working gas storage capacity.

[11] Tres Palacios Gas Storage LLC, "Abbreviated Application of Tres Palacios Gas Storage LLC for Amendment to Certificate of Public Convenience and Necessity, Reaffirmation of Market-Based Rate Authority, and Abandonment Authority Under Section 7 of the Natural Gas Act," Docket No. Cp22-xxx-000, October 12, 2022, pages 13-16.

FERC's order notes that "[t]he proposed project is designed to accommodate the unique production profiles of LNG liquefaction facilities; support highly variable loads such as electric generation; and mitigate adverse effects of upstream pipeline disruptions and other temporary capacity constraints."[12]

Q. PLEASE EXPLAIN THE NATURE OF THE FIRM SERVICE WITH KEYSTONE STORAGE.

A. Firm service is the highest priority of service, and it is expected that service interruptions or cuts under a firm service contract will not occur except under very specific circumstances. As stated in Keystone Storage's Operating Statement, "Firm Services under this Agreement are subject to interruptions resulting from Force Majeure, maintenance…, operational flow orders and/or curtailments, whether claimed by [Keystone Gas Storage] or any Interconnecting Pipeline."[13]

Q. HOW HAS THE COMPANY TYPICALLY WITHDRAWN GAS FROM KEYSTONE STORAGE TO SERVE CUSTOMER GAS SUPPLY NEEDS?

A. The Company withdraws gas from Keystone Storage in the winter to serve customers. In recent years, it has used Keystone Storage as a backstop for other flowing gas sources, often nominating aggregate supply levels at an amount greater than forecasted demand. As

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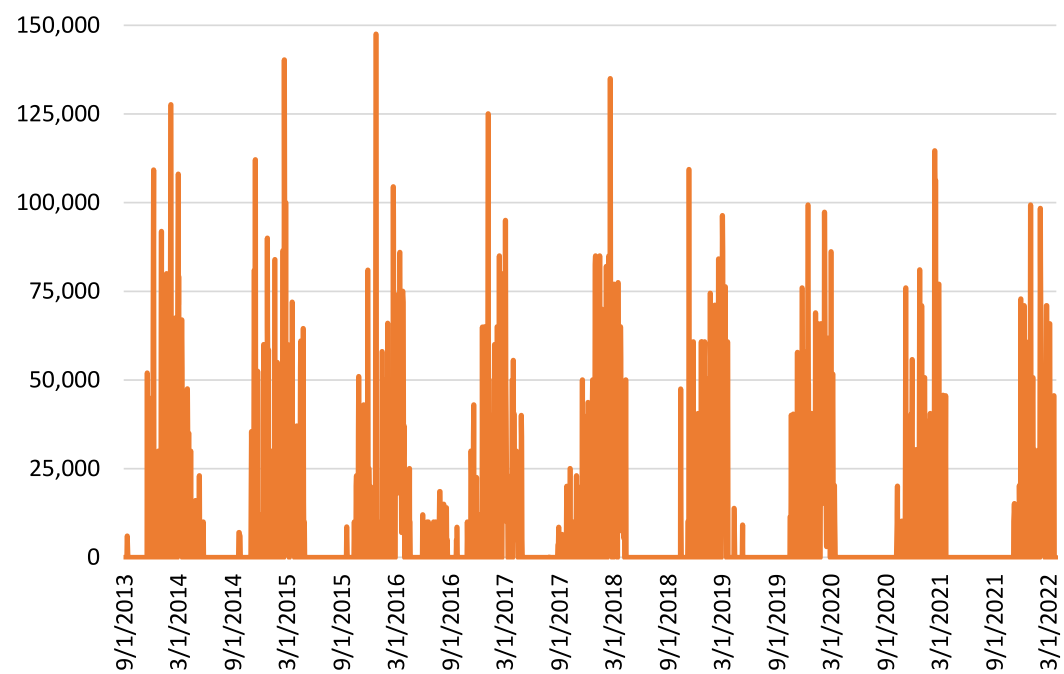
12 Federal Energy Regulatory Commission, "Order Issuing Certificate, LA Storage, LLC," Docket No. CP21-44-000, September 23, 2022, Pages 1-8.

13 Operating Statement for Kinder Morgan Keystone Gas Storage LLC, Version 4.0, Section 7.2, effective October 1, 2015.

shown in Figure 1, NMGC's maximum daily withdrawal from Keystone Storage in the last nine winters was 147,500 MMBtu on December 27, 2015, and its maximum withdrawal in the last four years was 114,631 MMBtu on February 14, 2021.

Figure 1: NMGC Historical Daily Withdrawal Activity at Keystone Storage (MMBtu)

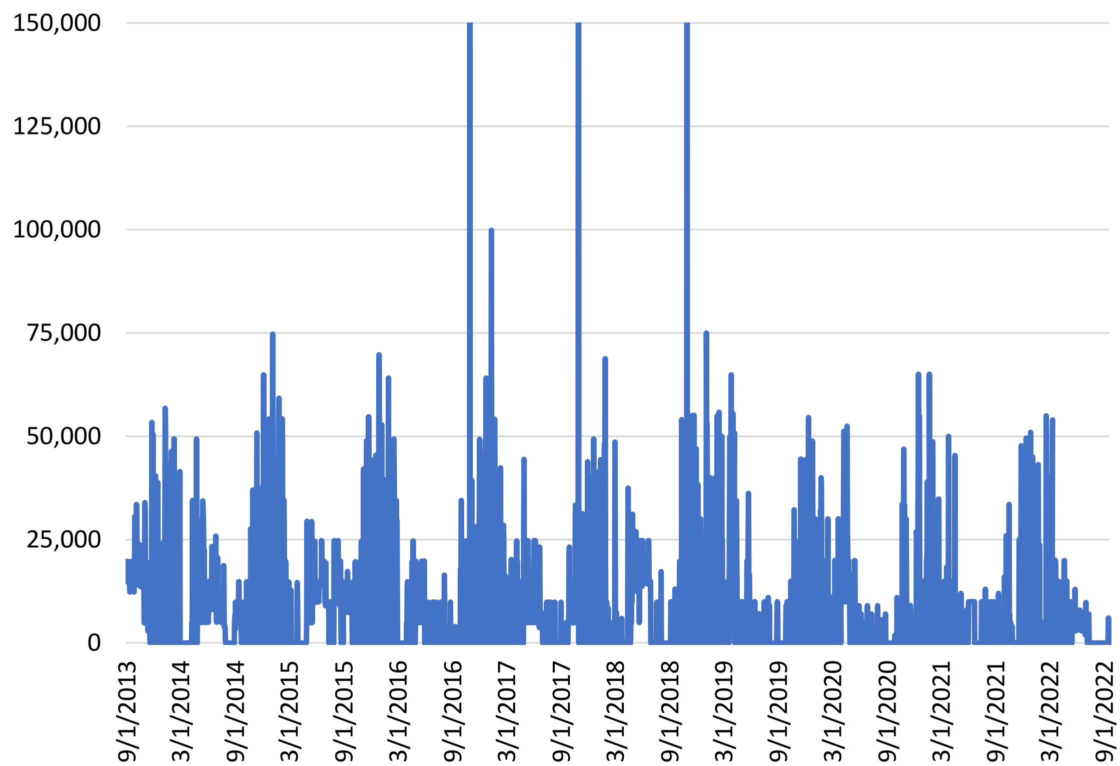


Q. HOW HAS THE COMPANY TYPICALLY INJECTED GAS INTO KEYSTONE STORAGE?

A. The Company injects gas into Keystone Storage year-round as necessary to refill the facility to be ready for the following winter, and to alleviate potential pipeline imbalances. As shown in Figure 2, NMGC's maximum injection in the last nine years was 99,831

MMBtu on January 11, 2017, and its maximum injection in the last four years was 75,000 MMBtu on January 4, 2019.[14]

Figure 2: NMGC Historical Daily Injection Activity at Keystone Storage (MMBtu)



Q. PLEASE DESCRIBE THE KEYSTONE STORAGE HISTORY OF DECLARING FORCE MAJEURES.

A. Keystone Storage has declared force majeures on five occasions in the last 12 years, as summarized in Figure 3. As discussed earlier, in my experience this frequency of force majeures at one facility is very uncommon in the natural gas industry. All five force

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14 October 31, 2016, 2017, and 2018 show injections of approximately 400,000 MMBtu in Figure 2, however these were custody transfers of gas within the storage facility from another party (i.e., "paper transactions") and not physical injections.

majeure events occurred during the winter, and each event had at least one day during or just prior to the event when high temperatures near Keystone Storage were below freezing. During these force majeure events, Keystone Storage's withdrawal rates were significantly impacted. The duration of the force majeures ranged from several hours to nine days, during which withdrawals at Keystone Storage were limited to as little as 140,000 Mcf/day, or 35% of its total maximum withdrawal capacity of 400,000 Mcf/day.

Figure 3: Keystone Storage Force Majeure Summary

Start – End Date	Reason	Lowest Maximum Withdrawal Rate
Feb 2, 2011[15] – Feb 7, 2011[16]	Extremely cold weather conditions resulted in freezing of lines and equipment	Unknown
Dec 29, 2014[17] – Jan 7, 2015[18]	Failure of a dehydration unit	250,000 Mcf/day
Feb 23, 2015[19] – Mar 4, 2015[20]	Failure of withdrawal compression	150,000 Mcf/day
Feb 14, 2021[21] – Feb 15, 2021[22]	Mechanical failure and low field pressure	TW: 140,000 Mcf/day EPNG: 60,000 Mcf/day NNG: 0 Mcf/day
Feb 4, 2022[23] – Feb 4, 2022[24]	Extreme cold temperatures limiting withdrawal ability	EPNG: 300,000 Mcf/day TW & NNG: 160,000 Mcf/day total

15 Keystone Gas Storage Force Majeure Notice, February 02, 2011.

16 Keystone Gas Storage Force Majeure Cancellation Notice, February 07, 2011.

17 Keystone Gas Storage Force Majeure Email, December 29, 2014.

18 Keystone Gas Storage Force Majeure Cancellation Email, January 7, 2015.

19 Keystone Gas Storage Force Majeure Email, February 23, 2015.

20 Keystone Gas Storage Force Majeure Cancellation Email, March 4, 2015.

21 Keystone Gas Storage Force Majeure Notice, February 14, 2021.

22 Keystone Gas Storage Force Majeure Cancellation Notice, February 15, 2021.

23 Keystone Gas Storage Force Majeure Email, February 3, 2022.

24 Keystone Gas Storage Force Majeure Cancellation Email, February 4, 2022.

Q. PLEASE EXPLAIN THE CUT HISTORY ASSOCIATED WITH STORAGE, PRODUCERS AND INTERSTATE PIPELINES FROM WHICH THE COMPANY RECEIVES GAS FOR DELIVERY TO CUSTOMERS.

A. As discussed previously, the Company frequently does not receive all the gas it nominated (or third-party marketers nominated) to serve its customers. As shown in Figures 4 and 5, cuts are higher in the winter months, but cuts are experienced year-round. NMGC had to address gas supply failures of over 1,000 Dth on 85 days in the last two years, which is equivalent to 12% of the time. NMGC had to address gas supply failures of over 1,000 Dth on 15% of the days (22 days) in the winter of 2020/2021 (November-March), and on 11% of the days (16 days) in the winter of 2021/22.

Figure 4: NMGC Daily Cuts (Final, End of Day) – Full Range

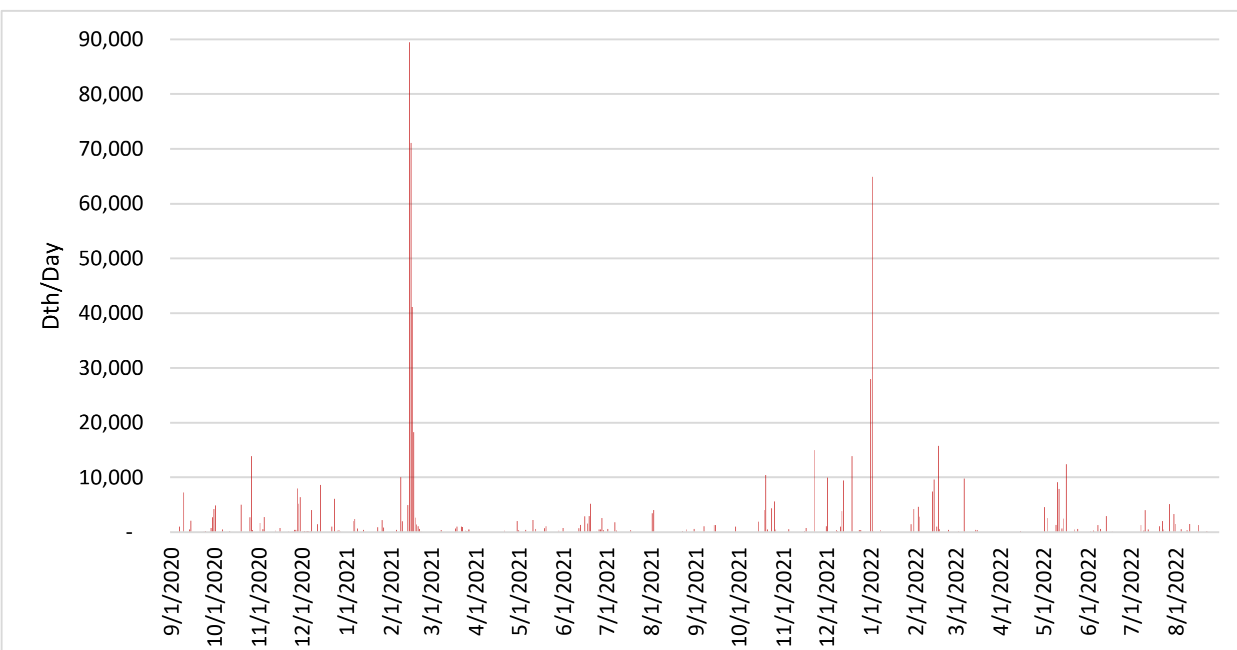
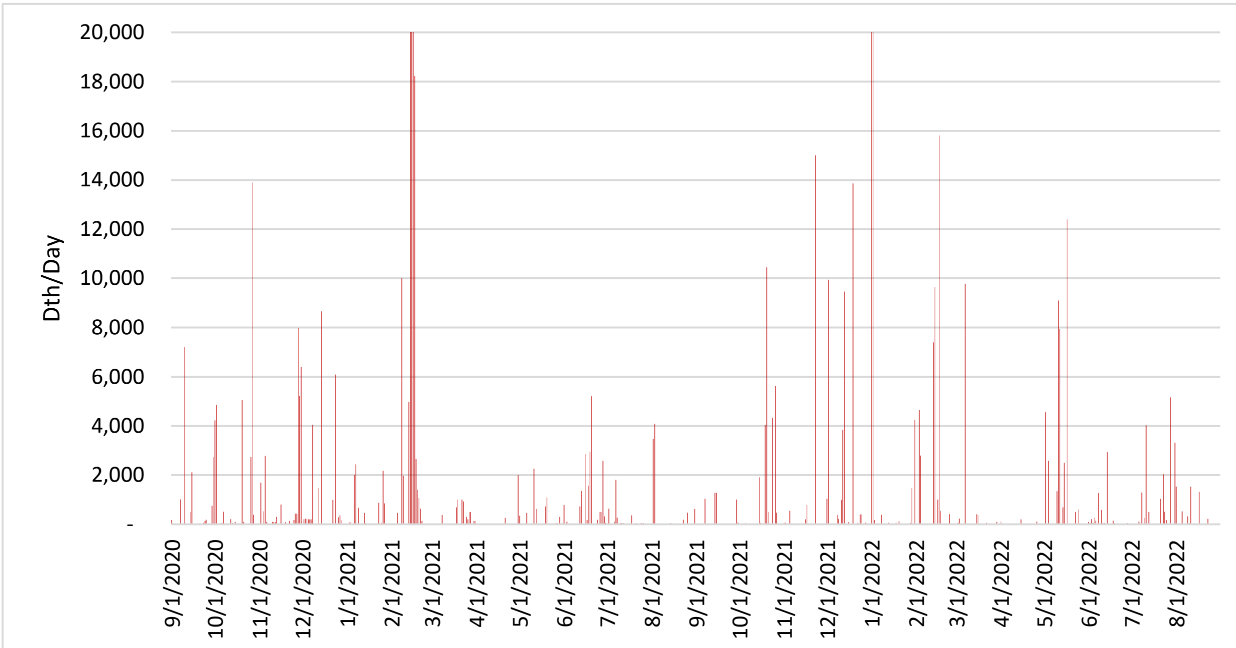


Figure 5: NMGC Daily Cuts (Final, End of Day) – Focus on 0-20,000 Dth/day



Q. WHAT IMPACTS HAVE FORCE MAJEURES AND CUTS AT KEYSTONE STORAGE, PRODUCERS AND INTERSTATE PIPELINES HAD ON NMGC'S CUSTOMERS?

A. Any disruption in planned gas supplies requires NMGC to modify its gas supply plans to serve customers. The extent of the modification depends upon the magnitude of the cut in gas supplies and other market conditions at the time. Twice in the last 12 years, NMGC had to take emergency actions to react to significant gas supply cuts related to force majeures.

During the February 2011 winter storm, Keystone Storage and several gas suppliers declared force majeure events due to the extreme winter weather.[25] While I am not aware of any evidence that Keystone Storage cut NMGC's withdrawals during the storm, Keystone Storage did declare a force majeure and cut withdrawals to other customers, which contributed to overall gas shortage conditions in the market. NMGC did receive cuts from other suppliers, which when combined with peak demand conditions due to the extreme cold, resulted in NMGC having to curtail gas service to approximately 28,000 customers.[26]

During the February 2021 winter storm, Keystone Storage and several gas suppliers declared force majeure events due to the extreme winter weather and as a result, NMGC was forced to make emergency spot market purchases to replace the gas supplies that were cut. Because the price of gas experienced an unprecedented spike during the storm, NMGC incurred extraordinarily high costs to replace the cut gas supplies. Those extreme costs were passed on to customers.

Q. HAVE THESE IMPACTS ON CUSTOMERS BEEN DISCUSSED BY THE COMMISSION?

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25 This cold weather event was unusual in terms of temperature, wind, and duration. It was not, however, entirely without precedent. The Southwest experienced other cold weather events in 1983, 1989, 2003, 2006, 2008, and 2010. FERC/NERC Staff Report on the 2011 Southwest Cold Weather Event, page 169.

26 August 7, 2014 NMGC Management Presentation, page 9.

A. Yes, the Commission conducted detailed reviews of both the February 2011 and February 2021 weather events and the associated customer impacts. As part of those reviews the Commission required NMGC to examine potential solutions to reliability and/or price spikes and make multiple filings to present their findings. Most recently, in an Order dated June 15, 2021, the Commission required the Company to submit a filing "evaluating and assessing potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, that may be adopted to prevent a reoccurrence of this event [the 2021 Winter Event] and the potential for extraordinary gas expenses and curtailments to customers."[27] The Company submitted its compliance filing on March 31, 2022, which explored several options to address reliability and price spikes.

Q. HOW DOES THE COMPANY PLAN TO ADDRESS THE RELIABILITY AND PRICE SPIKE CONCERNS RAISED BY THE COMMISSION?

A. NMGC proposes to build an LNG storage, liquefaction and vaporization facility that will be located on the Company's system as a full or partial replacement for the Company's leased Keystone Storage. The purpose of this case is to obtain a CCN for the development of the proposed LNG Facility.

Q. PLEASE SUMMARIZE THE MAJOR OPERATIONAL FEATURES AND ANTICIPATED COST OF THE PROPOSED LNG FACILITY.

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[27] Final Order, "In the matter of New Mexico Gas Company, Inc.'s Application for an Expedited Variance Approving its Plan for Recovery of the Gas Costs Related to the 2021 Winter Event," Page 39, Paragraph N, Case No. 21-00095-UT, June 15, 2021.

A. The proposed LNG Facility will be located near Rio Rancho, New Mexico adjacent to existing NMGC intrastate transmission lines. It will have a net storage capacity of 1 Bcf, the ability to liquify 10,000 Mscf/day, and have maximum vaporization of 195,000 Mscf/day. The expected capital construction cost for the LNG Facility is approximately $180 million, and the estimated total annual operating expenditures are approximately $3.5 million.[28]

Q. PLEASE DESCRIBE HOW YOUR DIRECT TESTIMONY ALIGNS WITH OTHER TESTIMONY PRESENTED BY THE COMPANY IN THIS CASE.

A. I rely on information and conclusions from other witnesses in this case to develop my conclusions regarding the LNG Facility. The specific direct testimony I rely on is:

- NMGC Witness Tom C. Bullard describes the LNG Facility in detail as well as how it will enhance NMGC's gas supply portfolio and support operations.
- NMGC Witness Daniel P. Yardley discusses the rate impact of the LNG Facility.

Q. HOW IS THE BALANCE OF YOUR DIRECT TESTIMONY ORGANIZED?

A. Section III describes why building a new LNG facility is consistent with sound energy policy related to transitioning to a lower carbon future. Section IV describes the non-economic benefits of the LNG Facility. Section V compares the economics of the NMGC LNG Storage Facility compared to alternatives including continuing with Keystone Storage. Finally, Section VI contains my conclusions.

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[28] Pre-FEED Study, 2022 dollars (NMGC Exhibit TCB-3).

III. BUILDING THE LNG FACILITY IS CONSISTENT WITH CLIMATE CHANGE POLICIES FOR THE NATURAL GAS INDUSTRY

a. Introduction

Q. WHAT TOPIC DO YOU ADDRESS IN THIS SECTION OF YOUR DIRECT TESTIMONY?

A. In this section, I explain why building the LNG Facility is consistent with reasonable climate change policies and carbon reduction goals. As discussed in more detail below, many believe that achieving climate goals will require a reduction in natural gas use. I would caution that the transition away from natural gas will necessarily take time. Natural gas loads will be called for by customers and need to be reliably served for at least the next twenty to thirty years and therefore it is reasonable and prudent, even necessary, to continue to invest in the infrastructure needed to deliver natural gas safely and reliably.

Q. WHAT ARE NEW MEXICO'S CLIMATE CHANGE POLICIES?

A. In 2019 New Mexico's Governor issued an Executive Order that set a goal of reducing the state's carbon emissions by 45% economy-wide from 2005 levels by 2030 and established an interagency Climate Change Task Force ("Task Force") to create a New Mexico Climate Strategy.[29] The Task Force has reported on progress and developed draft climate action plans. In the Spring of 2022, the Task Force convened a Technical Advisory Group to assess the state's climate goals and to offer ideas to strengthen implementing actions. The Task Force plans to release a comprehensive 2023-2028 Climate Action Plan in early 2023.

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[29] Governor Michelle Lujan Grisham, Executive Order 2019-003: Executive Order on Addressing Climate Change and Energy Waste Prevention, January 29, 2019.

Q. WHAT NEW MEXICO STATE CLIMATE CHANGE POLICIES APPLY TO THE FUTURE OF NATURAL GAS USE IN THE STATE?

A. The Task Force has developed building sector emission reduction goals that target building electrification and reducing natural gas use. While the final Climate Action Plan has not been released, proposed building sector goals include:

1) Establish legislation requiring 100% fuel switching of gas space and water heating systems at end-of-life by 2023.
2) Electrify 1/3 of the space and water heating in buildings by 2030 by providing financing and incentives.
3) Establish a building performance standard by 2023 that drives a 33% reduction in commercial gas consumption by 2030.
4) Develop and incentivize the adoption of an all-electric, net-zero-carbon stretch code that is adopted by municipalities representing 50% of New Mexico's population by 2025.[30]

Q. WHAT ARE NMGC AND ITS PARENT COMPANY'S CLIMATE CHANGE GOALS?

A. Emera Inc., NMGC's parent company, has established a climate commitment with a goal to achieve 55% reduction in CO_2 emissions by 2025 and an 80% reduction by 2040 on a path to net-zero emissions by 2050. Emera Inc. has stated that its gas utilities (including NMGC) have identified opportunities to reduce emissions, including reducing transmission

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[30] Technical Advisory Group, "Input on New Mexico's Climate Goals and Implementing Actions: Building Sector Emission Reduction Goals", June 2022

and distribution methane leakage, using compressed natural gas fleet vehicles, increasing energy efficiency, and exploring renewable natural gas opportunities.[31]

Q. HOW IS THE LNG FACILITY CONSISTENT WITH THE CLIMATE CHANGE POLICIES AND GOALS YOU DESCRIBED?

A. While achieving New Mexico's climate goals will require reducing emissions associated with natural gas use, it is highly likely that New Mexico's natural gas distribution infrastructure will need to remain reliable and economically viable for at least the next two to three decades. Using this timeframe, the LNG Facility will support reliability and affordability and is unlikely to increase stranded costs for NMGC. Lastly, low, or no-carbon alternatives, such as energy efficiency are currently not available at the scale necessary to replace the services that will be provided by the proposed LNG Facility.

b. Stranded Costs

Q. ARE YOU CONCERNED ABOUT THE POSSIBILITY OF STRANDED COSTS RESULTING FROM THE CONSTRUCTION OF LONG-LIVED NATURAL GAS INFRASTRUCTURE GIVEN CLIMATE CHANGE POLICIES?

A. No, not for the proposed LNG Facility. As discussed later, if you review this proposed facility over a 20-year or 30-year period or longer, it represents a reliable and economically viable solution to the Company's twin needs of supply certainty and price protection. In addition, NMGC is facing reliability and price volatility issues now, which must be

[31] Emera Inc. 2021 Sustainability Report, June 2022, p. 16, 81

addressed. While there is no definitive path that gas demand will take as a result of climate change policies, I believe that most existing natural gas load will continue to need to be served for the next 20 years or more. Therefore, it is likely that the LNG Facility will continue to provide reliability and price benefits to customers for multiple decades and will not likely result in stranded costs. Given the operational failures that have repeatedly occurred by Keystone Storge, there is no solution to these needs that will not involve some form of replacement infrastructure and additional cost. Based on the analysis discussed later in my Direct Testimony, I agree with NMGC's conclusion that the LNG Facility represents the best choice among the options that have been evaluated.

c. Reliability

Q. WHY IS RELIABILITY STILL IMPORTANT TO A GAS SUPPLY PORTFOLIO, GIVEN CLIMATE CHANGE POLICIES?

A. Climate change goals do not change the need for gas utilities to continue to provide safe and reliable service to customers. Natural gas outages can be dangerous and expensive. Restoration of natural gas service requires physical visits to each service premise to inspect equipment and ensure the safe restart of equipment, and sometimes multiple visits per premise are necessary. Customers can be without heat or hot water for days or weeks, which can create health and safety issues, residents often need to be relocated during the outage, reestablishing service is a labor intensive and expensive process, and buildings without heat can sustain other damage. For example, during the February 2011 winter storm, LDCs in New Mexico, Arizona, and Texas curtailed gas service to more than 50,000 customers due to freeze-offs and equipment reliability issues. During this event, some customers were without natural gas for up to eight days.[32] If one believes that storm severity is increasing as a consequence of climate change, then this increases the need for peaking supplies and contingency resources such as LNG to help prevent outages.

Q. HOW WILL THE LNG FACILITY CONTRIBUTE TO THE RELIABILITY OF NMGC'S GAS SUPPLY PORTFOLIO?

A. Natural gas outages often require customers to withstand cold weather conditions with insufficient heat and often required alternate housing. Therefore, it is imperative that the safety and reliability of the natural gas system be maintained, even during the energy transition that may change the way that natural gas is used in the future. The energy transition timeline and path are uncertain, so it is reasonable for gas utilities like NMGC to take measures to maintain and improve reliability. Adding the LNG Facility, which will be located on the NMGC system and owned and controlled by NMGC will be an important step to improve the reliability of NMGC's gas supply portfolio and provide benefits to all customers for decades.

d. Non-Infrastructure Alternatives

Q. COULD NMGC USE A NON-INFRASTRUCTURE ALTERNATIVE LIKE ENERGY EFFICIENCY TO PROVIDE RELIABILITY AND PRICE BENEFITS INSTEAD OF BUILDING THE LNG FACILITY?

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[32] The FERC and the North American Electric Reliability Corporation, "Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011," August 2011, page 2, 126-134.

A. No. While non-infrastructure alternatives such as energy efficiency certainly provide benefits, what is achievable through NMGC's energy efficiency programs is not large enough to replace the benefits provided by the LNG Facility. NMGC has offered energy efficiency programs since 2009. In its most recent plan, NMGC significantly increased its annual energy efficiency budget to approximately $15 million, consistent with recent legislation that allows utilities to increase energy efficiency program cost caps to 5% of customer bills.[33] With the enhanced programs, NMGC expects customers to save approximately 453,000 Dth annually from its energy efficiency programs, which translates to an average of approximately 1,240 Dth/day.[34] This is a small fraction of the deliverability of the LNG Facility of 195,000 Mcf/day. In addition, savings due to energy efficiency is a passive reduction in load and it cannot be called upon as a resource by the utility when it is needed, making energy efficiency not a perfect substitute for the deliverability of an LNG facility.

Q. COULD NMGC USE A NON-INFRASTRUCTURE ALTERNATIVE LIKE INTERRUPTIBLE LOAD TO PROVIDE RELIABILITY AND PRICE BENEFITS INSTEAD OF BUILDING THE LNG FACILITY AND THEREFORE LOWERING GHG EMISSIONS?

[33] Direct Testimony of Steve L. Casey, In the matter of the Application of New Mexico Gas Company Inc. for approval of its 2023-2025 Energy Efficiency Program Pursuant to the New Mexico Public Utility and Efficient Use of Energy Acts, Case No. 22-00232-UT, August 31, 2022, p. 8-9.

[34] NMGC Exhibit SLC-2, In the matter of the Application of New Mexico Gas Company Inc. for approval of its 2023-2025 Energy Efficiency Program Pursuant to the New Mexico Public Utility and Efficient Use of Energy Acts, Case No. 22-00232-UT, August 31, 2022, p. 25.

A. No. There are interruptible services that NMGC could offer that may reduce demand during peak periods, thus providing reliability and price benefits, however the magnitude will not be enough to replace the benefits provided by the LNG Facility. For example, NMGC is considering initiating an interruptible sales tariff as a non-infrastructure complement to the new LNG Facility. Many gas utilities have interruptible tariffs under which customers agree to be curtailed for the benefit of paying a lower rate than firm customers. Customers on an interruptible tariff usually must attest that they maintain alternate fuel capability or have the ability to shut down operations upon notice from the utility. These customers must curtail within a certain time of receiving the request from the utility (e.g., one hour) or be penalized. The ability to curtail interruptible sales customers upon relatively short notice could provide similar reliability and/or price benefits as an LNG facility depending on the terms of the tariff and the specific curtailment procedures. However, since this interruptible program has never been offered to NMGC customers, it is difficult to estimate what the participation might be, but it is not expected to be similar in magnitude to the benefits provided by the LNG Facility. For example, NMGC believes that fewer than five large end use sales customers have alternate fuel capability, and it is not certain that those customers would be willing to move to interruptible service.

e. Other Utilities

Q. ARE OTHER GAS UTILITIES CONSIDERING NEW INFRASTRUCTURE TO ADDRESS PEAK DAY RELIABILITY, REDUNDANCY, AND PRICE CONCERNS?

A. Yes. Even though climate change policies across the nation often include decarbonization goals such as achieving net zero emissions by 2050, many utilities have recently built, have proposed, or are discussing plans to build LNG facilities to address reliability, redundancy, and price concerns.

Q. PLEASE PROVIDE EXAMPLES OF UTILITIES THAT HAVE RECENTLY BUILT LNG FACILITIES.

A. The following are examples of utilities that have recently built LNG facilities to address reliability, redundancy, and price concerns:

- The Tacoma LNG Facility at the Port of Tacoma in Washington state, built by Puget Sound Energy, began commercial operation in February 2022. The facility stores 8 million gallons (0.66 Bcf) of LNG with a maximum liquefaction rate of 250,000 gallons/day (0.021 Bcf/day) and a maximum vaporization rate of 66,000 Dth/day.[35] The Tacoma LNG Facility will serve both gas utility customers as well as replace diesel fuel for marine customers. The total cost of the regulated utility's portion of the facility is $242 million as of June 30, 2022.[36] Related to serving gas utility customers, Puget Sound Energy states that "The Tacoma LNG Facility meets peak demand and mitigates the risk of the region being served by a single transmission pipeline. When it vaporizes LNG into the gas distribution system, it has the ability to reduce costs, provide alternative supplies during emergencies, improve

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[35] Puget Sound Energy, Inc., 2021Q4FERC Form No. 2, April 15, 2022.

[36] Puget Sound Energy, Inc., 2022 Q2 FERC 10-Q, June 30, 2022.

reliability and deliver an alternate fuel source during planned maintenance activities."[37]

- In the summer of 2021, the Robeson LNG Facility in North Carolina came online.[38] The 1 Bcf LNG facility had a construction cost of approximately $250 million.[39] It is owned and operated by Duke Energy subsidiary Piedmont Natural Gas to "provide significant enhancements to system reliability and operational flexibility that is needed to meet our customers' demand for natural gas during periods of extreme cold weather... As this is a Piedmont asset, we will not be dependent on an outside third party to facilitate the movement of natural gas from the storage tank to our customers under peak conditions."[40]
- The City of Monroe, North Carolina built a $7.5 million LNG facility with a capacity of 68,000 gallons (approximately 6,000 Mcf) to "supplement the City's gas supply during times of peak demand when the cost of gas increases exponentially." The facility came online in January 2021.[41]
- UGI built two new LNG facilities in the last five years. The Bethlehem LNG Facility opened in November 2020 with the ability to store 2 million gallons (0.17

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[37] Tacoma Liquefied Natural Gas (LNG) Facility, https://www.pse.com/pages/energy-supply/natural-gas-storage, Accessed September, 30, 2022.

[38] Robeson Liquefied Natural Gas, https://www.piedmontng.com/Our-Company/Infrastructure-Projects/Robeson-Liquefied-Natural-Gas, accessed September 30, 2022.

[39] Piedmont Natural Gas to build new liquefied natural gas facility in North Carolina, https://news.duke-energy.com/releases/piedmont-natural-gas-to-build-new-liquefied-natural-gas-facility-in-north-carolina, accessed October 6, 2022.

[40] Direct Testimony and Exhibits of Brian R. Weisker On Behalf of Piedmont Natural Gas Company, Docket No. G-9, Sub 781, March 22, 2021, page 10-11.

[41] City of Monroe, "Energy Services Department Holds Ribbon-Cutting Ceremony for Liquefied Natural Gas Plant," Feb 1, 2021.

Bcf) of LNG and vaporize at a maximum rate of 70,000 Dth/day. The Steelton LNG Facility opened in late 2017, storing 2 million gallons (0.17 Bcf) of LNG and vaporizing at a maximum rate of 65,000 Dth/day.[42] Reasons for these projects include addressing regional supply constraints resulting from pipeline delays by meeting peak demand and keeping costs affordable.[43]

- In late 2019, Southwest Gas Corporation ("SWG") placed Tucson LNG in-service at a cost of approximately $76 million.[44] The facility has a capacity of approximately 2.815 million gallons (0.23 Bcf), and a vaporization rate of 65,000 Dth/day. SWG does not have on-site liquefaction and fills the storage tank by trucking in LNG.[45] In its application SWG stated that "The primary purpose of the proposed LNG storage facility is to have readily available local gas supply to dispatch into SWG's distribution system during supply disruption events."[46] As noted previously, SWG had an outage of 19,000 customers during the February 2011 winter event. SWG also stated, "By having readily available local natural gas supply that can be timely dispatched into sections of its distribution system upon demand, an LNG storage facility will support SWG's ongoing efforts to enhance

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42 UGI Corporation, 2018 Annual Report, November 20, 2018.

43 "UGI Energy Services Bethlehem LNG Facility Now Online," Shale Directories.com, November 9, 2020.

44 Southwest Gas Corporation, "Liquefied Natural Gas Facility Construction Report Pursuant to Decision No. 74875," Docket No. G-01551A-14-0024, June 22, 2020, p. 1-2.

45 Southwest Gas Corporation, "Order: In the Matter of the Application of Southwest Gas Corporation for Determination of Prudence and Pre-Approval of Ratemaking Treatment Relating to Construction of Liquefied Natural Gas Storage Facility in Southern Arizona," Docket No. G-01551A-14-0024, December 19 and 20, 2016, Paragraph 5.

46 Southwest Gas Corporation, "Application: In the Matter of the Application of Southwest Gas Corporation for Determination of Prudence and Approval of Cost Recovery Relating to the Construction of a Liquefied Natural Gas Storage Facility," Docket No. G-01551A-14-0024, January 27, 2014, Paragraph 10.

the reliability of segments of its distribution system and mitigate against future service interruptions resulting from supply shortage events."[47] According to SWG's application, "Other advantages of having a storage facility connected to part of SWG's distribution system include: (i) ability to mitigate localized curtailments that could come about due to third-party damage caused by construction or other activities; (ii) mitigating localized interruptions that may result from the performance of required maintenance; and (iii) sustaining local system requirements during times of high system demand."[48] In the Arizona Corporation Commission's approval of Tucson LNG, it stated that "[n]natural gas storage can provide a variety of benefits including price hedging and stability opportunities, enhanced service reliability, and more efficient management of pipeline assets including avoidance of pipeline penalties."[49] It also stated that "[t]here are existing natural gas storage facilities to the east of Arizona… but their distance from Arizona markets reduces their usefulness in comparison to a potential natural gas storage facility in Arizona that would provide ready market access."[50]

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47 Southwest Gas Corporation, "Application: In the Matter of the Application of Southwest Gas Corporation for Determination of Prudence and Approval of Cost Recovery Relating to the Construction of a Liquefied Natural Gas Storage Facility," Docket No. G-01551A-14-0024, January 27, 2014, Paragraph 13.

48 Southwest Gas Corporation, "Application: In the Matter of the Application of Southwest Gas Corporation for Determination of Prudence and Approval of Cost Recovery Relating to the Construction of a Liquefied Natural Gas Storage Facility," Docket No. G-01551A-14-0024, January 27, 2014, Paragraph 14.

49 Arizona Corporation Commission, "Order: In the Matter of the Application of Southwest Gas Corporation for Determination of Prudence and Pre-Approval of Ratemaking Treatment Relating to Construction of Liquefied Natural Gas Storage Facility in Arizona," Decision No. 74875, Docket No. G-01551A-14-0024, December 23, 2014, Paragraph 3.

50 Arizona Corporation Commission, "Order: In the Matter of the Application of Southwest Gas Corporation for Determination of Prudence and Pre-Approval of Ratemaking Treatment Relating to Construction of Liquefied Natural Gas Storage Facility in Arizona," Decision No. 74875, Docket No. G-01551A-14-0024, December 23, 2014, Paragraph 5.

In addition, the Commission recognized that "[t]he LNG proposal is not the lowest cost path option in the short term but does offer some long term benefit to the state of Arizona in the form of local area natural gas storage that could help avoid possible future service interruptions."[51]

Q. PLEASE PROVIDE EXAMPLES OF OTHER UTILITIES THAT HAVE RECENTLY *PROPOSED* TO BUILD LNG FACILITIES.

A. The following are recent examples of utilities that have proposed LNG facilities to address reliability, redundancy, and price concerns:

- In 2019, Dominion Energy Utah (Questar Gas Company) sought and received approval to build a new LNG facility near Magna, Utah, which is currently under construction and expected to be operational in 2022 Q4. The facility will include a 15-million-gallon storage tank (1.2 Bcf), a liquefaction rate of 8,200 Dth/day, and a vaporization rate of 150,000 Dth/day. In its application, Dominion stated that "In recent years, and on repeated occasions, the Company has experienced natural gas supply disruptions, some of which have resulted in supply shortfalls" and "the Company concluded that the best available long-term supply reliability solution to address future supply shortfalls is to construct the DEU-owned LNG Facility with

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[51] Arizona Corporation Commission, "Order: In the Matter of the Application of Southwest Gas Corporation for Determination of Prudence and Pre-Approval of Ratemaking Treatment Relating to Construction of Liquefied Natural Gas Storage Facility in Arizona," Decision No. 74875, Docket No. G-01551A-14-0024, December 23, 2014, Paragraph 9.

liquefaction near the center of the Company's demand center."[52] Regarding the potential for significant supply shortfalls, in the Order approving the Magna LNG facility, the Utah Public Service Commission states "a prudent utility should plan for such a low risk, but high consequence, event."[53]

- On November 18, 2021, the Georgia Public Service Commission adopted a joint stipulation regarding Atlanta Gas Light Company's ("AGL") 2022-2031 Integrated Capacity and Delivery Plan, which includes approval to expand AGL's existing Cherokee LNG Facility.[54] The Cherokee LNG Facility can currently store 2 Bcf of LNG with a vaporization rate of 400,000 Dth/day. AGL's plan is to add an another 2 Bcf storage tank to the site and an additional 400,000 Dth/day of vaporization. The estimated cost of this expansion project is $259 million. AGL states that "AGL proposes to increase the capability of its LNG assets to address not only the increasing firm design day load requirements, but also to meet near-term customer needs in a durationally cold winter," and "[t]he risk around getting a pipeline project scoped, filed, approved, and then constructed in time for a 2023 or 2024 in-service date is not feasible in the current regulatory environment. Accordingly,

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[52] Application for Voluntary Request of Approval of Resource Decision, In the Matter of the Request of Dominion Energy Utah for Approval of a Voluntary Resource Decision to Construct an LNG Facility, April 30, 2019, Paragraphs 1, 6, and 11.

[53] Request of Dominion Energy Utah for Approval of a Voluntary Resource Decision to Construct a Liquified Natural Gas Facility, Order, Docket No. 19-057-13, October 25, 2019, page 11.

[54] Georgia Public Service Commission Order, Atlanta Gas Light Company's 2022-2031 Integrated Capacity and Delivery Plan, Docket No. 43820, Document No. 187725, November 18, 2021.

AGL's proposal to enhance its on-system gas supply capabilities through an expansion at the Cherokee LNG site is the best alternative."[55]

- On December 22, 2021, the Public Service Commission of Wisconsin approved WE Energies' application to build two new LNG plants, Bluff Creek located in La Grange, Wisconsin and Ixonia located in Ixonia, Wisconsin. The total estimated cost of the project is $409 million with $205 for the Bluff Creek LNG and $204 million for the Ixonia LNG.[56] Each facility will store 12 million gallons (1 Bcf) of LNG and include both liquefaction and vaporization equipment.[57] The order indicates "The applicants contend that the project will provide additional benefits, beyond direct monetary benefits, such as increased reliability and resiliency, direct control over natural gas supplies during winter months, a physical hedge against higher prices, and the ability to manage and control additional expansion.[58] When intervenors challenged the need of the new facilities because they allege that commitments to reduce emissions require reducing natural gas demand by 17% by 2030, the Commission stated:

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[55] Atlanta Gas Light Integrated Capacity and Delivery Plan 2022-2031, Docket No. 43820, April 28, 2021, page 19-20.

[56] Public Service Commission of Wisconsin, Application of Wisconsin Electric Power Company and Wisconsin Gas LLC for a Certificate of Authority under Wis. Stat. § 196.49 and Wis. Admin. Code § PSC 133.03 to Construct a System of New Liquefied Natural Gas Facilities and Associated Natural Gas Pipelines near Ixonia and Bluff Creek, Wisconsin, Final Decision, December 22, 2021, page 1.

[57] We Energies' Proposed LNG Peaking Facility in Wisconsin Facing Local Opposition, https://www.naturalgasintel.com/we-energies-proposed-lng-peaking-facility-in-wisconsin-facing-local-opposition/, Accessed October 7, 2022.

[58] Public Service Commission of Wisconsin, Application of Wisconsin Electric Power Company and Wisconsin Gas LLC for a Certificate of Authority under Wis. Stat. § 196.49 and Wis. Admin. Code § PSC 133.03 to Construct a System of New Liquefied Natural Gas Facilities and Associated Natural Gas Pipelines near Ixonia and Bluff Creek, Wisconsin, Final Decision, December 22, 2021, page 16.

> The Commission does not agree with these assertions. Additionally, the Commission is statutorily obligated to carefully weigh the evidence of the record against the backdrop of the statutes and administrative rules from which it derives its jurisdiction. The Commission finds that there is not sufficient evidence in the record to support a 17.0 percent reduction and the applicants' modeling supported the demand projections and load forecasts. The Commission cannot make its decisions based on aspirational goals. While these goals are laudable, the Commission must assess the data and make reasoned decisions based on that information.[59]

- In April 2022, Narragansett Electric proposed the Aquidneck Island Gas Reliability Project, which is a portable LNG facility that will be mobilized seasonally "to address capacity vulnerability and capacity constraints" on Aquidneck Island.[60] This facility is being proposed in response to a January 2019 outage in Newport, Rhode Island. The $15 million[61] facility will store 70,000 gallons (5,775 Mcf) of LNG and vaporize up to 31.3 Dth/day.[62]
- In September 2022, in response to the Minnesota Public Utilities Commission's Order related to gas costs incurred during the February 2021 winter event, CenterPoint Energy discussed the potential for increasing LNG peaking capacity within its service territory. Specifically, CenterPoint Energy is evaluating potential upgrades to its existing liquefaction system to allow for reliable liquefaction in the

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[59] Public Service Commission of Wisconsin, Application of Wisconsin Electric Power Company and Wisconsin Gas LLC for a Certificate of Authority under Wis. Stat. § 196.49 and Wis. Admin. Code § PSC 133.03 to Construct a System of New Liquefied Natural Gas Facilities and Associated Natural Gas Pipelines near Ixonia and Bluff Creek, Wisconsin, Final Decision, December 22, 2021, page 12.

[60] Vhb, "Energy facility Siting Board Project Siting Report: Aquidneck Island Gas Reliability Project, Old Mill Lane Portsmouth, RI," Docket No. SB-2021-04, April 2022, page 1.

[61] Vhb, "Energy facility Siting Board Project Siting Report: Aquidneck Island Gas Reliability Project, Old Mill Lane Portsmouth, RI," Docket No. SB-2021-04, April 2022, page 26.

[62] Vhb, "Energy facility Siting Board Project Siting Report: Aquidneck Island Gas Reliability Project, Old Mill Lane Portsmouth, RI," Docket No. SB-2021-04, April 2022, page 2.

> winter, and they are also studying the feasibility of increasing vaporization output from 72,000 Dth/day to 90,000 Dth/day. These enhancements are necessary because: "peak shaving supplies need to be available to maintain distribution system pressure and capacity during periods of peak demand. However, subject to operational limitations on the use of LNG, upgrading the LNG plant to increase the vaporization output and allow for winter liquefaction may provide some availability to respond to market price spikes. While increasing the daily vaporization output allows greater flexibility to utilize the LNG plant to respond to prices, higher daily usage without any change to the overall storage capacity also means fewer overall days of available storage."[63]

Q. WHAT DO YOU CONCLUDE REGARDING WHETHER BUILDING A NEW LNG FACILITY IS CONSISTENT WITH CLIMATE CHANGE GOALS?

A. As shown by projects across America, decarbonization goals are not inconsistent with prudent and reasonable development such as building an LNG plant that increases reliability and risk management. The importance of managing natural gas system reliability and price spikes can be expected to continue for at least the next 20 – 30 years. This is especially true in a state such as New Mexico, and with a utility such as NMGC where many residential and small business customers throughout the state rely on natural gas to heat their homes. As other regulators have concluded, the need for and economics

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[63] CenterPoint Energy Customer Protection Plan, Attachment B – Detailed Long-Term Modification Evaluation Storage, Peak Shaving, and Curtailments, Docket Nos. G999/CI-21-135 and G008/M-21-138, September 15, 2022, page 8.

of LNG facilities are fully able to be justified even where state policies support decarbonization goals. Similarly, NMGC's proposal to build the LNG Storage Facility to address the Commission concerns about price volatility and energy reliability can be fully reconciled with the state's goals of achieving reductions in carbon emissions.

IV. <u>LNG FACILITY BENEFITS</u>

a. Introduction

Q. WHAT TOPIC DO YOU ADDRESS IN THIS SECTION OF YOUR DIRECT TESTIMONY?

A. In this section, I describe the operational benefits that the LNG Facility will provide to customers by including it in NMGC's gas supply portfolio.

Q. WHAT IS A UTILITY GAS SUPPLY PORTFOLIO AND HOW IS IT DEVELOPED?

A. One of the responsibilities of a gas utility is to develop a portfolio of natural gas supplies that can be delivered to its service territory to serve customer demand. Typical utility supply portfolios consist of some combination of gas supplies purchased at a liquid trading point, long-haul and/or short-haul pipeline capacity, underground storage, peaking supplies (*e.g.*, LNG, liquid propane, propane air, compressed natural gas), and city gate delivered supplies. Not all utilities hold all types of gas supply assets; specific circumstances dictate the types of assets held by a particular utility (*e.g.*, location, access to specific assets, cost, and market conditions).

There are several different approaches to acquiring assets for a gas supply portfolio. Utilities can execute contracts to purchase natural gas supplies and to obtain access to pipeline capacity, storage, or peaking supplies. These contracts typically vary in duration, with contracts for existing infrastructure typically shorter term (*e.g.*, one season to a few years), while contracts for new infrastructure typically longer term (*e.g.*, 10-20 years), although there are exceptions to both. Alternatively, utilities can build or acquire assets – both natural gas supplies and infrastructure – for their gas supply portfolios.

Q. WHAT ARE THE PRIMARY CONSIDERATIONS REGULATED GAS UTILITIES TAKE INTO ACCOUNT WHEN DEVELOPING THEIR GAS PORTFOLIO?

A. The primary consideration is reliability[64] – the ability of the utility to deliver its gas supply to meet its customers forecasted demand under design weather conditions.[65] Design weather for a gas utility represents extremely cold weather conditions for which a utility plans to serve customer demand. A secondary, but important consideration, is obtaining gas resources on a cost-effective basis, which includes consideration of the ability to mitigate price volatility as called for in the Commission's June 15, 2021 Final Order.[66] As

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[64] Commission Rule 17.7.4.11, part A. "The utility shall evaluate the ability of its natural gas resources to provide adequate redundancy of supply and of delivery systems."

[65] NMGC employs a gas portfolio design criteria based on historical weather data measured using a refinement of Heating Degree Days ("HDD"), which includes the effect of wind on space heating requirements, which is termed an Effective Degree Day ("EDD"). Design day EDDs range from 64 EDD to 76 EDD throughout NMGC's service territory. NMGC 2016 Integrated Resource Plan, page 18-19.

[66] Final Order, "In the matter of New Mexico Gas Company, Inc.'s Application for an Expedited Variance Approving its Plan for Recovery of the Gas Costs Related to the 2021 Winter Event," Page 17, Paragraph iii., Case No. 21-00095-UT, June 15, 2021.

is discussed below, the LNG Facility will contribute to NMGC's ability to manage reliability and mitigate the effects of price spikes on customers.

Q. WHAT OTHER FACTORS ARE IMPORTANT TO CONSIDER WHEN DEVELOPING A GAS SUPPLY PORTFOLIO?

A. In addition to type of asset and method of acquisition, there are several other factors to consider when choosing assets to include in a gas supply portfolio. Other important considerations include flexibility, diversity, safety, and operational considerations, such as direct control versus third-party control. As will be discussed, the LNG Facility will positively impact each of these considerations.

b. Reliability

Q. WHY IS RELIABILITY IMPORTANT TO A GAS SUPPLY PORTFOLIO?

A. Utilities have an obligation to serve firm customers and natural gas outages are dangerous and expensive, so it is critical that the supply portfolio provide utilities with reliable delivered gas supplies. Losing natural gas service in the winter can cause serious health and safety issues if people are without heat. Some natural gas interruptions have lasted for several weeks, during which customers are without heat and hot water and often require alternate housing. As a result, maintaining reliability is a foundational principle of providing natural gas service and must be considered as part of the supply planning process. Generally, utilities back-up their obligations to firm customers with firm supply contracts and corresponding firm pipeline transportation capacity or other firm contracts. NMGC notes that it "holds firm rights for adequate capacity to serve its customers," and "has entered into contracts which specify supply exclusivity and replacement provisions, higher degrees of supply reliability, greater nomination options, and or/delivery point flexibility."[67] These considerations also apply to the use of natural gas as a "bridging" fuel for electric generation. As the nation saw during Winter Storm Uri, failures in natural gas delivery can lead to widespread unavailability of natural gas-fired generation facilities, which in turn can lead to further failures in the electric and gas infrastructure.

Q. PLEASE DESCRIBE THE RELIABILITY ISSUES THAT NMGC HAS EXPERIENCED WITH ITS CURRENT GAS SUPPLY PORTFOLIO.

A. As I described previously, NMGC has experienced numerous incidents where natural gas it had planned to deliver to its customers was unavailable. These reliability issues have been caused by failures of some combination of producers, interstate pipelines, and Keystone Storage at various times. When these failures occur, NMGC is forced to attempt to develop alternate gas supply and delivery plans to ensure reliability to its customers. Sometimes these alternate gas supply and delivery plans are more expensive than the Company's original plans, but these expenses must be incurred to prevent outages for NMGC's customers. The LNG Facility will enhance the reliability of NMGC's gas supply portfolio adding a reliable asset and eventually eliminating an asset that has had reliability issues in the past.

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[67] New Mexico Gas Company, 2020 Integrated Resource Plan, April 16, 2020, p. 18 and 19.

Q. HOW DOES THE LNG FACILITY CONTRIBUTE TO THE RELIABILITY OF NMGC'S GAS SUPPLY PORTFOLIO?

A. There are several factors that will enhance the reliability of the LNG Facility compared to Keystone Storage and other alternatives. Most importantly, the proposed LNG Facility will be a local asset. It will be located within NMGC's service territory and directly feed NMGC's system. This direct connection eliminates the need to use upstream third-party pipeline transportation to deliver the vaporized LNG when needed in the winter to serve customers. Second, the LNG Facility will be owned and operated by NMGC, which provides NMGC much more control over how the facility is operated and maintained. Third, because it is owned and operated by NMGC, it can ensure that the facility is built with the proper weatherization and necessary backup to withstand cold weather conditions, so it is able to operate during extreme weather events. FERC noted similar concepts in its report on the 2011 outages:

> Additional gas storage capacity in Arizona and New Mexico could have prevented many of the outages that occurred by making additional supply available during the periods of peak demand. Natural gas storage is a key component of the natural gas grid that helps maintain reliability of gas supplies during periods of high demand. Storage can help LDCs maintain adequate supply during periods of heavy demand by supplementing pipeline capacity, and can serve as backup supply in case of interruptions in wellhead production. Additional gas storage capacity in the downstream market areas closer to demand centers in Arizona and New Mexico could have prevented most of the outages that occurred by making additional supply available in a more timely manner during peak demand periods.[68]

[68] Staffs of the Federal Energy Regulatory Commission and the North American Electric Reliability Corporation, "Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011: Causes and Recommendations," August 2011, pages 213-214.

c. Ability to Meet Forecasted Demand

Q. WHY IS THE ABILITY TO MEET FORECASTED DEMAND IMPORTANT TO A UTILITY GAS SUPPLY PORTFOLIO?

A. Because gas utilities are required to meet firm customers' needs under a variety of weather and economic conditions, and because factors such as future weather are difficult to predict, utilities typically build gas supply portfolios that can meet customers' forecasted needs under a wide range of demand scenarios. For example, it is important to ensure that a utility's gas supply portfolio is sufficient to meet customer demands under extreme cold conditions, known as "design day," "design winter," and "design year," Which includes meeting all firm demands. It is also critical that a utility's gas supply portfolio be designed to serve daily fluctuations in demand that occur as a result of changing weather. It is not appropriate to plan solely for an average demand day, as many days will have demand that exceeds an average day and utilities have an obligation to serve and are responsible for delivering under extreme weather conditions. It is also not appropriate to solely plan for a design day as duration of weather events and winter periods must also be considered in portfolio planning.

Q. HOW DOES THE LNG FACILITY CONTRIBUTE TO THE ABILITY OF NMGC'S GAS SUPPLY PORTFOLIO TO MEET FORECASTED DEMAND?

A. The overall ability of NMGC's gas supply portfolio to meet forecasted demand is addressed in its integrated resource plans ("IRPs") that are filed periodically with the Commission in accordance with Rule 17.7.4 NMAC. NMGC filed its most recent IRP on April 16, 2020

("2020 IRP").[69] In its 2020 IRP, NMGC presents a design day load expectation of approximately 880,000 Dth/day for the Northwest, Southeast, and Independent Systems combined for the winter of 2020-2021 and approximately 960,000 Dth/day for the winter of 2029-2030.[70] NMGC indicates that demand will be served with a combination of shipper supplies, baseload contracts, flex contracts, peaking contracts, and storage. The LNG Facility will ultimately be replacing all or part of the capacity and deliverability provided by Keystone Storage, and the LNG Facility will have the same withdrawal/vaporization rate as NMGC's Keystone Storage contract. Further, the LNG Facility, unlike Keystone Storage, does not experience a ratchet down in its delivery capability based on inventory levels and month of the year. Therefore, substituting the LNG Facility for Keystone Storage will maintain the ability of NMGC's portfolio to meet forecasted demand on design day. Although the LNG Facility will have lower overall storage capacity (1 Bcf at the LNG Facility compared to 2.7 Bcf at Keystone Storage) and lower injection/liquefaction capability (10,000 Mcf/day at the LNG Facility compared to 75,000 Mcf/day at Keystone Storage), it will have equal daily withdrawal capabilities. More importantly, the Company will have confidence that the gas can be delivered into its distribution network as the LNG Facility is a locally situated asset under the direct control of the Company. For these reasons, the Company is confident that the LNG Facility will allow it to continuously serve customers as part of its gas portfolio design criteria.

[69] New Mexico Gas Company, 2020 Integrated Resource Plan, April 16, 2020, p. 3.

[70] New Mexico Gas Company, 2020 Integrated Resource Plan, April 16, 2020, p. 17.

d. Cost Level and Cost Stability

Q. WHY IS COST LEVEL AND COST STABILITY IMPORTANT TO A GAS SUPPLY PORTFOLIO?

A. The total cost to acquire and deliver gas supply to customers is an important factor for utilities to consider when developing a gas supply portfolio to ensure that customers are being served in a reliable yet cost effective manner. Cost effectiveness encompasses both the absolute cost level as well as cost stability. Especially for assets that have long lives or long-term contracts, it is important to not only consider cost today, but the potential for significant changes in costs over time. Cost stability is one reason that many LDCs utilize hedging (either physically through storage or through financial products) as part of their overall gas supply portfolio strategy.

Q. HOW DOES THE LNG FACILITY CONTRIBUTE TO A COST EFFECTIVE AND STABLE COST PORTFOLIO?

A. NMGC plans to enter the winter with the LNG Facility mostly full, so the cost of the LNG will be known and fixed for the majority of the winter.[71] Having a supply of LNG at a fixed price will provide customers with a physical price hedge and the opportunity for NMGC to avoid expensive market purchases during peak price events. An example of how this could have changed the cost of gas during Storm Uri is discussed later in my Direct Testimony.

[71] If the Company chooses to refill the LNG Facility mid-winter to replace any LNG vaporized early in the season, it will change the LNG price for the remainder of the winter, but the LNG price will still be known and not subject to day-to-day fluctuations.

In addition, the LNG Facility will allow the Company the opportunity to minimize pipeline imbalances by using the LNG Facility's ability to make real-time changes to vaporization and/or liquefaction. Pipelines require shippers to use close to the same amount of gas as they put into the pipeline, with differences captured as imbalances. Imbalance penalties can be significant if imbalances are beyond certain thresholds, especially during periods of pipeline stress. Using the LNG Facility's intraday flexibility to limit pipeline imbalances will provide additional cost benefits to NMGC's portfolio.

Lastly, as discussed in Section V below, the LNG Facility is a cost-effective replacement for Keystone Storage when compared to alternatives.

e. Flexibility

Q. WHY IS FLEXIBILITY IMPORTANT TO A GAS SUPPLY PORTFOLIO?

A. Flexibility refers to the ability of a gas supply portfolio to serve potentially changing needs. The flexibility to access multiple supply sources, to allow for intraday load swings, or provide service to accommodate shifting load centers over time are examples of flexibility that certain assets could provide that would add value to a gas supply portfolio. NMGC states that "[b]y having multiple supply sources and contract options, NMGC has greater flexibility in the event supply from a geographical area is disrupted or a specific supplier fails to perform."[72] Weather, market conditions, and operational

[72] New Mexico Gas Company, 2020 Integrated Resource Plan, April 16, 2020, p. 18.

conditions are constantly changing, so it is important to build a gas supply portfolio with the flexibility to handle these changes.

Q. HOW DOES THE LNG FACILITY CONTRIBUTE TO THE FLEXIBILITY OF NMGC'S GAS SUPPLY PORTFOLIO?

A. The LNG Facility will contribute to flexibility by allowing for intraday changes to the injections/liquefaction and withdrawals/vaporization operations at the plant. Most pipeline and storage nominations can only be made during pre-specified windows of time in advance of the gas being delivered. Currently there are five nomination periods – two day-ahead periods for gas to be delivered the following day starting at 8AM (mountain) and three intraday periods. Some pipelines and storage facilities offer services that allow for changes between the nomination periods, but these services are not always available and come at a premium cost. In contrast, the LNG Facility will be able to respond quickly to intraday changes in customer demand as it will be locally controlled by NMGC and not subject to pipeline and storage nomination schedules or balancing requirements. In addition, most pipeline and storage facilities require deliveries to be fairly constant throughout a 24-hour day. In contrast, the LNG Facility will allow for as much swing as is necessary within the day (e.g., the LNG Facility could run for one hour and be shut down if supply is only needed for an hour), which provides significantly more flexibility. NMGC noted this benefit in its most recent IRP, "In order for gas storage to be the most effective to meet the needs of NMGC's customers, it should be as near as possible to major demand areas. If storage is located directly on the NMGC system rather than an interstate pipeline, NMGC can dispatch gas based on need rather than being limited to the natural gas scheduling cycles, which could delay gas flow for hours."[73]

f. Diversity

Q. WHY IS DIVERSITY IMPORTANT TO A GAS SUPPLY PORTFOLIO?

A. Having access to a diverse range of gas supplies, transportation paths, and types of assets in the portfolio provides value in the sense that it provides the opportunity to mitigate potential supply cuts, the effects of a price spike, and/or to take advantage of lower prices in different locations. For example, if a utility purchases all its gas from one remote supply location, and has not financially hedged, its customers will be subject to price swings experienced in that supply location. Adding diversity to an LDC's portfolio through access to multiple supply locations or through added storage (a physical hedge) can provide value by mitigating the effects of cuts or price swings.

Q, HOW DOES THE LNG FACILITY CONTRIBUTE TO THE DIVERSITY OF NMGC'S GAS SUPPLY PORTFOLIO?

A. NMGC states its "gas supply strategy consists of diversifying supplies between supply basins, among multiple suppliers, differing contract types, and contracting for gas storage. Sourcing supplies from multiple supply basins in the event a supply basin underperforms due to production or processing reductions."[74] While the LNG Facility is not a "supply basin" per se, it represents a brand-new source of supply with the ability to hedge through

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[73] New Mexico Gas Company, 2020 Integrated Resource Plan, April 16, 2020, p. 19.

[74] New Mexico Gas Company, 2020 Integrated Resource Plan, April 16, 2020, p. 18.

off-peak purchases. In addition, the LNG Facility will directly connect to NMGC's system without relying on interstate pipelines creating a new path for delivery of natural gas supplies. Both of these features of the LNG Facility will increase the diversity of NMGC's gas supply portfolio.

g. Safety

Q. WHY IS SAFETY IMPORTANT TO A GAS SUPPLY PORTFOLIO?

A. Natural gas is combustible, so it is extremely important that it be handled safely at all times. Strict safety standards have been developed that require that natural gas be produced, stored, and transported according to specific requirements. Operators throughout the natural gas supply chain – from producers and gathers, to interstate pipelines, to local distribution companies – must follow strict federal and state safety standards when transporting and storing natural gas. LNG is identified specifically in U.S. safety standards. The U.S. Pipeline Hazardous Materials Safety Administration ("PHMSA") is the designated administrator of the U.S. Code of Federal Regulations ("CFR") Part 193, which details the federal safety standards related to liquefied natural gas facilities. These standards require operators such as NMGC to adhere to strict safety and compliance standards, including but not limited to: siting requirements, design standards, construction standards, equipment standards, operational requirements and maintenance requirements. In addition, LNG operations personnel must undergo qualification training and periodic testing (i.e., Operator Qualification, or "OQ"). Other aspects of CFR 193 include fire protection and plant security.[75]

Q. DOES THE PROPOSED LNG FACILITY COMPORT WITH THESE SAFETY REGULATIONS?

A. My understanding is that the LNG Facility will be built in accordance with the CFR 193 safety requirements, including compliance with containment requirements and site size and location requirements. Overall, LNG facilities have a low accident and incident rate and are considered safe. The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration requires operators to submit incident reports related to incidents and accidents. Since January 2011, 33 LNG related incidents were reported, and one-third were at import/export LNG facilities. There was no loss of life associated with these incidents and only one injury that required brief hospitalization.[76]

h. Operations

Q. WHY ARE DISTRIBUTION OPERATIONS IMPORTANT TO A GAS SUPPLY PORTFOLIO?

A. Operational considerations must be factored into the gas supply portfolio building process due to the specific configurations of a distribution system, the size, location, and needs of

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75 Title 49 / Subtitle B / Chapter I / Subchapter D / Part 193 of the U.S. Code of Federal Regulations.

76 U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration, "Liquified Natural Gas (LNG) Incident Data – January 2011 to present," accessed September 28, 2022.

customers, and the ability of gas to be transported across the distribution system. Due to the unique characteristics of distribution systems, utilities may have requirements to receive certain amounts of natural gas at specific locations on their system to maintain delivery pressures, serve growing loads and/or allow for greater flexibility or security of supply. These operational considerations also play a role in determining an appropriate gas supply portfolio.

Q. HOW DOES THE LNG FACILITY PROVIDE OPERATIONAL BENEFITS TO NMGC'S GAS SUPPLY PORTFOLIO?

A. The LNG Facility provides operational benefits to NMGC's distribution system because it will be physically located within NMGC's Northwest System, providing direct supplies to NMGC's largest and highest-demand area. Not only will this support demand in the Northwest System, but it will also reduce the need to transport gas from the Permian Basin across the state to reach the Northwest System, alleviating potential constraints on the EPNG and TW pipelines and creating additional supply availability for NMGC's Southeast System by displacement. In addition, the LNG Facility will allow LNG liquid to be off-loaded from the facility into a truck, which can then be delivered and vaporized into the distribution system at critical points to provide operational support in the event of distribution system maintenance or operational issues.

V. ECONOMIC COMPARISON OF THE NMGC LNG STORAGE FACILITY TO ALTERNATIVES

a. Introduction

Q. WHAT TOPIC DO YOU ADDRESS IN THIS SECTION OF YOUR DIRECT TESTIMONY?

A. In this portion of my Direct Testimony, I will address each of the ten non-LNG alternatives considered in past NMGC regulatory proceedings, compare on a financial and operational basis the most likely viable non-LNG alternatives to NMGC's proposed LNG Facility, and also compare these alternatives to the costs of continuing with an extension of the Keystone Storage contract.

Q. DID YOU CONSIDER CONTINUING WITH AN EXTENSION OF KEYSTONE STORAGE CONTRACT TO BE A VIABLE LONG-TERM ALTERNATIVE?

A. No, not without additional resources that enhance supply reliability and address the need for price spike mitigation. Keystone Storage alone will not provide an adequate solution to reliability concerns due to its own history of unreliability, as evidenced by the number of force majeures Keystone Storage called during recent years. Since Keystone Storage does not adequately meet the initial criterion of alleviating NMGC's concerns, it was not evaluated as a potential solution, but costs for Keystone Storage have been projected as a point of comparison to the three potential viable on-system storage alternatives described below.

b. Supply Options Considered in Past Regulatory Proceedings

Q. DID YOU REVIEW THE COMPANY'S PROPOSED SUPPLY PORTFOLIO OPTIONS IN PAST REGULATORY PROCEEDINGS?

A. Yes, I did. Specifically, my review focused on three significant regulatory proceedings:

(i) Case No. 12-00364-UT, "In the Matter of New Mexico Gas Company Inc.'s Application for the Issuance of a Certificate of Public Convenience and Necessity to Construct a Liquefied Natural Gas Facility" Application filed October 25, 2011 (the "2012 CCN Filing");

(ii) Case No. 16-00097-UT, "In the Matter of the Application of New Mexico Gas Company Inc. for the Approval of its Proposed Solution to the February 2011 Supply Interruption" Compliance Filing dated April 18, 2016 (the "Proposed Solution Filing"), and

(iii)Case No. 21-00095-UT, "In the Matter of New Mexico Gas Company Inc.'s Application for an Expedited Variance Approving its Plan for Recovery of the Gas Costs Related to the 2021 Winter Event" Compliance Filing dated March 31, 2022 (the "2021 Winter Event Filing").

Q. PLEASE DESCRIBE THE SIGNIFICANCE TO YOUR DIRECT TESTIMONY OF THE COMPANY'S 2012 CCN FILING.

A. The 2012 CCN Filing was in reaction to a "once in 50-year storm in the southwestern United States,"[77] which resulted in the Company's interruption of service to approximately 28,000 of its customers. In that proceeding the Company requested approval of a 200 million cubic feet (MMcf), or 0.2 Bcf LNG storage tank, an LNG truck receiving terminal and an LNG vaporizer system. The LNG vaporizer system would have provided up to 100 MMcf per day into the Company's distribution system near NMGC's Santa Fe Junction in

[77] Application, Case No. 12-000364-UT, page 2.

Bernalillo County.[78] Significantly, in hindsight, the "once in 50-year storm" which occurred in 2011 would occur again eleven years later.

Q. PLEASE DESCRIBE THE SIGNIFICANCE TO THIS TESTIMONY OF THE PROPOSED SOLUTION FILING FROM 2016.

A. After the Company withdrew its application in the 2012 CCN Filing in response to opposition to its proposed $40 million LNG project, the Company agreed to take a fresh look at alternatives that may lead the Company to reevaluate the scope and cost of the withdrawn project.[79] This filing was provided for in the Stipulation approving the TECO Energy acquisition of NMGC in 2013.[80] The significance of this 2016 filing to this testimony is that in 2016 the Company "determined that the gas supply, transportation, and system enhancements completed since February 2011, combined with those enhancements that are currently in progress, provide NMGC's customers with improved gas supply reliability at a reasonable cost."[81] Indeed, in hindsight, the Company's "gas supply, transportation, and system enhancements" were proven effective against customer curtailments during the 2021 winter event; however, these improvements were insufficient to protect against extraordinarily high-priced spot market purchases necessary to meet the Company's forecasted demand.

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[78] Ibid, page 3.

[79] Case No. 16-00097-UT, Compliance filing page 2.

[80] NMPRC Case No. 13-00231-UT.

[81] Ibid, page 3.

Q. PLEASE DESCRIBE THE SIGNIFICANCE OF THE 2021 WINTER EVENT FILING.

A. The Company's application for a CCN is a direct response to the Commission's requirement in its Final Order dated June 15, 2021 in Case No. 21-00095-UT, that the Company address storage options. The Company's compliance filing in March 2022 and this Application are made "pursuant to the Commission's Final Order dated June 15, 2021 in Case No. 21-00095-UT, calling for an evaluation and assessment of potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, that may be adopted to prevent a reoccurrence of the 2021 Winter Event and the potential for extraordinary gas expenses and curtailments to customers."[82]

Q. PLEASE SUMMARIZE THE GAS SUPPLY OPTIONS EXPLORED IN THE 2012 CCN FILING, THE PROPOSED SOLUTION FILING AND THE 2021 WINTER EVENT FILING.

A. Each of these filings explored LNG as well as non-LNG supply options that could potentially address the reliability and customer demand concerns. In the course of completing the Company's March 31, 2022 Compliance Filing in the 2021 Winter Event Filing NMGC contracted with Campos Engineering to produce a "Storage Options

[82] Case No. 21-00095-UT Compliance filing, page 1.

Report".[83] Table 12 of the Storage Options Report cited seven options evaluated by Campos.

My review of this information concludes that Campos Engineering added three new options above and beyond the options considered in prior filings: 1) Acquisition or Drilling of Production Wells, 2) New Supply Points, and 3) Compressed Natural gas ("CNG") Facilities. The other options in the Storage Options Report are consistent with those found in the First CCN Filing and the Proposed Solution Filing. The non-LNG options from these three filings are summarized as follows in Table 2:

[83] Testimony of Thomas Bullard, Attachment, Case No. 21-00095-UT.

Table 2: Summary of Non-LNG Supply Options

Non-LNG Supply Option		First CCN Filing	Proposed Solution Filing	2021 Winter Event Filing
1)	Adding storage in West Texas (expanding Keystone Storage)	X	X	X
2)	Building a pipeline from the Raton Basin to NMGC's Northwest System	X	X	
3)	Developing a local gas storage field	X	X	X
4)	Looping of the Rio Puerco Mainline	X		
5)	Adding additional compression to the Rio Puerco Interconnect	X		
6)	Propane Air Facilities		X	X
7)	Other New Pipelines (Ojito, East Mountain)		X	
8)	Acquisition or Drilling of Production Wells			X
9)	New Supply Points			X
10)	CNG Facilities			X

Q. ARE ALL OF THESE NON-LNG SUPPLY OPTIONS VIABLE?

A. No. Of the ten options listed in above, five alternatives are either not viable on either a financial or operational basis or have been completed already by the Company.

Q. WHAT FIVE OF THE TEN OPTIONS PRESENTED IN TABLE 2 ARE NOT CURRENTLY VIABLE, AND WHY?

A. The following options are not currently viable and are therefore not included in my financial and operational analysis:

Option 2: Building a pipeline from the Raton Basin to NMGC's Northwest System. This option was previously rejected by NMGC in the First CCN Filing because of high construction costs, the difficulty of constructing a pipeline across mountainous terrain and environmentally sensitive areas, and the ongoing reliance on Raton Basin natural gas supplies and/or production facilities. In the Proposed Solution Filing this option was also rejected based on a construction cost estimate of $215 million compared to the then-cost estimate of $40 million for the LNG configuration under consideration at that time. In support of my testimony development, I requested the NMGC Engineering team provide a high-level cost estimate for a 141-mile, 16-inch steel transmission pipeline. Their high - level estimate is currently $257 million, significantly in excess of the Company's proposed LNG facility. Lastly, an additional pipeline resource does not solve the Company's reliance on remote, third-party supplier performance. For these reasons this option should be rejected.

Option 4: Looping of the Rio Puerco Mainline. The Company has completed construction of this option and it is currently in service.

Option 5: Adding additional compression to the Rio Puerco Interconnect. As with Option 3**, t**he Company has also completed construction of this option and it is currently in service.

Option 7: Building Other New Pipelines. Rejection of this alternative is based on the high projected cost of new pipelines ($1.823 million per mile using the new cost estimate for Option 2) and lack of local control. As was the case for Option 2, adding new gas supplies may not increase reliability or the system's ability to avoid future price spikes, due to continued reliance on upstream suppliers and pipeline infrastructure.

Option 9: New Supply Points. Although the addition of new supply points may help in supply diversification, it does not address the reliability concerns of the Company, as these supply points are reliant on third-party interstate pipelines that may subject the Company to supply cuts like other pipeline cuts during past winter events. Further, increasing supplier diversity does not address the Commission's directive calling for an evaluation and assessment of potential measures, and specifically, increased access to stored gas, including possible NMGC owned or controlled storage facilities, that may be adopted to prevent a reoccurrence of the 2021 Winter Event and the potential for extraordinary gas expenses and curtailments to customers.[84] As was the case with Winter Storm Uri, gas price spikes can extend across an area exceeding 1,000 miles, and the diversification of supply points may not reduce the risk of a broad supply-area shortage or resulting dramatic increase in prices.

[84] Final Order dated June 15, 2021 in Case No. 21-00095-UT.

c. Evaluation of Feasible Non-LNG Storage Alternatives

Q. WHAT CRITERIA DID YOU APPLY TO YOUR EVALUATION OF THE NON-LNG ALTERNATIVES?

A. As described below, and in the testimony of NMGC Witness Bullard, the primary benefit of an on-system LNG Facility is the reliability of access to stored gas it provides to the Company. Therefore, the overarching criterion that a non-LNG alternative must satisfy is reliability. Alternatives should meet the same level of reliability as the proposed LNG Facility, or at a minimum a level of reliability that would ensure that customers will not lose service as a result of upstream supply cuts. The second benefit afforded by the LNG Facility is its ability to provide storage gas to the Company's system that provides additional protection to the Company's customers against price volatility. Accordingly, a second criterion considered is the ability of the non-LNG alternative to provide supply during extremely high-priced market conditions when the Company must purchase replacement gas[85] in the spot market. The ability to provide replacement gas could potentially save NMGC customers millions of dollars in avoided costs. Although not as critical as NMGC's reliability criteria, the ability to supply replacement gas must be considered to fairly compare the non-LNG alternatives to the Company's proposed LNG Facility.

[85] I use the term "replacement gas" to define gas purchases necessitated by upstream supply cuts, and not normal "swing gas", which is an anticipated part of a reasonable gas supply strategy.

Q. PLEASE DESCRIBE THE REMAINING FIVE VIABLE NON-LNG ALTERNATIVES USING YOUR CRITERIA DEFINED ABOVE.

A. The remaining five non-LNG alternatives I evaluated are as follows:

Option 1: Adding Additional Storage out of West Texas. This non-LNG alternative *may* meet reliability needs *only if* the new storage facility has adequate additional storage and daily delivery capabilities as would the proposed LNG facility. Presumably this additional storage facility would be owned and operated by a third-party, which could contractually guarantee such capabilities. This alternative could also provide replacement gas in the event supply cuts occur on pipelines other than the pipeline used by the new storage facility. I am not aware of any new West Texas storage projects either under development or of any feasibility studies being conducted by third-party developers, which effectively renders this alternative moot in comparison to an LNG facility that can be managed to a build schedule and be in service by 2027.

Option 3: Developing a local gas storage field. A local gas storage field, attached to the Company's transmission system, would yield a higher level of reliability than leased storage from West Texas. However, the reliability of such a facility must be compared to LNG. As the Commission is aware, NMGC once owned and operated a local storage field. The San Ysidro storage facility, after thirty years of service, began to experience lost and unaccounted for gas at unacceptable levels and the storage facility was taken out of service. Such a failure is highly unlikely with an LNG facility. As with leased storage and LNG, local storage could provide a source of replacement gas during extreme events. However, it is more likely that a local storage facility would make more sense being an integral part of a revised gas supply strategy whereby higher utilization of the facility would be planned, meaning that such an alternative, if available would not be able to provide significant amounts of replacement gas in the event of upstream supply curtailment since storage withdrawals from the local storage field would already be planned to meet projected peak-day demand. In other words, a new underground storage facility is better thought of as an additional and more reliable winter-season supply which would complement an LNG facility rather than serving as a replacement for the LNG facility.

Option 6: Propane Air Facilities. Propane air facilities can be used to satisfy system reliability needs. Strategically placed facilities at vulnerable points on the distribution system can help ensure pressure is maintained at safe operating levels sufficient to maintain gas service to customers. A propane air gas mix is compatible with, but not equivalent to natural gas. Because of its higher heat content, sufficient natural gas must exist in the pipe to "blend" the propane air to a usable state which will prevent damage to sensitive end-user equipment. Therefore, use of propane air facilities should be treated as a last resort supply. In my opinion, propane air is a potential solution to NMGC's reliability concerns but should not be relied upon as a source of replacement gas for circumstances when gas suppliers, storage or delivery systems declare force majeure.

It is noteworthy that the Company has evaluated two approaches to propane air facilities in the past. In the First CCN Filing, ten separate facilities were envisioned to protect system reliability. In the Proposed Solution Filing, a much larger, two-tank propane air facility was envisioned for the purposes of reliability and as a source of replacement gas, but ultimately rejected based on the required location of the propane air facility on the Company's transmission system, which would result in a gas quality that would no longer meet pipeline quality gas standards needed to utilize off-system transportation.[86] At my request the Company's engineering department developed a high-level assessment of where, what size and the daily send out requirements of propane air facilities that would be needed to ensure reliability in the absence of the Keystone Storage contract. This hypothetical configuration requires eleven separate facilities to be owned and operated by NMGC. In total, the storage quantity and daily delivery capabilities are far lower than the proposed LNG facility – another reason why these facilities would not be a good candidate for providing material amounts of replacement gas. The total load that could be served and the facilities' capabilities are shown below in Table 3Table 3.

Table 3: Hypothetical Propane Air Facilities

Propane Air Facility Location	Propane/Air Send out (MMBTU/D)	Propane/Air Storage at Site (MMBTU)
Ottowi Take-off	1,336	5,345
Alameda ML Take-off	6,285	25,140
Santa Fe 16-inch ML Take-off	5,597	22,386
Atrisco ML Take-off	4,919	19,675
West Mesa ML Take-off	7,026	28,104
Gallup Grants ML	1,892	7,567
Farmington ML Take-off	2,733	10,930
Los Alamos Area	946	3,784
Santa Fe 20-inch Take-off Less Ottowi, Caja, HWY 599, Los Alamos	1,461	5,844
Caja BS to Santa Fe	1,450	5,802
HWY 599 BS to Santa Fe	1,293	5,171
Grand Total	**34,937**	**139,746**

86 Testimony of NMGC Witness Bullard, Case No. 21-00095-UT page 25 lines 1-4.

Option 8: Acquisition or Drilling of Production Wells. Owning and operating production wells could satisfy both reliability and replacement gas concerns. However, like company-owned underground storage, such assets, if available, would likely be integrated into the Company's larger gas supply plan and may not represent incremental supply that could be viewed as replacement gas. As discussed by NMGC Witness Bullard in his 2021 Winter Event Filing testimony, venturing into the production, gathering and processing business would be a new business endeavor for the Company.[87] For this reason, the acquisition or drilling of production wells is beyond the scope of my testimony in this proceeding, and is generally viewed as being beyond the scope of LDC activities.

Option 10: CNG Facilities. CNG facilities are somewhat similar to propane air facilities insofar as they would be located at strategic locations across the company's distribution system. Unlike propane air, CNG facilities rely on high-pressure tanks, which are limited in size compared to propane or LNG. Again, I rely upon, and agree with, the Company's engineering expertise that has assessed that a CNG solution is viable only as a last resort, and not as a replacement gas supply source for when upstream gas supply failures occur.[88]

d. Financial Comparison of NMGC's Proposed LNG Facility to Feasible Non-LNG Storage Alternatives

Q. WHICH OF THE TEN NON-LNG SUPPLY ALTERNATIVES DID YOU INCLUDE IN YOUR FINANCIAL ANALYSIS COMPARISON?

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[87] Ibid, page 32 lines 6-8.

[88] Ibid, page 39 line 21 through page 40 line 9.

A. Of the ten non-LNG supply alternatives discussed above, I have advanced Options 3 and 6 (local gas storage and propane air facilities, respectively) for financial analysis. The financial analysis is based on utility revenue requirement calculations using estimated capital costs, which drive the return of and pre-tax return on invested capital, plus estimated O&M expenses and property taxes. I have also calculated the revenue requirements of the proposed LNG Facility and compared these alternatives over 30 years.

Q. PLEASE DESCRIBE THE COST ESTIMATES FOR THE PROPOSED LNG FACILITY, PROPANE AIR AND NEW UNDERGROUND STORAGE ALTERNATIVES.

A. The LNG Facility relies on the Lisbon Engineering Preliminary Front-End Engineering Design ("pre-FEED") cost estimate provided with NMGC Witness Bullard's testimony (NMGC Exhibit TCB-3). These capital costs are expressed in 2022 dollars and are then escalated to 2027 dollars using estimated annual figures for the U.S. Gross Domestic Product Price Index[89] ("GDP-PI"). Similarly, annual operations and maintenance costs are pre-FEED estimates in 2022 dollars, escalated to 2027 dollars using GDP-PI and then escalated over the 30-year forecast horizon using Company estimates for labor and maintenance, and U.S. Energy Information Agency ("EIA")[90] forecasted compound annual growth rates ("CAGR") for electricity and fuel gas costs.

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89 Blue Chip Financial Forecast, Vol. 41, No. 10, September 30,2022.

90 EIA "Table 3. Energy Prices by Sector and Source", https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=ref2022&sourcekey=0.

The propane air storage costs were estimated based on the Company's operational estimates for eleven independent propane air storage facilities of varying sizes and delivery capabilities shown in Table 4 above. The cost of storage tanks, air mixers, compression and installation were estimated using a 2012 propane air study prepared for ENSTAR Gas[91], then escalated to 2021 dollars using the most recently available Handy-Whitman cost index[92]. These costs were then escalated to 2027 dollars using GDP-PI. O&M costs are assumed to be similar as that for operating the LNG Facility and were carried forward to this alternative.

Lastly, new underground storage was estimated[93] using cost estimates for seven recently developed projects, with in-service dates ranging from 2008 to 2012. Each of these individual cost estimates were then escalated to 2021 dollars using Handy-Whitman indexes, then escalated to 2027 using GDP-PI. Fixed and variable O&M costs were estimated using information from financial statements provided in a recent Cook Inlet Natural Gas Storage Alaska, LLC rate case proceeding[94]. These O&M costs, stated in 2017 dollars, were then escalated to 2027 dollars using GDP-PI. The details of these cost estimates are included in NMGC Workpaper JJR-WP-1.

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91 "ENSTAR Propane Air Study 2012", prepared by Infrastructure Assurance Center Decision and Information Sciences Division Argonne National Laboratory, February 2012.

92 The Handy-Whitman Index of Public Utility Construction Costs; Bulletin No. 195: 1912 to January 1, 2022.

93 Source: S&P Global Market Intelligence. Screening criteria used: 1) estimated construction cost >$0; 2) U.S. facilities only, and 3) Year of service >=2000.

94 RCA Case No. 18-043.

Q. HOW ARE THESE COST ESTIMATES TRANSFORMED INTO ANNUAL REVENUE REQUIREMENTS?

A. Each of these alternatives was compared based on standard utility revenue requirements calculation, which is the sum of the return of and return on invested capital, O&M costs, depreciation, and taxes. These revenue requirements are calculated annually for a 30-year time horizon, and utilize the company's most recently approved cost of capital.[95] Details of these revenue requirement calculations are also provided in workpaper JJR-WP-1.

Q. DID YOU ALSO EVALUATE THE REVENUE REQUIREMENTS FOR THE EXISTING KEYSTONE UNDERGROUND STORAGE FACILITY?

A. Yes, I did. The existing Keystone Storage is under contract for 2.7 Bcf of storage. The Company's current Keystone Storage contract goes through 2025 with the option to extend two additional years. Assuming that option is exercised, NMGC would pay $8.748 million in 2027. Historically, Keystone Storage has increased its annual reservation charges by 6.2%[96], which is the cost escalation I have assumed for the future. On a 30-year net present value ("NPV") basis Keystone Storage could cost NMGC customers $178 million.

Q. DID YOU ALSO CONSIDER WHETHER KEYSTONE STORAGE WOULD BE CONTRACTED FOR USAGE AFTER THE EXPIRATION OF THE 2027 CONTRACT TERM?

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95 Overall after-tax cost of capital of 6.44%. Case No. 2100267-UT Final Order.

96 Direct testimony of Thomas C. Bullard, page 18.

A. Yes. My understanding is that the Company anticipates reducing or eliminating its reliance on the Keystone Storage within 1 – 3 years after construction of the LNG Facility. This overlap between the LNG Facility being placed into service and Keystone Storage being partially retained allows for operational experience to be developed for the LNG facility before the full Keystone Storage capacity is relinquished. Accordingly, for purposes of financial analysis, the LNG storage option Keystone Storage is assumed to be retained for one year after it would expire in 2027, but at a reduced level for that transition year. Full retention of Keystone Storage contracted capacity of 2.7 Bcf is assumed under the propane air option, as this option does not provide the opportunity for any replacement gas supply, and cannot be utilized in the same operational manner as underground storage or LNG. I must note that even the joint usage of Keystone Storage and the possible propane air option fail to provide a meaningful level of price mitigation in the event of price spikes and the need for additional purchases of gas. The new underground storage option assumes immediate cessation of Keystone Storage contract upon its contractual expiration in 2027.

Q. WHAT OTHER CONSIDERATIONS ARE INCLUDED IN YOUR FINANCIAL ANALYSIS?

A. I have estimated the annual commodity price differential for propane compared to natural gas as the difference between the forecasted cost of natural gas and delivered propane prices as estimated by EIA, assuming one full inventory turn of the propane air facilities. There is no forecasted commodity price differential between Keystone Storage gas, LNG or new underground storage.

Q. HOW ARE TOTAL REVENUE REQUIREMENTS CALCULATED?

A. For each alternative being evaluated, the Revenue Requirements are the sum of the calculated new storage facility investment option revenue requirement plus expected future Keystone Storage costs plus the commodity price cost differentials.

Q. PLEASE SUMMARIZE THE RESULTS OF THESE REVENUE REQUIREMENTS CALCULATIONS.

A. NMGC Exhibit JJR-2 to my testimony summarizes the new facility revenue requirements, estimated future Keystone Storage costs and commodity cost differentials to derive total revenue requirements for each alternative. The revenue requirements calculated are expressed on a 30-year net present value ("NPV") basis, as well as individually for Year 2[97] and Year 15. These cost comparison points must also be compared in the context of the physical storage, deliverability and reliability of each alternative. Specifically, only those alternatives with adequate peak day delivery capability can be considered viable replacement gas options – not solely reliability options. The 30-year NPV of net revenue requirements is summarized in Table 4 as follows:

[97] Year 2 is used as an indicative near-term annual revenue requirement.

Table 4: Storage Alternatives: 30-Year NPV of Net Revenue Requirements

Analysis of Alternatives	LNG	Propane Air	New Local Underground Storage
Physical Characteristics			
Storage (Mcf)	1,000,000	134,760	2,700,000
Deliverability (Mcfd)	195,000	33,690	190,000
Number of Days of Full Deliverability	5.1	4.0	14.2
	30-Year NPV of Total Revenue Requirements ($ in Millions)		
Total Revenue Requirement Alternative	$318.4	$365.0	$485.4
Keystone Storage (status quo)	$239.3	$239.3	$239.3
Alternative Favorable / Unfavorable to Keystone Storage	$(79.1)	$(125.7)	($246.1)
Annual Incremental Revenue Requirement	$2.6	$4.2	$8.2
NMGC Total Annual Revenues (Forecasted 2026)	$549.7	$549.7	$549.7
Incremental Revenue Requirement: Average Present Value Percentage Basis	0.5%	0.8%	1.5%

Q. WHAT CONCLUSIONS DO YOU DRAW FROM THE INFORMATION IN TABLE 4?

A. Regarding propane air, because the LNG option provides over seven times the storage and more than five times the deliverability compared to propane air, propane air does not reasonably offer the opportunity for replacement gas when additional purchases need to be made during price spikes. Second, the propane air option requires long-term continuation of Keystone Storage volumes at current contracted volumes. Without the ability to mitigate upstream gas supply cuts, the propane air facilities must be considered "reliability only" assets and not comparable to the capabilities of the proposed LNG facility or additional underground storage.

Regarding underground storage, a new local underground storage facility potentially offers greater storage capacity compared to LNG, and is comparable on a daily deliverability basis. However, the estimated cost of a new underground storage facility is significantly higher than the cost of the LNG Facility. The cost differential between new underground storage and the proposed LNG is approximately $167 million on a 30-year NPV basis.

Q. WHAT BROADER CONCLUSIONS CAN BE DRAWN FROM YOUR FINANCIAL ANALYSIS?

A. I conclude that the LNG Option provides a viable means of meeting the reliability and price spike mitigation objectives that underlie my analysis, and that the LNG Option better responds to the Commission's directives to search for a means of addressing the needs that became so apparent during Winter Storm Uri, and earlier when gas service was interrupted for thousands of the Company's customers. Furthermore, the LNG Option is over time, and considering foreseeable events, cost-effective when compared to alternatives that provide the same level of operational and economic protection for NMGC's customers. From a financial perspective, I recognize that choosing to develop the LNG Option will increase rates under "normal" gas market conditions, however, it would be unreasonable to expect that any solution which provides enhanced reliability and price protection could be achieved without higher rates.

As discussed later in this testimony, this higher level of costs can save customers tens of millions of dollars when gas market conditions are not "normal," which is becoming so frequent that the term "normal" is difficult to define and even more difficult to adopt as a planning criterion. Winter storms – such as occurred in 2011 and 2021 will almost certainly occur again. The severity and frequency are beyond my ability to predict precisely, but the occurrence apparently is what drove the Commission's Oder in 2021 to evaluate storage options. The 2011 storm resulted in a curtailment of customers, and the 2021 storm resulted in an extraordinary expense to customers. Each of these event-results carries with it the potential for extraordinary costs to customers in the future which cannot be clearly quantified, but can reasonably be anticipated. Mitigating the impact of events like these is the strongest argument for the LNG Facility.

Based on my analysis, I consider the cost differential associated with adopting the LNG Option, which amounts to about 0.5% in average present value terms on a total bill basis, to be a reasonable premium to achieve reliability and price protection, which the status quo does not provide. Also, this pattern of higher near-term costs for new infrastructure is common when compared to contracting for existing infrastructure (such as Keystone Storage), and it should be recognized that new facilities experience a declining impact on revenue requirements over time, while contracts such as for Keystone Storage have an increasing impact on revenue requirements over time. Further, LNG is the more cost-effective storage alternative when compared to propane air or building new underground storage. The propane air storage quantities and daily deliverability do not allow for the Company to supplant any Keystone Storage, nor would such facilities enable the Company to make replacement gas purchases. These facts make the propane air option a less attractive one if the Commission's concerns regarding future price spikes are to be addressed.

e. Overall Assessment of the Proposed LNG Facility Compared to Alternatives

Q. WHAT IS YOUR OVERALL ASSESSMENT OF THE VIABLE STORAGE OPTIONS AVAILABLE TO THE COMPANY?

A. In my opinion, construction and operation of the proposed LNG Facility is superior to the status quo, building multiple propane air facilities or constructing new local underground storage. The status quo does not deliver the level of reliability and price protection necessary to meet NMGC's customers' needs, and is projected to continue to rise in price based on recent contracting experience. Eleven new propane air facilities would require extensive incremental operation and maintenance activities to run effectively, and would provide only enough storage capacity and deliverability to satisfy reliability concerns at the Company's most vulnerable points in its distribution system. Propane air, as contemplated here, would not be able to reasonably provide any replacement gas in the event of upstream supply disruption, and does not allow for any reduction of Keystone Storage contract volumes. Although new underground storage does provide the opportunity for replacement gas and has a greater number of days of service compared to the LNG options, it is significantly more expensive than the LNG alternative. Further, the prospect of finding a feasible site located near Company distribution facilities, and of adequate size and pressure, is questionable and it would be time-consuming and expensive to conduct such a search, and may not result in a viable local storage option. Given these findings, I conclude that the proposed LNG facility is the Company's best option to fulfill the primary (reliability) and secondary (replacement gas to achieve price protection) objectives I have established for my comparative analysis.

Q. COULD THE LNG FACILITY HAVE BEEN USED TO MITIGATE THE $107 MILLION OF EXTRAORDINARY GAS COSTS EXPERIENCED DURING STORM URI IN FEBRUARY 2021?

A. Yes, there are three ways in which NMGC potentially could have used the LNG Facility to reduce costs during Storm Uri. First, if NMGC had the LNG Facility instead of Keystone Storage, it would have been able to vaporize LNG instead of making intraday purchases during the storm. During this period, NMGC paid as much as $252/MMBtu for intraday replacement gas due to storage and supply cuts.[98] If the LNG Facility had been in service during that storm, its average gas cost would likely have been approximately $2.44/MMBtu, based on prior shoulder season average gas prices of $1.32,[99] plus O&M adders of $1.11/MMBtu.[100] Replacing those high-priced intraday gas purchases and all Keystone Storage withdrawals with vaporized LNG from the LNG Facility could have resulted in savings on the order of $14.6 million for customers.

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[98] New Mexico Gas Company Inc.'s Application for Expedited Approval for a Variance Approving its Plan for Recovery of 2021 Winter Weather Event Gas Costs Under the Extraordinary Circumstances Provision of 17.10.640.14 NMAC, Case No. 2-00095-UT, Exhibit 6; Final Order In the Matter of New Mexico Gas Company, Inc.'s Application for an Expedited Variance Approving its Plan for Recovery of the Gas Costs Related to the 2021 Winter Event, June 15, 2021, p. 11.

[99] Average daily price at El Paso, Permian for April, May, September, and October 2020. Source: S&P Global

[100] Pre-FEED Study (NMGC Exhibit TCB-3).

Second, after seeing the price spikes that had occurred over the holiday weekend and knowing that the storm conditions were continuing, NMGC could have considered planning to vaporize LNG on a proactive basis when it was making its day ahead purchase decisions on Tuesday morning (February 16, 2021) for Wednesday (February 17, 2021) flows. The Gas Daily market price of gas at the point where NMGC made its greatest day ahead purchases (i.e., Transwestern, San Juan) on Wednesday, February 17, 2021 was $223.11/MMBtu. Dispatching 75,000 MMBtu of lower cost vaporized LNG instead of purchasing day ahead gas for Wednesday could have saved customers $16.55 million. Making a similar decision on Wednesday morning to dispatch 70,000 Dth for Thursday (February 18, 2021) flows could have saved customers $2.26 million, both of which are in addition to the $14.6 million described above.

Finally, if NMGC had the LNG Facility during Storm Uri, it would have had the opportunity to consider selling a portion of its day ahead purchases back into the market over the holiday weekend and replace that gas with vaporized LNG at a much lower cost. The amount of gas to be sold back to the market and replaced with vaporized LNG is very circumstance-specific that requires careful consideration of market prices levels, current LNG inventory levels, rest of winter weather expectations and likelihood of higher price spikes later in the winter, among other factors. In addition, the fact that Storm Uri occurred over a holiday weekend so the same high daily market prices applied for four consecutive days is a coincidence that may not reoccur. And while I recognize that replacing flowing supplies with vaporized LNG is uncommon, it is a possibility that would have been available for this extraordinary event if the LNG Facility was installed prior to Storm Uri.

If NMGC had used vaporized LNG to replace 180,000 MMBtu of day ahead purchases over the holiday weekend, and was able to sell it in the intraday market at the prevailing Gas Daily price for Transwestern, San Juan, it could have saved customers $11.0 million. If all three strategies were employed during Storm Uri, having the LNG Facility could have provided the opportunity to save customers as much as $44.4 million without fully depleting the inventory at the LNG Facility. These calculations are supported by NMGC Exhibit JJR-3 attached to my testimony. In reality, I recognize that achieving this level of savings would have required a complete real-time understanding of what was driving gas prices during an unprecedented event, would have required that the full conceptual vaporization capability of the facility (195,000 Dth/Day) was able to be achieved, and would have left very little LNG in the tanks for use later in the heating season. For these reasons, I offer these calculations as a demonstration of the possibilities presented by having the LNG Facility in service under extraordinary supply disruptions and extreme price spikes, not as a standard of performance against which NMGC's activities should be benchmarked.

The full benefits and costs of the LNG Facility can only be considered if these long-term, anticipated but unquantifiable savings, are considered alongside the known and quantifiable costs of the Facility. This seems consistent to me with the directive of the NMPRC that that the Company is acting pursuant to.

Q. IF THE LNG FACILITY WOULD NOT HAVE ELIMINATED THE EXTRAORDINARY GAS COSTS DURING STORM URI, WHY SHOULD THE LNG FACILITY BE BUILT?

A. First, as explained previously, the primary purpose of the LNG Facility is to enhance the reliability of NMGC's gas supply portfolio. As described above, an on-system, Company-owned and controlled, fast responding resource provides the desired reliability improvement. Second, it is unreasonable to expect that any new infrastructure could provide complete price protection under the circumstances presented by Winter Storm Uri. Complete price protection, if even achievable, would involve reconsideration of NMGC's entire gas supply, transportation, and storage portfolio, as well as a reconsideration of its hedging and purchasing practices, and would likely be cost prohibitive. There were dozens of LDCs that experienced extraordinary gas costs as a result of Winter Storm Uri, and I am not aware of any LDC that has responded with an objective of trying to eliminate all future price risk. In addition, using the LNG Facility to provide price protection must consider several factors beyond the current market price of gas compared to the cost of the LNG inventory. LNG inventory levels, potential for cuts on the delivery of other gas supplies, the likelihood of additional cold weather, the ability to liquefy additional LNG, and other factors must be considered. So while the LNG Facility will not provide complete price protection, building the LNG Facility is certainly a major step in the right direction in terms of making a resource available that provides the Company an opportunity to mitigate price spikes under similar circumstances.

VI. CONCLUSION

Q. WHAT CONCLUSION HAVE YOU REACHED REGARDING NMGC'S PROPOSAL TO CONSTRUCT THE LNG FACILITY?

A. I have concluded that this proposal is reasonable as a means of addressing the reliability and price protection objectives that the Company has. It balances these two objectives, and realistically considers the alternatives available to the Company. It also provides a robust and resilient resource for meeting the needs of the Company as it addresses the challenges of simultaneously maintaining a safe, reliable and affordable service for New Mexico's ongoing natural gas needs and participating in and helping to achieve the energy transition that New Mexico and the rest of the nation has established as a goal of energy and environmental policy.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

JOHN J. REED
Chairman and Chief Executive Officer

Mr. Reed is a financial and economic consultant with more than 45 years of experience in the energy industry. Mr. Reed has also been the CEO of an NASD member securities firm, and Co-CEO of the nation's largest publicly traded management consulting firm (NYSE: NCI). He has provided advisory services in the areas of mergers and acquisitions, asset divestitures and purchases, strategic planning, project finance, corporate valuation, energy market analysis, rate and regulatory matters and energy contract negotiations to clients across North and Central America. Mr. Reed's comprehensive experience includes the development and implementation of nuclear, fossil, and hydroelectric generation divestiture programs with an aggregate valuation in excess of $20 billion. Mr. Reed has also provided expert testimony on financial and economic matters on more than 400 occasions before the FERC, Canadian regulatory agencies, state utility regulatory agencies, various state and federal courts, and before arbitration panels in the United States and Canada. After graduation from the Wharton School of the University of Pennsylvania, Mr. Reed joined Southern California Gas Company, where he worked in the regulatory and financial groups, leaving the firm as Chief Economist in 1981. He served as an executive and consultant with Stone & Webster Management Consulting and R.J. Rudden Associates prior to forming REED Consulting Group (RCG) in 1988. RCG was acquired by Navigant Consulting in 1997, where Mr. Reed served as an executive until leaving Navigant to join Concentric as Chairman and Chief Executive Officer.

REPRESENTATIVE PROJECT EXPERIENCE

Executive Management

- As an executive-level consultant, worked with CEOs, CFOs, other senior officers, and Boards of Directors of many of North America's top electric and gas utilities, as well as with senior political leaders of the U.S. and Canada on numerous engagements over the past 25 years. Directed merger, acquisition, divestiture, and project development engagements for utilities, pipelines and electric generation companies, repositioned several electric and gas utilities as pure distributors through a series of regulatory, financial, and legislative initiatives, and helped to develop and execute several "roll-up" or market aggregation strategies for companies seeking to achieve substantial scale in energy distribution, generation, transmission, and marketing.

Financial and Economic Advisory Services

- Retained by many of the nation's leading energy companies and financial institutions for services relating to the purchase, sale or development of new enterprises. These projects included major new gas pipeline projects, gas storage projects, several non-utility generation projects, the purchase and sale of project development and gas marketing firms, and utility acquisitions. Specific services provided include the development of corporate expansion plans, review of acquisition candidates, establishment of divestiture standards, due diligence on acquisitions or financing, market entry or expansion studies, competitive assessments, project financing studies, and negotiations relating to these transactions.

Litigation Support and Expert Testimony

- Provided expert testimony on more than 400 occasions in administrative and civil proceedings on a wide range of energy and economic issues. Clients in these matters have included gas distribution utilities, gas pipelines, gas producers, oil producers, electric utilities, large energy consumers, governmental and regulatory agencies, trade associations, independent energy project developers, engineering firms, and gas and power marketers. Testimony has focused on issues ranging from broad regulatory and economic policy to virtually all elements of the utility ratemaking process. Also frequently testified regarding energy contract interpretation, accepted energy industry practices, horizontal and vertical market power, quantification of damages, and management prudence. Has been active in regulatory contract and litigation matters on virtually all interstate pipeline systems serving the U.S. Northeast, Mid-Atlantic, Midwest, and Pacific regions.
- Also served on FERC Commissioner Terzic's Task Force on Competition, which conducted an industry-wide investigation into the levels of and means of encouraging competition in U.S. natural gas markets and served on a "Blue Ribbon" panel established by the Province of New Brunswick regarding the future of natural gas distribution service in that province.

Resource Procurement, Contracting and Analysis

- On behalf of gas distributors, gas pipelines, gas producers, electric utilities, and independent energy project developers, personally managed or participated in the negotiation, drafting, and regulatory support of hundreds of energy contracts, including the largest gas contracts in North America, electric contracts representing billions of dollars, pipeline and storage contracts, and facility leases.
- These efforts have resulted in bringing large new energy projects to market across North America, the creation of hundreds of millions of dollars in savings through contract renegotiation, and the regulatory approval of a number of highly contested energy contracts.

Strategic Planning and Utility Restructuring

- Acted as a leading participant in the restructuring of the natural gas and electric utility industries over the past fifteen years, as an advisor to local distribution companies, pipelines, electric utilities, and independent energy project developers. In the recent past, provided services to most of the top 50 utilities and energy marketers across North America. Managed projects that frequently included the redevelopment of strategic plans, corporate reorganizations, the development of multi-year regulatory and legislative agendas, merger, acquisition and divestiture strategies, and the development of market entry strategies. Developed and supported merchant function exit strategies, marketing affiliate strategies, and detailed plans for the functional business units of many of North America's leading utilities.

PROFESSIONAL HISTORY

Concentric Energy Advisors, Inc. (2002 – Present)
Chairman and Chief Executive Officer

CE Capital Advisors (2004 – Present)
Chairman, President, and Chief Executive Officer

Navigant Consulting, Inc. (1997 – 2002)
President, Navigant Energy Capital (2000 – 2002)
Executive Director (2000 – 2002)
Co-Chief Executive Officer, Vice Chairman (1999 – 2000)
Executive Managing Director (1998 – 1999)
President, REED Consulting Group, Inc. (1997 – 1998)

REED Consulting Group (1988 – 1997)
Chairman, President and Chief Executive Officer

R.J. Rudden Associates, Inc. (1983 – 1988)
Vice President

Stone & Webster Management Consultants, Inc. (1981 – 1983)
Senior Consultant
Consultant

Southern California Gas Company (1976 – 1981)
Corporate Economist
Financial Analyst
Treasury Analyst

EDUCATION

Wharton School, University of Pennsylvania
B.S., Economics and Finance, 1976
Licensed Securities Professional: NASD Series 7, 63, 24, 79 and 99 Licenses

BOARDS OF DIRECTORS (PAST AND PRESENT)

Concentric Energy Advisors, Inc.
Navigant Consulting, Inc.
Navigant Energy Capital
Nukem, Inc.
New England Gas Association
R. J. Rudden Associates
REED Consulting Group

AFFILIATIONS

American Gas Association
Energy Bar Association
Guild of Gas Managers
International Association of Energy Economists
Northeast Gas Association
Society of Gas Lighters
Society of Utility and Regulatory Financial Analysts

ARTICLES AND PUBLICATIONS

"Maximizing U.S. federal loan guarantees for new nuclear energy," Bulletin of the Atomic Scientists (with John C. Slocum), July 29, 2009
"Smart Decoupling – Dealing with unfunded mandates in performance-based ratemaking," Public Utilities Fortnightly, May 2012

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Alaska Regulatory Commission				
Chugach Electric	12/86	Chugach Electric	U-86-11	Cost Allocation
Chugach Electric	5/87	Enstar Natural Gas Company	U-87-2	Tariff Design
Chugach Electric	12/87	Enstar Natural Gas Company	U-87-42	Gas Transportation
Chugach Electric	11/87 2/88	Chugach Electric	U-87-35	Cost of Capital
Anchorage Municipal Light & Power	9/17	Anchorage Municipal Light & Power	U-16-094 U-17-008	Project Prudence
Municipality of Anchorage ("MOA") d/b/a Municipal Light and Power	8/19 10/19	Municipality of Anchorage ("MOA") d/b/a Municipal Light and Power	U-18-102 U-19-020 U-19-021	Merger Standard for Approval
Alberta Utilities Commission				
Alberta Utilities (AltaLink, EPCOR, ATCO, ENMAX, FortisAlberta, AltaGas)	1/13	Alberta Utilities	Application 1566373, Proceeding ID 20	Stranded Costs
Arizona Corporation Commission				
Tucson Electric Power	7/12	Tucson Electric Power	E-01933A-12-0291	Cost of Capital
UNS Energy and Fortis Inc.	1/14	UNS Energy, Fortis Inc.	E-04230A-00011 E-01933A-14-0011	Merger
California Energy Commission				
Southern California Gas Co.	8/80	Southern California Gas Co.	80-BR-3	Gas Price Forecasting

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
California Public Utility Commission				
Southern California Gas Co.	3/80	Southern California Gas Co.	TY 1981 G.R.C.	Cost of Service, Inflation
Pacific Gas Transmission Co.	10/91 11/91	Pacific Gas & Electric Co.	App. 89-04-033	Rate Design
Pacific Gas Transmission Co.	7/92	Southern California Gas Co.	A. 92-04-031	Rate Design
San Diego Gas & Electric Company	4/19 8/19	San Diego Gas & Electric Company	A. 19-04-017	Risk Premium, Return on Equity
Colorado Public Utilities Commission				
AMAX Molybdenum	2/90	Commission Rulemaking	89R-702G	Gas Transportation
AMAX Molybdenum	11/90	Commission Rulemaking	90R-508G	Gas Transportation
Xcel Energy	8/04	Xcel Energy	031-134E	Cost of Debt
Public Service Company of Colorado	6/17	Public Service Company of Colorado	17AL-0363G	Return on Equity (Gas)
Connecticut Public Utilities Regulatory Authority				
Connecticut Natural Gas	12/88	Connecticut Natural Gas	88-08-15	Gas Purchasing Practices
United Illuminating	3/99	United Illuminating	99-03-04	Nuclear Plant Valuation
Southern Connecticut Gas	2/04	Southern Connecticut Gas	00-12-08	Gas Purchasing Practices
Southern Connecticut Gas	4/05	Southern Connecticut Gas	05-03-17	LNG/Trunkline
Southern Connecticut Gas	5/06	Southern Connecticut Gas	05-03-17PH01	LNG/Trunkline
Southern Connecticut Gas	8/08	Southern Connecticut Gas	06-05-04	Peaking Service Agreement

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
SJW Group and Connecticut Water Service	4/19	SJW Group and Connecticut Water Service	19-04-02	Customer Benefits, Public Interest
District of Columbia PSC				
Potomac Electric Power Company	3/99 5/99 7/99	Potomac Electric Power Company	945	Divestiture of Gen. Assets & Purchase Power Contracts
AltaGas Ltd./WGL Holdings	4/17 8/17 10/17	AltaGas Ltd./WGL Holdings	1142	Merger Standards, Public Interest Standard
Federal Energy Regulatory Commission				
Safe Harbor Water Power Corp.	8/82	Safe Harbor Water Power Corp.	-	Wholesale Electric Rate Increase
Western Gas Interstate Company	5/84	Western Gas Interstate Company	RP84-77	Load Forecast Working Capital
Southern Union Gas	4/87 5/87	El Paso Natural Gas Company	RP87-16-000	Take-or-Pay Costs
Connecticut Natural Gas	11/87	Penn-York Energy Corporation	RP87-78-000	Cost Allocation/Rate Design
AMAX Magnesium	12/88 1/89	Questar Pipeline Company	RP88-93-000	Cost Allocation/Rate Design
Western Gas Interstate Company	6/89	Western Gas Interstate Company	RP89-179-000	Cost Allocation/Rate Design, Open-Access Transportation
Associated CD Customers	12/89	CNG Transmission	RP88-211-000	Cost Allocation/Rate Design
Utah Industrial Group	9/90	Questar Pipeline Company	RP88-93-000, Phase II	Cost Allocation/Rate Design
Iroquois Gas Trans. System	8/90	Iroquois Gas Transmission System	CP89-634-000/001 CP89-815-000	Gas Markets, Rate Design, Cost of Capital, Capital Structure

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Boston Edison Company	1/91	Boston Edison Company	ER91-243-000	Electric Generation Markets
Cincinnati Gas and Electric Co., Union Light, Heat and Power Company, Lawrenceburg Gas Company	7/91	Texas Gas Transmission Corp.	RP90-104-000 RP88-115-000 RP90-192-000	Cost Allocation, Rate Design, Comparability of Service
Ocean State Power II	7/91	Ocean State Power II	ER89-563-000	Competitive Market Analysis, Self-dealing
Brooklyn Union/PSE&G	7/91	Texas Eastern	RP88-67, et al	Market Power, Comparability of Service
Northern Distributor Group	9/92 11/92	Northern Natural Gas Company	RP92-1-000, et al	Cost of Service
Canadian Association of Petroleum Producers and Alberta Pet. Marketing Comm.	10/92 7/97	Lakehead Pipeline Co. LP	IS92-27-000	Cost Allocation, Rate Design
Colonial Gas, Providence Gas	7/93 8/93	Algonquin Gas Transmission	RP93-14	Cost Allocation, Rate Design
Iroquois Gas Transmission	94	Iroquois Gas Transmission	RP94-72-000	Cost of Service, Rate Design
Transco Customer Group	1/94	Transcontinental Gas Pipeline Corporation	RP92-137-000	Rate Design, Firm to Wellhead
Pacific Gas Transmission	2/94 3/95	Pacific Gas Transmission	RP94-149-000	Rolled-In vs. Incremental Rates, Rate Design
Tennessee GSR Group	1/95 3/95 1/96	Tennessee Gas Pipeline Company	RP93-151-000 RP94-39-000 RP94-197-000 RP94-309-000	GSR Costs
PG&E and SoCal Gas	8/96 9/96	El Paso Natural Gas Company	RP92-18-000	Stranded Costs

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Iroquois Gas Transmission System, LP	97	Iroquois Gas Transmission System, LP	RP97-126-000	Cost of Service, Rate Design
BEC Energy - Commonwealth Energy System	2/99	Boston Edison Company/ Commonwealth Energy System	EC99-33-000	Market Power Analysis – Merger
Central Hudson Gas & Electric, Consolidated Co. of New York, Niagara Mohawk Power Corporation, Dynegy Power Inc.	10/00	Central Hudson Gas & Electric, Consolidated Co. of New York, Niagara Mohawk Power Corporation, Dynegy Power Inc.	EC01-7-000	Market Power 203/205 Filing
Wyckoff Gas Storage	12/02	Wyckoff Gas Storage	CP03-33-000	Need for Storage Project
Indicated Shippers/Producers	10/03	Northern Natural Gas	RP98-39-029	Ad Valorem Tax Treatment
Maritimes & Northeast Pipeline	6/04	Maritimes & Northeast Pipeline	RP04-360-000	Rolled-In Rates
ISO New England	8/04 2/05	ISO New England	ER03-563-030	Cost of New Entry
Transwestern Pipeline Company, LLC	9/06	Transwestern Pipeline Company, LLC	RP06-614-000	Business Risk
Portland Natural Gas Transmission System	6/08	Portland Natural Gas Transmission System	RP08-306-000	Market Assessment, Natural Gas Transportation, Rate Setting
Portland Natural Gas Transmission System	5/10 3/11 4/11	Portland Natural Gas Transmission System	RP10-729-000	Business Risks, Extraordinary and Non-recurring Events Pertaining to Discretionary Revenues

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Morris Energy	7/10	Morris Energy	RP10-79-000	Impact of Preferential Rate
Gulf South Pipeline	10/14	Gulf South Pipeline	RP15-65-000	Business Risk, Rate Design
BNP Paribas Energy Trading, GP South Jersey Resource Group, LLC	2/15	Transcontinental Gas Pipeline Corporation	RP06-569-008 RP07-376-005	Regulatory Policy, Incremental Rates, Stacked Rate
Tallgrass Interstate Gas Transmission, LLC	10/15 12/15	Tallgrass Interstate Gas Transmission, LLC	RP16-137-000	Market Assessment, Rate Design, Rolled-in Rate Treatment
Tennessee Valley Authority	2/21 3/21	Athens Utility Board, Gibson Electric Membership Corp., Joe Wheeler Electric Membership Corp., and Volunteer Energy Cooperative v. Tennessee Valley Authority	EL21-40-000 TX21-01-000	Public Policy, Competition, Economic Harm
Florida Impact Estimating Conference				
Florida Power and Light Co. on behalf of the Florida Investor-Owned Utilities	2/19 3/19	Florida Power and Light Co. on behalf of the Florida Investor-Owned Utilities	Right to Competitive Energy Market for Customers of Investor-Owned Utilities; Allowing Energy Choice	Economic and Financial Impact of Deregulation on Customers and Market Design and Function
Florida Public Service Commission				
Florida Power and Light Co.	10/07	Florida Power & Light Co.	070650-EI	Need for New Nuclear Plant

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Florida Power and Light Co.	5/08	Florida Power & Light Co.	080009-EI	New Nuclear Cost Recovery, Prudence
Florida Power and Light Co.	3/09 8/09	Florida Power & Light Co.	080677-EI	Benchmarking in Support of ROE
Florida Power and Light Co.	3/09 5/09 8/09	Florida Power & Light Co.	090009-EI	New Nuclear Cost Recovery, Prudence
Florida Power and Light Co.	3/10 5/10 8/10	Florida Power & Light Co.	100009-EI	New Nuclear Cost Recovery, Prudence
Florida Power and Light Co.	3/11 7/11	Florida Power & Light Co.	110009-EI	New Nuclear Cost Recovery, Prudence
Florida Power and Light Co.	3/12 7/12	Florida Power & Light Co.	120009-EI	New Nuclear Cost Recovery, Prudence
Florida Power and Light Co.	3/12 8/12	Florida Power & Light Co.	120015-EI	Benchmarking in Support of ROE
Florida Power and Light Co.	3/13 7/13	Florida Power & Light Co.	130009	New Nuclear Cost Recovery, Prudence
Florida Power and Light Co.	3/14	Florida Power & Light Co.	140009	New Nuclear Cost Recovery, Prudence
Florida Power and Light Co.	3/15 7/15	Florida Power & Light Co.	150009	New Nuclear Cost Recovery, Prudence
Florida Power and Light Co.	10/15	Florida Power and Light Co.	150001	Recovery of Replacement Power Costs
Florida Power and Light Co.	3/16	Florida Power & Light Co.	160021-EI	Benchmarking in Support of ROE
Florida Power and Light Co.	3/21 7/21	Florida Power & Light Co.	20210015-EI	Benchmarking in Support of ROE
Florida Senate Committee on Communication, Energy and Utilities				
Florida Power and Light Co.	2/09	Florida Power & Light Co.	-	Securitization

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Hawai'i Public Utility Commission				
Hawaiian Electric Light Company, Inc.	6/00	Hawaiian Electric Light Company, Inc.	99-0207	Standby Charge
NextEra Energy, Inc. Hawaiian Electric Companies	4/15 8/15 10/15	Hawaiian Electric Company, Inc.; Hawaii Electric Light Company, Inc., Maui Electric Company, Ltd., NextEra Energy, Inc.	2015-0022	Merger Application
Idaho Public Utilities Commission				
Hydro One Limited and Avista Corporation	9/18 11/18	Hydro One Limited and Avista Corporation	AVU-E-17-09 AVU-G-17-05	Governance, Financial Integrity and Ring-fencing Merger Commitments
Illinois Commerce Commission				
Renewables Suppliers (Algonquin Power Co., EDP Renewables North America, Invenergy, NextEra Energy Resources)	3/14	Renewables Suppliers	13-0546	Application for Rehearing and Reconsideration, Long-term Purchase Power Agreements
WE Energies Corporation	8/14 12/14 2/15	WE Energies/Integrys	14-0496	Merger Application

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Indiana Utility Regulatory Commission				
Northern Indiana Public Service Company	10/01	Northern Indiana Public Service Company	41746	Valuation of Electric Generating Facilities
Northern Indiana Public Service Company	1/08 3/08	Northern Indiana Public Service Company	43396	Asset Valuation
Northern Indiana Public Service Company	8/08	Northern Indiana Public Service Company	43526	Fair Market Value Assessment
Indianapolis Power & Light Company	12/14	Indianapolis Power & Light Company	44576	Asset Valuation
Indianapolis Power & Light Company	12/16	Indianapolis Power & Light Company	44893	Rate Recovery for New Plant Additions, Valuation of Electric Generating Facilities
Indianapolis Power & Light Company D/B/A AES Indiana	8/21	Indianapolis Power & Light Company D/B/A AES Indiana	45591	Power Project Development and PPA Evaluation
Iowa Utilities Board				
Interstate Power and Light	7/05	Interstate Power and Light and FPL Energy Duane Arnold, LLC	SPU-05-15	Sale of Nuclear Plant
Interstate Power and Light	5/07	City of Everly, Iowa	SPU-06-5	Municipalization
Interstate Power and Light	5/07	City of Kalona, Iowa	SPU-06-6	Municipalization
Interstate Power and Light	5/07	City of Wellman, Iowa	SPU-06-10	Municipalization
Interstate Power and Light	5/07	City of Terril, Iowa	SPU-06-8	Municipalization
Interstate Power and Light	5/07	City of Rolfe, Iowa	SPU-06-7	Municipalization

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Kansas Corporation Commission				
Great Plains Energy Kansas City Power and Light Company	1/17	Great Plains Energy, Kansas City Power & Light Company, and Westar Energy	16-KCPE-593-ACQ	Merger Standards, Acquisition Premium, Ring-Fencing, Public Interest Standard
Great Plains Energy Kansas City Power and Light Company	8/17 2/18	Great Plains Energy, Kansas City Power & Light Company, and Westar Energy	18-KCPE-095-MER	Merger Standards, Transaction Value, Merger Benefits, Ring-Fencing,
Maine Public Utility Commission				
Northern Utilities	5/96	Granite State and PNGTS	95-480 95-481	Transportation Service and PBR
Maine Water Company	7/19 8/19	Maine Water Company	2019-00096	Merger Standards, Net Benefits to Customers, Ring-fencing
Maryland Public Service Commission				
Eastalco Aluminum	3/82	Potomac Edison	7604	Cost Allocation
Potomac Electric Power Company	8/99	Potomac Electric Power Company	8796	Stranded Cost & Price Protection
AltaGas Ltd./WGL Holdings	4/17 9/17 1/18 2/18	AltaGas Ltd./WGL Holdings	9449	Merger Standards, Public Interest Standard
Washington Gas Light Company	8/20	Washington Gas Light Company	9622	Regulatory Policy
Massachusetts Department of Public Utilities				
Haverhill Gas	5/82	Haverhill Gas	DPU #1115	Cost of Capital
New England Energy Group	1/87	Commission Investigation	-	Gas Transportation Rates

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Energy Consortium of Mass.	9/87	Commonwealth Gas Company	DPU-87-122	Cost Allocation, Rate Design
Mass. Institute of Technology	12/88	Middleton Municipal Light	DPU #88-91	Cost Allocation, Rate Design
Energy Consortium of Mass.	3/89	Boston Gas	DPU #88-67	Rate Design
PG&E Bechtel Generating Co./ Constellation Holdings	10/91	Commission Investigation	DPU #91-131	Valuation of Environmental Externalities
Coalition of Non-Utility Generators	1991	Cambridge Electric Light Co. & Commonwealth Electric Co.	DPU 91-234 EFSC 91-4	Integrated Resource Management
The Berkshire Gas Company Essex County Gas Company Fitchburg Gas and Elec. Light Co.	5/92	The Berkshire Gas Company Essex County Gas Company Fitchburg Gas & Elec. Light Co.	DPU #92-154	Gas Purchase Contract Approval
Boston Edison Company	7/92	Boston Edison	DPU #92-130	Least-Cost Planning
Boston Edison Company	7/92	The Williams/Newcorp Generating Co.	DPU #92-146	RFP Evaluation
Boston Edison Company	7/92	West Lynn Cogeneration	DPU #92-142	RFP Evaluation
Boston Edison Company	7/92	L'Energia Corp.	DPU #92-167	RFP Evaluation
Boston Edison Company	7/92	DLS Energy, Inc.	DPU #92-153	RFP Evaluation

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Boston Edison Company	7/92	CMS Generation Co.	DPU #92-166	RFP Evaluation
Boston Edison Company	7/92	Concord Energy	DPU #92-144	RFP Evaluation
The Berkshire Gas Company Colonial Gas Company Essex County Gas Company Fitchburg Gas and Electric Company	11/93	The Berkshire Gas Company Colonial Gas Company Essex County Gas Company Fitchburg Gas and Electric Co.	DPU #93-187	Gas Purchase Contract Approval
Bay State Gas Company	10/93	Bay State Gas Company	93-129	Integrated Resource Planning
Boston Edison Company	94	Boston Edison	DPU #94-49	Surplus Capacity
Hudson Light & Power Department	4/95	Hudson Light & Power Dept.	DPU #94-176	Stranded Costs
Essex County Gas Company	5/96	Essex County Gas Company	96-70	Unbundled Rates
Boston Edison Company	8/97	Boston Edison Company	97-63	Holding Company Corporate Structure
Berkshire Gas Company	6/98	Berkshire Gas Mergeco Gas Co.	D.T.E. 98-87	Merger Approval
Eastern Edison Company	8/98	Montaup Electric Company	D.T.E. 98-83	Marketing for Divestiture of its Generation Business
Boston Edison Company	98	Boston Edison Company	D.T.E. 97-113	Fossil Generation Divestiture
Boston Edison Company	2/99	Boston Edison Company	D.T.E. 98-119	Nuclear Generation Divestiture
Eastern Edison Company	12/98	Montaup Electric Company	D.T.E. 99-9	Sale of Nuclear Plant

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
NStar	9/07 12/07	NStar, Bay State Gas, Fitchburg G&E, NE Gas, W. MA Electric	DPU 07-50	Decoupling, Risk
NStar	6/11	NStar, Northeast Utilities	DPU 10-170	Merger Approval
Town of Milford	1/19 3/19 5/19	Milford Water Company	DPU 18-60	Valuation Analysis
Massachusetts Energy Facilities Siting Council				
Mass. Institute of Technology	1/89	M.M.W.E.C.	EFSC-88-1	Least-Cost Planning
Boston Edison Company	9/90	Boston Edison	EFSC-90-12	Electric Generation Markets
Silver City Energy Ltd. Partnership	11/91	Silver City Energy	D.P.U. 91-100	State Policies, Need for Facility
Michigan Public Service Commission				
Detroit Edison Company	9/98	Detroit Edison Company	U-11726	Market Value of Generation Assets
Consumers Energy Company	8/06 1/07	Consumers Energy Company	U-14992	Sale of Nuclear Plant
WE Energies	12/11	Wisconsin Electric Power Co	U-16830	Economic Benefits, Prudence
Consumer Energy Company	7/13	Consumers Energy Company	U-17429	Certificate of Need, Integrated Resource Plan
WE Energies	8/14 3/15	WE Energies/Integrys	U-17682	Merger Application
Minnesota Public Utilities Commission				
Xcel Energy/No. States Power	9/04	Xcel Energy/No. States Power	G002/GR-04-1511	NRG Impacts
Interstate Power and Light	8/05	Interstate Power and Light and FPL Energy Duane Arnold, LLC	E001/PA-05-1272	Sale of Nuclear Plant

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Northern States Power Company d/b/a Xcel Energy	11/05	Northern States Power Company	E002/GR-05-1428	NRG Impacts on Debt Costs
Northern States Power Company d/b/a Xcel Energy	9/06 10/06 11/06	NSP v. Excelsior	E6472/M-05-1993	PPA, Financial Impacts
Northern States Power Company d/b/a Xcel Energy	11/06	Northern States Power Company	G002/GR-06-1429	Return on Equity
Northern States Power	11/08 05/09	Northern States Power Company	E002/GR-08-1065	Return on Equity
Northern States Power	11/09 6/10	Northern States Power Company	G002/GR-09-1153	Return on Equity
Northern States Power	11/10 5/11	Northern States Power Company	E002/GR-10-971	Return on Equity
Northern States Power Company	1/16	Northern States Power Company	E002/GR-15-826	Industry Perspective
Northern States Power Company	11/19	Northern States Power Company	E002/GR-19-564	Return on Equity
CenterPoint Energy	10/21 1/22	CenterPoint Energy	G008/M-21-138 71-2500-37763	Prudence, Gas Purchasing Decisions
Missouri House Committee on Energy and the Environment				
Ameren Missouri	3/16	Ameren Missouri	HB 2816	Performance-Based Ratemaking
Missouri Public Service Commission				
Missouri Gas Energy	1/03 4/03	Missouri Gas Energy	GR-2001-382	Gas Purchasing Practices, Prudence
Aquila Networks	2/04	Aquila-MPS, Aquila L&P	ER-2004-0034 HR-2004-0024	Cost of Capital, Capital Structure

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Aquila Networks	2/04	Aquila-MPS, Aquila L&P	GR-2004-0072	Cost of Capital, Capital Structure
Missouri Gas Energy	11/05 2/06 7/06	Missouri Gas Energy	GR-2002-348 GR-2003-0330	Capacity Planning
Missouri Gas Energy	11/10 1/11	KCP&L	ER-2010-0355	Natural Gas DSM
Missouri Gas Energy	11/10 1/11	KCP&L GMO	ER-2010-0356	Natural Gas DSM
Laclede Gas Company	5/11	Laclede Gas Company	CG-2011-0098	Affiliate Pricing Standards
Union Electric Company d/b/a Ameren Missouri	2/12 8/12	Union Electric Company	ER-2012-0166	Return on Equity, Earnings Attrition, Regulatory Lag
Union Electric Company d/b/a Ameren Missouri	6/14	Noranda Aluminum Inc.	EC-2014-0223	Ratemaking, Regulatory and Economic Policy
Union Electric Company d/b/a Ameren Missouri	1/15 2/15	Union Electric Company	ER-2014-0258	Revenue Requirements, Ratemaking Policies
Great Plains Energy Kansas City Power and Light Company	8/17 2/18 3/18	Great Plains Energy, Kansas City Power & Light Company, and Westar Energy	EM-2018-0012	Merger Standards, Transaction Value, Merger Benefits, Ring-Fencing,
Union Electric Company d/b/a Ameren Missouri	6/19	Union Electric Company d/b/a Ameren Missouri	EO-2017-0176	Affiliate Transactions, Cost Allocation Manual
Union Electric Company d/b/a Ameren Missouri	7/19 1/20 2/20	Union Electric Company d/b/a Ameren Missouri	ER-2019-0335	Reasonableness of Affiliate Services and Costs
Union Electric Company d/b/a Ameren Missouri	3/21	Union Electric Company d/b/a Ameren Missouri	GR-2021-0241	Affiliate Transactions

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Union Electric Company d/b/a Ameren Missouri	3/21 10/21	Union Electric Company d/b/a Ameren Missouri	ER-2021-0240	Affiliate Transactions, Prudence Standard, Used and Useful Principle
Empire District Electric Company	5/21 12/21 1/22	Empire District Electric Company	ER-2021-0312	Return on Equity
Empire District Gas Company	8/21 3/22	Empire District Gas Company	GR-2021-0320	Return on Equity
Empire District Electric Company	5/22	Empire District Electric Company	EO-2022-0040 EO-2022-0193	Prudence Policy, Securitization
Evergy Missouri West	7/22	Evergy Missouri West	EF-2022-0155	Regulatory Policy, Securitization of Fuel and Purchased Power Costs
Union Electric Company d/b/a Ameren Missouri	8/22	Union Electric Company d/b/a Ameren Missouri	ER-2022-0337	Affiliate Transactions, Prudence Standard
Evergy Missouri Metro and Evergy Missouri West	8/22	Evergy Missouri Metro and Evergy Missouri West	ER-2022-0129 ER-2022-0130	Prudence Standard
Missouri Senate Committee on Commerce, Consumer Protection, Energy and the Environment				
Ameren Missouri	3/16	Ameren Missouri	SB 1028	Performance-Based Ratemaking
Montana Public Service Commission				
Great Falls Gas Company	10/82	Great Falls Gas Company	82-4-25	Gas Rate Adjustment Clause
National Energy Board (now the Canada Energy Regulator)				
Alberta Northeast	2/87	Alberta Northeast Gas Export Project	GH-1-87	Gas Export Markets
Alberta Northeast	11/87	TransCanada Pipeline	GH-2-87	Gas Export Markets
Alberta Northeast	1/90	TransCanada Pipeline	GH-5-89	Gas Export Markets

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Independent Petroleum Association of Canada	1/92	Interprovincial Pipeline, Inc.	RH-2-91	Pipeline Valuation, Toll
The Canadian Association of Petroleum Producers	11/93	Trans Mountain Pipeline	RH-1-93	Cost of Capital
Alliance Pipeline LP	6/97	Alliance Pipeline LP	GH-3-97	Market Study
Maritimes & Northeast Pipeline	97	Sable Offshore Energy Project	GH-6-96	Market Study
Maritimes & Northeast Pipeline	2/02	Maritimes & Northeast Pipeline	GH-3-2002	Natural Gas Demand Analysis
TransCanada Pipelines	8/04	TransCanada Pipelines	RH-3-2004	Toll Design
Brunswick Pipeline	5/06	Brunswick Pipeline	GH-1-2006	Market Study
TransCanada Pipelines Ltd.	12/06 4/07	TransCanada Pipelines Ltd.: Gros Cacouna Receipt Point Application	RH-1-2007	Toll Design
Repsol Energy Canada Ltd	3/08	Repsol Energy Canada Ltd	GH-1-2008	Market Study
Maritimes & Northeast Pipeline	7/10	Maritimes & Northeast Pipeline	RH-4-2010	Regulatory Policy, Toll Development
TransCanada Pipelines Ltd	9/11 5/12	TransCanada Pipelines Ltd.	RH-3-2011	Business Services and Tolls Application
Trans Mountain Pipeline LLC	6/12 1/13	Trans Mountain Pipeline LLC	RH-1-2012	Toll Design
TransCanada Pipelines Ltd	8/13	TransCanada Pipelines Ltd	RE-001-2013	Toll Design

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
NOVA Gas Transmission Ltd	11/13	NOVA Gas Transmission Ltd	OF-Fac-Gas-N081-2013-10 01	Toll Design
Trans Mountain Pipeline LLC	12/13	Trans Mountain Pipeline LLC	OF-Fac-Oil-T260-2013-03 01	Economic and Financial Feasibility, Project Benefits
Energy East Pipeline Ltd.	10/14	Energy East Pipeline	Of-Fac-Oil-E266-2014-01 02	Economic and Financial Feasibility, Project Benefits
NOVA Gas Transmission Ltd	5/16	NOVA Gas Transmission Ltd	GH-003-2015	Certificate of Public Convenience and Necessity
TransCanada PipeLines Limited	4/17 9/17	TransCanada PipeLines Limited	RH-003-2017	Public Interest, Toll Design
NOVA Gas Transmission Ltd	10/17	NOVA Gas Transmission Ltd	MH-031-2017	Toll Design
NOVA Gas Transmission Ltd	3/19 11/19	NOVA Gas Transmission Ltd	RH-001-2019	Tolling Changes
Enbridge Pipelines Inc.	12/19 6/20 8/20 4/21	Enbridge Pipelines Inc.	RH-001-2020	Market and Scarcity Conditions; Reasonableness of Tolls, Terms, and Conditions; Public Interest; Open Season Process
NOVA Gas Transmission LTD.	5/21 12/21	NOVA Gas Transmission LTD.	RH-001-2021	Toll Design
TransCanada Keystone Pipeline GP Ltd	6/22	TransCanada Keystone Pipeline Limited Partnership by its General Partner TransCanada Keystone Pipeline GP Ltd	RH-005-2020	Toll Design
CNOOC Marketing Canada	8/22	CNOOC Marketing Canada	RH-001-2022	Open Access Issues

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
New Brunswick Energy and Utilities Board				
Atlantic Wallboard/JD Irving Co	1/08	Enbridge Gas New Brunswick	MCTN #298600	Rate Setting for EGNB
Atlantic Wallboard/Flakeboard	9/09 6/10 7/10	Enbridge Gas New Brunswick	NBEUB 2009-017	Rate Setting for EGNB
Atlantic Wallboard/Flakeboard	1/14	Enbridge Gas New Brunswick	NBEUB Matter 225	Rate Setting for EGNB
New Hampshire Public Utilities Commission				
Bus & Industry Association	6/89	P.S. Co. of New Hampshire	DR89-091	Fuel Costs
Bus & Industry Association	5/90	Northeast Utilities	DR89-244	Merger & Acquisition Issues
Eastern Utilities Associates	6/90	Eastern Utilities Associates	DF89-085	Merger & Acquisition Issues
EnergyNorth Natural Gas	12/90	EnergyNorth Natural Gas	DE90-166	Gas Purchasing Practices
EnergyNorth Natural Gas	7/90	EnergyNorth Natural Gas	DR90-187	Special Contracts, Discounted Rates
Northern Utilities, Inc.	12/91	Commission Investigation	DR91-172	Generic Discounted Rates
Public Service Co. of New Hampshire	7/14	Public Service Co. of NH	DE 11-250	Prudence
Public Service Co. of New Hampshire	7/15 11/15	Public Service Co. of NH	14-238	Restructuring and Rate Stabilization
New Jersey Board of Public Utilities				
Hilton/Golden Nugget	12/83	Atlantic Electric	BPU 832-154	Line Extension Policies
Golden Nugget	3/87	Atlantic Electric	BPU 837-658	Line Extension Policies

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
New Jersey Natural Gas	2/89	New Jersey Natural Gas	BPU GR89030335J	Cost Allocation, Rate Design
New Jersey Natural Gas	1/91	New Jersey Natural Gas	BPU GR90080786J	Cost Allocation, Rate Design
New Jersey Natural Gas	8/91	New Jersey Natural Gas	BPU GR91081393J	Rate Design, Weather Normalization Clause
New Jersey Natural Gas	4/93	New Jersey Natural Gas	BPU GR93040114J	Cost Allocation, Rate Design
South Jersey Gas	4/94	South Jersey Gas	BRC Dock No. GR080334	Revised Levelized Gas Adjustment
New Jersey Utilities Association	9/96	Commission Investigation	BPU AX96070530	PBOP Cost Recovery
Morris Energy Group	11/09	Public Service Electric & Gas	BPU GR 09050422	Discriminatory Rates
New Jersey American Water Co.	4/10	New Jersey American Water Co.	BPU WR 1040260	Tariff Rates and Revisions
Electric Customer Group	1/11	Generic Stakeholder Proceeding	BPU GR10100761 ER10100762	Natural Gas Ratemaking Standards and pricing
New Mexico Public Service Commission				
Gas Company of New Mexico	11/83	Public Service Co. of New Mexico	1835	Cost Allocation, Rate Design
Southwestern Public Service Co., New Mexico	12/12	SPS New Mexico	12-00350-UT	Rate Case, Return on Equity
PNM Resources	12/13 10/14 12/14	Public Service Co. of New Mexico	13-00390-UT	Nuclear Valuation, In Support of Stipulation

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
New York State Public Service Commission				
Iroquois Gas Transmission	12/86	Iroquois Gas Transmission System	70363	Gas Markets
Brooklyn Union Gas Company	8/95	Brooklyn Union Gas Company	95-6-0761	Panel on Industry Directions
Central Hudson, ConEdison and Niagara Mohawk	9/00	Central Hudson, ConEdison and Niagara Mohawk	96-E-0909 96-E-0897 94-E-0098 94-E-0099	Section 70, Approval of New Facilities
Central Hudson, New York State Electric & Gas, Rochester Gas & Electric	5/01	Joint Petition of NiMo, NYSEG, RG&E, Central Hudson, Constellation and Nine Mile Point	01-E-0011	Section 70, Rebuttal Testimony
Rochester Gas & Electric	12/03	Rochester Gas & Electric	03-E-1231	Sale of Nuclear Plant
Rochester Gas & Electric	1/04	Rochester Gas & Electric	03-E-0765 02-E-0198 03-E-0766	Sale of Nuclear Plant; Ratemaking Treatment of Sale
Rochester Gas and Electric and NY State Electric & Gas Corp	2/10	Rochester Gas & Electric NY State Electric & Gas Corp	09-E-0715 09-E-0716 09-E-0717 09-E-0718	Depreciation Policy
National Fuel Gas Corporation	9/16 9/16	National Fuel Gas Corporation	16-G-0257	Ring-fencing Policy
NextEra Energy Transmission New York	8/18	NextEra Energy Transmission New York	18-T-0499	Certificate of Need for Transmission Line, Vertical Market Power
NextEra Energy Transmission New York	2/19 8/19	NextEra Energy Transmission New York	18-E-0765	Certificate of Need for Transmission Line, Vertical Market Power
Nova Scotia Utility and Review Board				
Nova Scotia Power	9/12	Nova Scotia Power	P-893	Audit Reply

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Nova Scotia Power	8/14	Nova Scotia Power	P-887	Audit Reply
Nova Scotia Power	5/16	Nova Scotia Power	2017-2019 Fuel Stability Plan	Used and Useful Ratemaking
NSP Maritime Link ("NSPML")	12/16 2/17 5/17	NSP Maritime Link ("NSPML")	M07718 NSPML Interim Cost Assessment Application	Used and Useful Ratemaking
NSP Maritime Link ("NSPML")	10/19	NSP Maritime Link ("NSPML")	M09277 NSPML 2020 Interim Assessment Application	Recovery of Depreciation and Return, Costs and Customer Benefits, Debt Service Coverage Ratio
Nova Scotia Power	2/21	Nova Scotia Power	M10013 Annapolis Tidal Generation Station Retirement: Request for Accounting Treatment and Net Book Value Recovery	Generation Plant Cost Recovery
NSP Maritime Link ("NSPML")	8/21	NSP Maritime Link ("NSPML")	M10206 NSPML Final Cost Assessment Application	Prudence Review
Nova Scotia Power	1/22 8/22	Nova Scotia Power	M10431 2022-2024 General Rate Application	Decarbonization Policy, Recovery of Energy Transition Costs
Oklahoma Corporation Commission				
Oklahoma Natural Gas Company	6/98	Oklahoma Natural Gas Company	PUD 980000177	Storage Issues
Oklahoma Gas & Electric Company	5/05 9/05	Oklahoma Gas & Electric Company	PUD 200500151	Prudence of McLain Acquisition
Oklahoma Gas & Electric Company	3/08	Oklahoma Gas & Electric Company	PUD 200800086	Acquisition of Redbud Generating Facility

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Oklahoma Gas & Electric Company	8/14 1/15	Oklahoma Gas & Electric Company	PUD 201400229	Integrated Resource Plan
Ontario Energy Board				
Market Hub Partners Canada, LP	5/06	Natural Gas Electric Interface Roundtable	File No. EB-2005-0551	Market-based Rates for Storage
Ontario Power Generation	9/13 2/14 5/14	Ontario Power Generation	EB-2013-0321	Prudence Review of Nuclear Project Management Processes
Oregon Public Utilities Commission				
Hydro One Limited and Avista Corporation	8/18 10/18	Hydro One Limited and Avista Corporation	UM 1897	Reasonableness and Sufficiency of the Governance, Bankruptcy, and Financial Ring-Fencing Stipulated Settlement Commitments
Pennsylvania Public Utility Commission				
ATOC	4/95	Equitrans	R-00943272	Rate Design, Unbundling
ATOC	3/96 4/96	Equitrans	P-00940886	Rate Design, Unbundling
Rhode Island Public Utilities Commission				
Newport Electric	7/81	Newport Electric	1599	Rate Attrition
South County Gas	9/82	South County Gas	1671	Cost of Capital
New England Energy Group	7/86	Providence Gas Company	1844	Cost Allocation, Rate Design
Providence Gas	8/88	Providence Gas Company	1914	Load Forecast, Least-Cost Planning
Providence Gas Company and The Valley Gas Company	1/01 3/02	Providence Gas Company and The Valley Gas Company	1673 1736	Gas Cost Mitigation Strategy
The New England Gas Company	3/03	New England Gas Company	3459	Cost of Capital

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
PPL Corporation and PPL Rhode Island Holdings, LLC	11/21	PPL Corporation, PPL Rhode Island Holdings, LLC, National Grid USA, and The Narragansett Electric Company	21-09	Merger Approval Issues
Texas Public Utility Commission				
Southwestern Electric	5/83	Southwestern Electric	-	Cost of Capital, CWIP
P.U.C. General Counsel	11/90	Texas Utilities Electric Company	9300	Gas Purchasing Practices, Prudence
Oncor Electric Delivery Company	8/07	Oncor Electric Delivery Company	34040	Regulatory Policy, Rate of Return, Return of Capital and Consolidated Tax Adjustment
Oncor Electric Delivery Company	6/08	Oncor Electric Delivery Company	35717	Regulatory policy
Oncor Electric Delivery Company	10/08 11/08	Oncor, TCC, TNC, ETT, LCRA TSC, Sharyland, STEC, TNMP	35665	Competitive Renewable Energy Zone
CenterPoint Energy	6/10 10/10	CenterPoint Energy/Houston Electric	38339	Regulatory Policy, Risk, Consolidated Taxes
Oncor Electric Delivery Company	1/11	Oncor Electric Delivery Company	38929	Regulatory Policy, Risk
Cross Texas Transmission	8/12 11/12	Cross Texas Transmission	40604	Return on Equity
Southwestern Public Service	11/12	Southwestern Public Service	40824	Return on Equity
Lone Star Transmission	5/14	Lone Star Transmission	42469	Return on Equity, Debt, Cost of Capital
CenterPoint Energy Houston Electric, LLC	6/15	CenterPoint Energy Houston Electric, LLC	44572	Distribution Cost Recovery Factor

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
NextEra Energy, Inc.	10/16 2/17	Oncor Electric Delivery Company LLC, NextEra Energy	46238	Merger Application, Ring-fencing, Affiliate Interest, Code of Conduct
CenterPoint Energy Houston Electric, LLC	4/19 6/19	CenterPoint Energy Houston Electric, LLC	49421	Incentive Compensation
Sun Jupiter Holdings LLC and IIF US Holding 2 LP	11/19	Sun Jupiter Holdings LLC and IIF US Holding 2 LP Acquisition of El Paso Electric Company	49849	Public Interest Standard, Ring-fencing, Regulatory Commitments, Rate Credit and Economic Considerations, Ownership and Governance Post-closing, Tax Matters
Texas-New Mexico Power Company and Avangrid, Inc. and NM Green Holdings, Inc.	3/21	Texas-New Mexico Power Company and Avangrid, Inc. and NM Green Holdings, Inc.	51547	Merger Approval Conditions
Texas Railroad Commission				
Western Gas Interstate Company	1/85	Southern Union Gas Company	5238	Cost of Service
Atmos Pipeline Texas	9/10 1/11	Atmos Pipeline Texas	GUD 10000	Ratemaking Policy, Risk
Atmos Pipeline Texas	1/17 4/17	Atmos Pipeline Texas	GUD 10580	Ratemaking Policy, Return on Equity, Rate Design Policy
Texas State Legislature				
CenterPoint Energy	4/13	Association of Electric Companies of Texas	SB 1364	Consolidated Tax Adjustment Clause Legislation
Utah Public Service Commission				
AMAX Magnesium	1/88	Mountain Fuel Supply Company	86-057-07	Cost Allocation, Rate Design
AMAX Magnesium	4/88	Utah P&L/Pacific P&L	87-035-27	Merger & Acquisition

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Utah Industrial Group	7/90 8/90	Mountain Fuel Supply	89-057-15	Gas Transportation Rates
AMAX Magnesium	9/90	Utah Power & Light	89-035-06	Energy Balancing Account
AMAX Magnesium	8/90	Utah Power & Light	90-035-06	Electric Service Priorities
Questar Gas Company	12/07	Questar Gas Company	07-057-13	Benchmarking in Support of ROE
Vermont Public Service Board				
Green Mountain Power	8/82	Green Mountain Power	4570	Rate Attrition
Green Mountain Power	12/97	Green Mountain Power	5983	Cost of Service
Green Mountain Power	7/98 9/00	Green Mountain Power	6107	Rate Development
Virginia Corporation Commission				
Virginia Electric and Power Company d/b/a Dominion Energy Virginia	3/21 5/21	Virginia Electric and Power Company d/b/a Dominion Energy Virginia	PUR-2021-00058	Regulatory Policy
Washington Utilities and Transportation Commission				
Hydro One Limited and Avista Corporation	9/18	Hydro One Limited and Avista Corporation	U-170970	Reasonableness and Sufficiency of the Governance, Bankruptcy, and Financial Ring-Fencing Stipulated Settlement Commitments
Wisconsin Public Service Commission				
WEC & WICOR	11/99	WEC	9401-YO-100 9402-YO-101	Approval to Acquire the Stock of WICOR
Wisconsin Electric Power Company	1/07	Wisconsin Electric Power Co.	6630-EI-113	Sale of Nuclear Plant

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Wisconsin Electric Power Company	10/09	Wisconsin Electric Power Co.	6630-CE-302	CPCN Application for Wind Project
Northern States Power Wisconsin	10/13	Xcel Energy (dba Northern States Power Wisconsin)	4220-UR-119	Fuel Cost Adjustments
Wisconsin Electric Power Company	11/13	Wisconsin Electric Power Co.	6630-FR-104	Fuel Cost Adjustment
Wisconsin Gas LLC	5/14	Wisconsin Gas LLC	6650-CG-233	Gas Line Expansion, Reasonableness
WE Energy	8/14 1/15 3/15	WE Energy/Integrys	9400-YO-100	Merger Approval
Wisconsin Public Service Corporation	1/19	Madison Gas and Electric Company and Wisconsin Public Service Corporation	5-BS-228	Evaluation of Models Used in Resource Investment Decisions

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
American Arbitration Association				
Michael Polsky	3/91	M. Polsky vs. Indeck Energy	-	Corporate Valuation, Damages
ProGas Limited	7/92	ProGas Limited v. Texas Eastern	-	Gas Contract Arbitration
Attala Generating Company	12/03	Attala Generating Co v. Attala Energy Co.	16-Y-198-00228-03	Power Project Valuation, Breach of Contract, Damages
Nevada Power Company	4/08	Nevada Power v. Nevada Cogeneration Assoc. #2	-	Power Purchase Agreement
Sensata Technologies, Inc./EMS Engineered Materials Solutions, LLC	1/11	Sensata Technologies, Inc./EMS Engineered Materials Solutions, LLC v. Pepco Energy Services	11-198-Y-00848-10	Change in Usage Dispute, Damages
Sandy Creek Energy Associates, LP	9/17	Sandy Creek Energy Associates, LP vs. Lower Colorado River Authority	01-16-0002-6892	Power Purchase Agreement, Analysis of Damages
Dynegy Midwest Generation, LLC	1/21 2/21	BNSF Railway Company and Norfolk Southern Railway Company v. Dynegy Midwest Generation, LLC	01-18-0001-3283	Electric Generation Asset Management
Bermuda Supreme Court, Civil Jurisdiction				
Bermuda Electric Light Company Limited	12/22	Bermuda Electric Light Company Limited v. The Regulatory Authority of Bermuda	2022: NO. 97	Ratemaking Practices and Policy

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Canadian Arbitration Panel				
Hydro-Québec	4/15 5/16 7/16	Hydro-Fraser et al v. Hydro-Québec	-	Electric Price Arbitration
Commonwealth of Massachusetts, Appellate Tax Board				
NStar Electric Company	8/14	NStar Electric Company	F316346 F319254	Valuation Methodology
Western Massachusetts Electric Company	2/16	Western Massachusetts Electric Company v. Board of Assessors of The City of Springfield	315550 319349	Valuation Methodology
Commonwealth of Massachusetts, Suffolk Superior Court				
John Hancock	1/84	Trinity Church v. John Hancock	C.A. No. 4452	Damages Quantification
Court of Common Pleas of Philadelphia County, Civil Division				
Sunoco Marketing & Terminals LP	11/16	Sunoco Marketing & Terminals, LP v. South Jersey Resources Group	150302520	Damages Quantification
District of Columbia, Committee on Consumer and Regulatory Affairs				
Potomac Electric Power Co.	7/99	Potomac Electric Power Co.	Bill 13-284	Utility Restructuring
Illinois Appellate Court, Fifth Division				
Norweb, PLC	8/02	Indeck North America v. Norweb	97 CH 07291	Breach of Contract, Power Plant Valuation
Independent Arbitration Panel				
Alberta Northeast Gas Limited	2/98	ProGas Ltd., Canadian Forest Oil Ltd., AEC Oil & Gas	-	
Ocean State Power	9/02	Ocean State Power vs. ProGas Ltd.	2001/2002 Arbitration	Gas Price Arbitration

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Ocean State Power	2/03	Ocean State Power vs. ProGas Ltd.	2002/2003 Arbitration	Gas Price Arbitration
Ocean State Power	6/04	Ocean State Power vs. ProGas Ltd.	2003/2004 Arbitration	Gas Price Arbitration
Shell Canada Limited	7/05	Shell Canada Limited and Nova Scotia Power Inc.	-	Gas Contract Price Arbitration
International Chamber of Commerce				
Senvion GmbH	4/17	Senvion GmbH v. EDF Renewable Energy, Inc.	01-15-0005-4590	Breach-Related Damages, Unfair Competition, Unjust Enrichment
Senvion GmbH	9/17	Senvion GmbH v. EEN CA Lac Alfred Limited Partnership, et al.	21535	Breach-Related Damages
Senvion GmbH	12/17	Senvion GmbH v. EEN CA Massif du Sud Limited Partnership, et al.	21536	Breach-Related Damages
EDF Inc.	3/21	Exelon Generating Company, LLC v. EDF Inc.	25479/MK	Valuation of Nuclear Power Plants
International Court of Arbitration				
Wisconsin Gas Company, Inc.	2/97	Wisconsin Gas Co. vs. Pan-Alberta	9322/CK	Contract Arbitration
Minnegasco, A Division of NorAm Energy Corp.	3/97	Minnegasco vs. Pan-Alberta	9357/CK	Contract Arbitration
Utilicorp United Inc.	4/97	Utilicorp vs. Pan-Alberta	9373/CK	Contract Arbitration
IES Utilities	97	IES vs. Pan-Alberta	9374/CK	Contract Arbitration

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Mitsubishi Heavy Industries, Ltd., and Mitsubishi Nuclear Energy Systems, Inc.	12/15 2/16	Southern California Edison Company, Edison Material Supply LLC, San Diego Gas & Electric Co., and the City of Riverside vs. Mitsubishi Heavy Industries, Ltd., and Mitsubishi Nuclear Energy Systems, Inc.	19784/AGF/RD	Damages Arising Under a Nuclear Power Equipment Contract
Province of Alberta, Court of Queen's Bench				
Alberta Northeast Gas Limited	5/07	Cargill Gas Marketing Ltd. vs. Alberta Northeast Gas Limited	Action No. 0501-03291	Gas Contracting Practices
Quebec Superior Court, District of Gaspé				
Senvion Canada and Senvion GmbH	2/19	Senvion Canada and Senvion GmbH v. Suspendem Rope Access	-	Breach-Related Damages, Reimbursement of Liquidated Damages, Reimbursement of Scheduled Maintenance Penalties
State of Delaware, Court of Chancery, New Castle County				
Wilmington Trust Company	11/05	Calpine Corporation vs. Bank of New York and Wilmington Trust Company	C.A. No. 1669-N	Bond Indenture Covenants
State of New Jersey, Mercer County Superior Court				
Transamerica Corp., et al.	7/07 10/07	IMO Industries Inc. vs. Transamerica Corp., et al.	L-2140-03	Breach-Related Damages, Enterprise Value
State of New York, Nassau County Supreme Court				
Steel Los III, LP	6/08	Steel Los II, LP & Associated Brook, Corp v. Power Authority of State of NY	Index No. 5662/05	Property Seizure

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
State of New Hampshire, Board of Tax and Land Appeals				
Public Service Company of New Hampshire d/b/a Eversource Energy	11/18	Appeal of Public Service Company of New Hampshire d/b/a Eversource Energy	28873-14-15-16-17PT	Valuation of Transmission and Distribution Assets
State of New Hampshire, Judicial Court-Rockingham Superior Court				
Public Service Company of New Hampshire d/b/a Eversource Energy	10/18	Public Service Company of New Hampshire d/b/a Eversource Energy v. City of Portsmouth	218-2016-CV-00899 218-2017-CV-00917	Valuation of Transmission and Distribution Assets
State of New Hampshire, Superior Court-Merrimack County				
Public Service Company of New Hampshire d/b/a Eversource Energy	3/18	Public Service Company of New Hampshire d/b/a Eversource Energy v. Town of Bow	217-2015-CV-00469 217-2016-CV-00474 217-2017-CV-00422	Valuation of Transmission and Distribution Assets
State of Rhode Island, Providence City Court				
Aquidneck Energy	5/87	Laroche vs. Newport	-	Least-Cost Planning
State of Texas, Hutchinson County Court				
Western Gas Interstate	5/85	State of Texas vs. Western Gas Interstate Co.	14,843	Cost of Service
State of Utah, Third District Court				
PacifiCorp & Holme, Roberts & Owen, LLP	1/07	USA Power & Spring Canyon Energy vs. PacifiCorp. et al.	Civil No. 050903412	Breach-Related Damages
U.S. Bankruptcy Court, New Hampshire District				
EUA Power Corporation	7/92	EUA Power Corporation	BK-91-10525-JEY	Pre-Petition Solvency

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
U.S. Bankruptcy Court, New Jersey District				
Ponderosa Pine Energy Partners, Ltd.	7/05	Ponderosa Pine Energy Partners, Ltd.	05-21444	Forward Contract Bankruptcy Treatment
U.S. Bankruptcy Court, New York Northern District				
Cayuga Energy, NYSEG Solutions, The Energy Network	09/09	Cayuga Energy, NYSEG Solutions, The Energy Network	06-60073-6-sdg	Going Concern
U.S. Bankruptcy Court, New York Southern District				
Johns Manville	5/04	Enron Energy Mktg. v. Johns Manville; Enron No. America v. Johns Manville	01-16034 (AJG)	Breach of Contract, Damages
U.S. Bankruptcy Court, Texas Northern District				
Southern Maryland Electric Cooperative, Inc., and Potomac Electric Power Company	11/04	Mirant Corporation, et al. v. SMECO	03-4659; Adversary No. 04-4073	PPA Interpretation, Leasing
U.S. Bankruptcy Court, Texas Southern District				
Ultra Petroleum Corp. et al	3/17	Ultra Petroleum Corp. et al	16-32202 (MI)	Valuation
U.S. Court of Federal Claims				
Boston Edison Company	7/06 11/06	Boston Edison Company v. United States	99-447C 03-2626C	Spent Nuclear Fuel Breach, Damages
Consolidated Edison Company	7/07	Consolidated Edison Company	06-305T	Evaluation of Lease Purchase Option
Consolidated Edison Company	2/08 6/08	Consolidated Edison Company v. United States	04-0033C	Spent Nuclear Fuel Breach, Damages

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
Vermont Yankee Nuclear Power Corporation	6/08	Vermont Yankee Nuclear Power Corporation v. United States	03-2663C	Spent Nuclear Fuel Breach, Damages
Virginia Electric and Power Company d/b/a Dominion Virginia Power	3/19	Virginia Electric and Power Company d/b/a Dominion Virginia Power v. United States	17-464C	Double Recovery, Cost Recovery of Infrastructure Improvements
U. S. District Court, California, Northern				
Pacific Gas & Electric Co./PGT PG&E/PGT Pipeline Exp. Project	4/97	Norcen Energy Resources Limited	C94-0911 VRW	Fraud Claim
U. S. District Court, Colorado, Boulder County				
KN Energy, Inc.	3/93	KN Energy vs. Colorado GasMark, Inc.	92 CV 1474	Gas Contract Interpretation
U.S. District Court, Colorado, Garfield County				
Questar Corporation, et al	11/00	Questar Corporation, et al.	00CV129-A	Partnership Fiduciary Duties
U. S. District Court, Connecticut				
Constellation Power Source, Inc.	12/04	Constellation Power Source, Inc. v. Select Energy, Inc.	Civil Action 304 CV 983 (RNC)	ISO Structure, Breach of Contract

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
U.S. District Court, Illinois, Northern District, Eastern Division				
U.S. Securities and Exchange Commission	4/12	U.S. Securities and Exchange Commission v. Thomas Fisher, Kathleen Halloran, and George Behrens	07 C 4483	Prudence, PBR
U. S. District Court, Maine				
ACEC Maine, Inc. et al.	10/91	CIT Financial vs. ACEC Maine	90-0304-B	Project Valuation
Combustion Engineering	1/92	Combustion Eng. vs. Miller Hydro	89-0168P	Output Modeling, Project Valuation
U. S. District Court, Massachusetts				
Eastern Utilities Associates & Donald F. Pardus	3/94	NECO Enterprises Inc. vs. Eastern Utilities Associates	Civil Action No. 92-10355-RCL	Seabrook Power Sales
U. S. District Court, Montana				
KN Energy, Inc.	9/92	KN Energy v. Freeport MacMoRan	CV 91-40-BLG-RWA	Gas Contract Settlement
U.S. District Court, New Hampshire				
Portland Natural Gas Transmission and Maritimes & Northeast Pipeline	9/03	Public Service Company of New Hampshire vs. PNGTS and M&NE Pipeline	C-02-105-B	Impairment of Electric Transmission Right-of-Way

SPONSOR	DATE	CASE/APPLICANT	DOCKET NO.	SUBJECT
U. S. District Court, New York Southern District				
Central Hudson Gas & Electric	11/99 8/00	Central Hudson v. Riverkeeper, Inc., Robert H. Boyle, John J. Cronin	Civil Action 99 Civ 2536 (BDP)	Electric Restructuring, Environmental Impacts
Consolidated Edison	3/02	Consolidated Edison v. Northeast Utilities	Case No. 01 Civ. 1893 (JGK) (HP)	Industry Standards for Due Diligence
Merrill Lynch & Company	1/05	Merrill Lynch v. Allegheny Energy, Inc.	Civil Action 02 CV 7689 (HB)	Due Diligence, Breach of Contract, Damages
U.S. District Court, South Carolina				
Toshiba Corporation	4/20	Lightsey v. Toshiba Corp.	Action No. 9:18-cv-190	Project Delays and Cost Overruns Analyses
U. S. District Court, Virginia Eastern District				
Aquila, Inc.	1/05 2/05	VPEM v. Aquila, Inc.	Civil Action 304 CV 411	Breach of Contract, Damages
U. S. District Court, Virginia Western District				
Washington Gas Light Company	8/15 9/15	Washington Gas Light Company v. Mountaineer Gas Company	Civil Action No. 5:14-cv-41	Nominations and Gas Balancing, Lost and Unaccounted for Gas, Damages
U.S. Securities and Exchange Commission				
Eastern Utilities Association	10/92	EUA Power Corporation	File No. 70-8034	Value of EUA Power
U.S. Tax Court, Illinois				
Exelon Corporation	4/15 6/15	Exelon Corporation, as Successor by Merger to Unicom Corporation and Subsidiaries et al. v. Commission of Internal Revenue	29183-13 29184-13	Valuation of Analysis of Lease Terms and Quantify Plant Values

Financial Summary of Viable Storage Alternatives

Dollars in Millions

Line No.		LNG	Propane Air	New Underground Storage
	Physical Characteristics			
1	Storage (Mcf)	1,000,000	134,760	2,700,000
2	Maximum Deliverability (McfD)	195,000	33,690	190,000
3	*Number of Days*	*5.1*	*4.0*	*14.2*
4				
5	Capital Outlay (*2022 Dollars*)	$180.9	$25.6	$264.9
6				
7	*New Facility Revenue Requirements*			
8	30-Year NPV	$306.0	$84.3	$477.1
9	Year 2	$27.0	$6.4	$43.9
10	Year 15	$20.0	$6.3	$32.1
11				
12	*Add: Keystone Storage Reservation Costs*			
13	30-Year NPV	$12.4	$239.3	$8.3
14	Year 2	$4.7	$9.3	$0.0
15	Year 15	$0.0	$20.4	$0.0
16				
17	*Add: Commodity Cost Differential to Keystone Storage*			
18	30-Year NPV	$0.0	$41.4	$0.0
19	Year 2	$0.0	$2.5	$0.0
20	Year 15	$0.0	$4.1	$0.0
21				
22	*Total Revenue Requirements*			
23	30-Year NPV	$318.4	$365.0	$485.4
24	Year 2	$31.7	$18.2	$43.9
25	Year 15	$20.0	$30.8	$32.1
26				
27	***Status Quo: Keystone Storage @2.7 Bcf (Net of 1.0 Bcf Sublease)***			
28	30-Year NPV	$239.3	$239.3	$239.3
29	Year 2	$9.3	$9.3	$9.3
30	Year 15	$20.4	$20.4	$20.4
31				
32	*Variance to Status Quo*	*Favorable / (Unfavorable)*		
33	30-Year NPV	($79.1)	($125.7)	($246.1)
34	Year 2	($22.4)	($8.9)	($34.6)
35	Year 15	$0.4	($10.4)	($11.7)
36				
37	*Variance of Non-LNG Alternatives to LNG Case 1*	*Favorable / (Unfavorable)*		
38	30-Year NPV	N/A	($46.6)	($167.0)
39	Year 2	N/A	$13.5	($12.2)
40	Year 15	N/A	($10.8)	($12.1)

New Mexico Gas Company
Avoided Cost of Replacement Gas
2021 Winter Storm Uri

Line No.	Feb-21	Friday 12	Saturday 13	Sunday 14	Monday 15	Tuesday 16	Wednesday 17	Thursday 18	Total	Source:
	Replace Intraday Purchases (and Keystone Storage Withdrawals)									
	Dth									
1	Intraday purchase #1			34,502	10,000		10,751		55,253	*Exhibit 6 NMGC Application Case No. 21-00095-UT*
2	Intraday purchase #2			5,000	4,486				9,486	*Exhibit 6 NMGC Application Case No. 21-00095-UT*
3	Intraday purchase #3			15,000					15,000	*Exhibit 6 NMGC Application Case No. 21-00095-UT*
4	Intraday purchase #4			2,300					2,300	*Exhibit 6 NMGC Application Case No. 21-00095-UT*
5	Net Keystone Withdrawals		28,639	123,409	104,385	61,608	106,495	124,429	548,965	*Company Data*
6	Total Replacement Gas Need		28,639	180,211	118,871	61,608	117,246	124,429	631,004	*Sum lines 1 through 5*
7										
8										
9	Maximum LNG Available	195,000	195,000	195,000	195,000	195,000	195,000	195,000		*Pre-FEED Study*
10										
11	Replacement Gas Supplied by LNG		28,639	180,211	118,871	61,608	117,246	124,429	631,004	*Lesser of Line 6 or 9*
12										
13	Cost of LNG per Dth		$2.44	$2.44	$2.44	$2.44	$2.44	$2.44		*Company Data*
14	Intraday Purchase Price #1			$205.14	$205.14		$100.00			*Exhibit 6 NMGC Application Case No. 21-00095-UT*
15	Intraday Purchase Price #2			$165.00	$252.00					*Exhibit 6 NMGC Application Case No. 21-00095-UT*
16	Intraday Purchase Price #3			$175.00						*Exhibit 6 NMGC Application Case No. 21-00095-UT*
17	Intraday Purchase Price #4			$180.00						*Exhibit 6 NMGC Application Case No. 21-00095-UT*
18	Keystone Storage WACOG		$1.77	$1.77	$1.77	$1.77	$1.77	$1.77		*Company Data*
19										
20										
21	Cost of Intraday Purchases		$ -	$ 10,941,740	$ 3,181,872	$ -	$ 1,075,100	$ -	$ 15,198,712	*Line 1 * Line 14 + Line 2 * Line 15 + Line 3 * Line 16 + Line 4* Line 17*
22	Cost of Keystone Storage Gas		$ 50,691	$ 218,434	$ 184,761	$ 109,046	$ 188,496	$ 220,239	$ 971,668	*Line 5 * Line 18*
23	Cost of LNG		$ 69,748	$ 438,887	$ 289,499	$ 150,041	$ 285,542	$ 303,035	$ 1,536,752	*Line 11 * Line 13*
24	Replacement Gas (Savings)		$ 19,057	$ (10,721,287)	$ (3,077,134)	$ 40,994	$ (978,054)	$ 82,796	$ (14,633,629)	*Line 23 - Line 22 - Line 21*
25										
26										
27	**Proactive Use of LNG - Hypothetical**									
28	Remaining LNG Withdrawal Capability Available		166,361	14,789	76,129	133,392	77,754	70,571		*Line 9 - Line 11*
29	Proactive LNG Scheduled to reduce Day Ahead Purchase		0 - Because did not know gas price would spike				75,000	70,000	145,000	*Assumption*
30	Remaining LNG Withdrawal Capability to Address Additional Unknown Cuts		166,361	14,789	76,129	133,392	2,754	571		*Line 28 - Line 29*
31										
32	Gas Daily Gas Price (Transwestern, San Juan)	$10.77	$63.54	$63.54	$63.54	$63.54	$223.11	$34.73		*Gas Daily*
33	Cost of LNG		$2.44	$2.44	$2.44	$2.44	$2.44	$2.44		*Company Data*
34										
35	Proactive Use of LNG (Savings)		$ -	$ -	$ -	$ -	$ (16,550,594)	$ (2,260,272)	$ (18,810,866)	*(Line 33 - Line 32) * Line 29*
36										
37	**Allow for Resale of Day Ahead Purchase**									
38	LNG Withdrawal Capability Available		166,361	14,789	76,129	133,392	2,754	571		*Line 9 - Line 11 - Line 29*
39	Intraday LNG Used to allow for resale of Day Ahead Purchase		60,000	-	60,000	60,000	0 - because used proactively		180,000	*Assumption*
40	Remaining LNG Withdrawal Capability to Address Additional Unknown Cuts		106,361	14,789	16,129	73,392	2,754	571		*Line 38 - Line 39*
41										
42	Gas Daily Gas Price (Transwestern, San Juan)	$10.77	$63.54	$63.54	$63.54	$63.54	$223.11	$34.73		*Gas Daily*
43	Cost of LNG		$2.44	$2.44	$2.44	$2.44	$2.44	$2.44		*Company Data*
44										
45	Proactive Use of LNG (Savings)		$ (3,666,276)	$ -	$ (3,666,276)	$ (3,666,276)	$ -	$ -	$ (10,998,827)	*(Line 43 - Line 42) * Line 39*
46										
47										
48	Total Savings								**$ (44,443,322)**	*Line 24 + Line 35 + Line 45*
49										
50	LNG Inventory (End of Day)	1,000,000	911,361	731,150	552,279	430,671	238,425	43,996		*Previous Day - Line 11 - Line 29 - Line 39*

Assumptions:
Tank full at beginning of Storm
LNG Cost =

April, May, Sept, Oct 2020 daily average price at El Paso Permian	$	1.32	/MMBtu
+ variable cost adder from Pre-FEED Study	$	1.11	/MMBtu
	$	**2.44**	

Resale at Gas Daily Transwestern San Juan price

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

Dashboard

Key Assumptions	
Salaries and Benefits	3.0%
Maintenance Costs	2.5%
Property Taxes (% of Net Plant)	1.308%
Other Taxes (% of O&M)	0.0%
Keystone Annual Increase	6.20%
Underground Storage Adder per MMBtu	$0.000
LNG Adder per MMBtu	$0.000

Revenue Requirements *($ Million)*		Keystone	LNG	Propane Air	New Underground Storage
30-Year NPV w/terminal value, specific asset lives					
Gross Revenue Requirements		$239.3	$306.0	$84.3	$477.1
Keystone Costs			$12.4	$239.3	$8.3
Commodity Cost Differential			$0.0	$41.4	$0.0
30-Year NPV w/terminal value		**$239.3**	**$318.4**	**$365.0**	**$485.4**
Variance to Keystone	*Fav / (Unfav)*		($79.1)	($125.7)	($246.1)
30-Year NPV difference between LNG and Alternatives				*($46.6)*	*($167.0)*

LNG	Depreciable Life
Tank (with contingency)	70.0
Liquefaction	40.0
Vaporization	33.0
Compression	44.0
Buildings and Utilities and Other Contingency	30.0
Consumables, Services Site and Owner's Costs	30.0
LP Storage	35.0
Underground Storage	30.0

Goal Seek Check	
LNG Case 1	$0
Propane Air	$0
Underground Storage	$0

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Exhibit JJR-2
Financial Summary of Viable Storage Alternatives
Dollars in Millions

Line No.		**LNG**	**Propane Air**	**New Underground Storage**
	Physical Characteristics			
1	Storage (Mcf)	1,000,000	134,760	2,700,000
2	Maximum Deliverability (McfD)	195,000	33,690	190,000
3	*Number of Days*	*5.1*	*4.0*	*14.2*
4				
5	Capital Outlay (*2022 Dollars*)	$180.9	$25.6	$264.9
6				
7	*New Facility Revenue Requirements*			
8	30-Year NPV	$306.0	$84.3	$477.1
9	Year 2	$27.0	$6.4	$43.9
10	Year 15	$20.0	$6.3	$32.1
11				
12	*Add: Keystone Storage Reservation Costs*			
13	30-Year NPV	$12.4	$239.3	$8.3
14	Year 2	$4.7	$9.3	$0.0
15	Year 15	$0.0	$20.4	$0.0
16				
17	*Add: Commodity Cost Differential to Keystone Storage*			
18	30-Year NPV	$0.0	$41.4	$0.0
19	Year 2	$0.0	$2.5	$0.0
20	Year 15	$0.0	$4.1	$0.0
21				
22	*Total Revenue Requirements*			
23	30-Year NPV	$318.4	$365.0	$485.4
24	Year 2	$31.7	$18.2	$43.9
25	Year 15	$20.0	$30.8	$32.1
26				
27	***Status Quo: Keystone Storage @2.7 Bcf (Net of 1.0 Bcf Sublease)***			
28	30-Year NPV	$239.3	$239.3	$239.3
29	Year 2	$9.3	$9.3	$9.3
30	Year 15	$20.4	$20.4	$20.4
31				
32	*Variance to Status Quo*	*Favorable / (Unfavorable)*		
33	30-Year NPV	($79.1)	($125.7)	($246.1)
34	Year 2	($22.4)	($8.9)	($34.6)
35	Year 15	$0.4	($10.4)	($11.7)
36				
37	*Variance of Non-LNG Alternatives to LNG Case 1*	*Favorable / (Unfavorable)*		
38	30-Year NPV	N/A	($46.6)	($167.0)
39	Year 2	N/A	$13.5	($12.2)
40	Year 15	N/A	($10.8)	($12.1)

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Table 4 (Direct Testimony)
Financial Summary of Viable Storage Alternatives

Dollars in Millions

Line No.		LNG	Propane Air	New Underground Storage
	Physical Characteristics			
1	Storage (Mcf)	1,000,000	134,760	2,700,000
2	Maximum Deliverability (McfD)	195,000	33,690	190,000
3	*Number of Days*	*5.1*	*4.0*	*14.2*
4				
5		*30-Year NPV of Total Revenue Requirements ($ in Millions*		
6	Total Revenue Requirement Alternative	$318.4	$365.0	$485.4
7	Keystone Storage (status quo)	$239.3	$239.3	$239.3
8	Alternative Favorable / (Unfavorable) to Keystone	($79.1)	($125.7)	($246.1)
9				
10	Annual Incremental Revenue Requirement	$2.6	$4.2	$8.2
11	NMGC Total Annual Revenues (Forecasted 2026)	$549.7	$549.7	$549.7
	Incremental Revenue Requirement: Percentage Basis	0.5%	0.8%	1.5%

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New Mexico Gas
Option 1 - New Liquefied Natural Gas (LNG)

Line		Physical Characteristics
1		
2		
3	Storage Capacity (MCF)	1,000,000
4	Max Deliverability (MCFD)	195,000
5	No. Days at Max	5.13
6	Liquefaction Rate (MCFD)	10,000
7	Refill Rate (Days)	100.00
8		
9		

Line	Capital Expenditures	Unit Costs[1]	Escalation to Year 1	Year 1 Capex	Useful Lives (years)[2]
10	*Nominal $*	*2022*	*2027*		
11					
12	Tank (with contingency)	$60,990,000	1.1369	$69,341,000	70.0
13	Liquefaction	26,388,000	1.1369	$30,001,000	40.0
14	Vaporization	13,252,000	1.1369	$15,067,000	33.0
15	Compression	10,491,000	1.1369	$11,928,000	44.0
16	Buildings and Utilities and Other Contingency	38,869,000	1.1369	$44,191,000	30.0
17	Consumables, Services Site and Owner's Costs	30,945,000	1.1369	$35,182,000	30.0
18	**Total Cost**	**$180,935,000**		**$205,710,000**	

O&M	Annual Costs[1]	Escalation to Year 1	Year 1 O&M
Nominal $	*2022*	*2027*	
Salaries and Benefits	$1,085,000	1.1369	$1,234,000
Electricity	986,000	1.0114	$997,000
Fuel Gas Cost	126,000	0.9459	$119,000
Maintenance Costs	1,247,000	1.1369	$1,418,000
Total	$3,444,000		$3,768,000

Line	O&M	Escalation[3]	2027	2028	2029	2030	2031	2032	2033	2034	2035
19											
20											
21			1	2	3	4	5	6	7	8	9
22											
23	Salaries and Benefits	3.0%	$1,234,000	$1,271,020	$1,309,151	$1,348,425	$1,388,878	$1,430,544	$1,473,461	$1,517,664	$1,563,194
24	Electricity	2.0%	$997,000	$1,017,209	$1,037,827	$1,058,863	$1,080,326	$1,102,223	$1,124,565	$1,147,359	$1,170,615
25	Fuel Gas Cost	2.7%	$119,000	$122,230	$125,547	$128,954	$132,453	$136,048	$139,740	$143,533	$147,428
26	Maintenance Costs	2.5%	$1,418,000	$1,453,450	$1,489,786	$1,527,031	$1,565,207	$1,604,337	$1,644,445	$1,685,556	$1,727,695
27	Total		$3,768,000	$3,863,908	$3,962,310	$4,063,273	$4,166,864	$4,273,152	$4,382,211	$4,494,112	$4,608,933
28											
29											

Line		Assumption[4]	
30			
31	Property Taxes	1.308%	of Net Plant
32	Other Taxes	0.000%	of O&M
33			

34 [1] Source: Lisbon Group Pree-Feed Study, Rio Puerco LNG Plant, Revision B Cost Estimates, 07/14/2022. (2022 dollars, per page 21 of report).
35 [2] Depreciation expert estimates.
36 [3] EIA Industrial electricity and Industrial natural gas 30-year CAGR.
37 [4] Company provided.

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New Mexico Gas Company
Application for a CCN
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Line													
1													
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18													
19													
20	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
21	10	11	12	13	14	15	16	17	18	19	20	21	22
22													
23	$1,610,090	$1,658,393	$1,708,145	$1,759,389	$1,812,171	$1,866,536	$1,922,532	$1,980,208	$2,039,614	$2,100,802	$2,163,826	$2,228,741	$2,295,604
24	$1,194,343	$1,218,551	$1,243,251	$1,268,451	$1,294,162	$1,320,393	$1,347,157	$1,374,463	$1,402,323	$1,430,747	$1,459,747	$1,489,336	$1,519,524
25	$151,429	$155,538	$159,760	$164,095	$168,549	$173,123	$177,821	$182,647	$187,604	$192,695	$197,925	$203,296	$208,813
26	$1,770,888	$1,815,160	$1,860,539	$1,907,052	$1,954,729	$2,003,597	$2,053,687	$2,105,029	$2,157,655	$2,211,596	$2,266,886	$2,323,558	$2,381,647
27	$4,726,750	$4,847,643	$4,971,694	$5,098,987	$5,229,609	$5,363,649	$5,501,197	$5,642,347	$5,787,195	$5,935,841	$6,088,384	$6,244,931	$6,405,587
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													

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New Mexico Gas Company
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Line								
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16								
17								
18								
19								
20	2049	2050	2051	2052	2053	2054	2055	2056
21	23	24	25	26	27	28	29	30
22								
23	$2,364,472	$2,435,406	$2,508,468	$2,583,722	$2,661,234	$2,741,071	$2,823,303	$2,908,002
24	$1,550,324	$1,581,748	$1,613,809	$1,646,520	$1,679,894	$1,713,944	$1,748,685	$1,784,130
25	$214,480	$220,301	$226,280	$232,420	$238,728	$245,207	$251,861	$258,697
26	$2,441,188	$2,502,218	$2,564,773	$2,628,893	$2,694,615	$2,761,980	$2,831,030	$2,901,806
27	$6,570,463	$6,739,672	$6,913,330	$7,091,555	$7,274,471	$7,462,202	$7,654,879	$7,852,634
28								
29								
30								
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New Mexico Gas Company
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New Mexico Gas
Option No. 2 - Propane Air Facilities

Line	Option 1: Eleven Site Configuration (New)													
1					85%				2012 Dollars					
2		tank size (gal)	No. of Tanks[2]	Total gallons	Net Capacity[1]	Total Dth	Max Sendout[1]	No. Days @ Max	Cost per Tank[3]	Total Tank $	Air Mixer[3]	Compression	Installation	Total
3	Ottowi Take-off	18,000	4	68,608	58,317	5,345	1,336	4.00	$30,000	$120,000	$98,173	$500,000	$502,721	$1,220,895
4	Alameda ML Take-off	30,000	11	322,721	274,313	25,140	6,285	4.00	$45,000	$495,000	$379,768	$500,000	$962,337	$2,337,105
5	Santa Fe 16-inch ML Take-off	30,000	10	287,372	244,267	22,386	5,597	4.00	$45,000	$450,000	$340,597	$500,000	$903,418	$2,194,014
6	Atrisco ML Take-off	18,000	15	252,564	214,679	19,675	4,919	4.00	$30,000	$450,000	$302,024	$500,000	$876,417	$2,128,440
7	West Mesa ML Take-off	30,000	13	360,767	306,652	28,104	7,026	4.00	$45,000	$585,000	$421,929	$500,000	$1,054,850	$2,561,779
8	Gallup Grants ML	18,000	6	97,140	82,569	7,567	1,892	4.00	$30,000	$180,000	$129,791	$500,000	$566,854	$1,376,645
9	Farmington ML Take-off	18,000	8	140,313	119,266	10,930	2,733	4.00	$30,000	$240,000	$177,634	$500,000	$642,344	$1,559,977
10	Los Alamos Area	18,000	3	48,570	41,284	3,784	946	4.00	$30,000	$90,000	$75,969	$500,000	$466,178	$1,132,147
11	Santa Fe 20-inch Take-off	18,000	5	75,014	63,762	5,844	1,461	4.00	$30,000	$150,000	$105,272	$500,000	$528,690	$1,283,963
12	Caja BS to Santa Fe	18,000	5	74,474	63,303	5,802	1,450	4.00	$30,000	$150,000	$104,674	$500,000	$528,272	$1,282,946
13	HWY 599 BS to Santa Fe	18,000	4	66,379	56,422	5,171	1,293	4.00	$30,000	$120,000	$95,704	$500,000	$500,993	$1,216,696
14						139,746	34,937							$18,294,608
15														
16													H-W Index	
17													2012	406.5
18													2021	521.0
19													Inflation Factor	1.28167
20														
21	Total - All systems												2021 Dollars	$23,448,000
22														
23	[1] Company estimates.											Escalation factor to	2027	1.2393
24	[2] Goal Seek to hit Net Capacity Requirements.												**2027 Dollars**	**$29,058,000**
25	[3] "ENSTAR Propane Air Study 2012", prepared by Infrastructure Assurance Center Decision and Information Sciences Division Argonne National Laboratory, February 2012.													

Line		
28	Conversion	
29	10.911	gallons of propane per Dth of natural gas

Line	size	cost (2012$)
29	1,000	$ 2,500
30	18,000	$ 30,000
31	30,000	$ 45,000

Line			
28	Depreciable Life	**35.0**	Years

Line	O&M	Escalation	1	2	3	4	5	6	7	8	9	10	11	12
34	Salaries and Benefits	3.0%	$1,234,000	$1,271,020	$1,309,151	$1,348,425	$1,388,878	$1,430,544	$1,473,461	$1,517,664	$1,563,194	$1,610,090	$1,658,393	$1,708,145
35	Electricity	2.0%	179,000	$182,628	$186,330	$190,107	$193,960	$197,892	$201,903	$205,995	$210,171	$214,431	$218,777	$223,212
36	Fuel Gas Cost	2.7%	21,000	$21,570	$22,155	$22,757	$23,374	$24,008	$24,660	$25,329	$26,017	$26,723	$27,448	$28,193
37	Maintenance Costs	2.5%	1,418,000	$1,453,450	$1,489,786	$1,527,031	$1,565,207	$1,604,337	$1,644,445	$1,685,556	$1,727,695	$1,770,888	$1,815,160	$1,860,539
38	Total		$2,852,000	$2,928,668	$3,007,422	$3,088,319	$3,171,419	$3,256,781	$3,344,469	$3,434,545	$3,527,077	$3,622,131	$3,719,778	$3,820,088

Line			
40	Property Taxes	1.308%	of Net Plant
41	Other Taxes	0.0%	of O&M

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New Mexico Gas Company
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Source: New Mexico Gas Company Engineering

Line	Load (MMBTU/D)	Sendout (MMBTU/D)	Storage (MMBTU)
3	26,723	1,336	5,345
4	125,700	6,285	25,140
5	111,932	5,597	22,386
6	98,374	4,919	19,675
7	140,519	7,026	28,104
8	37,836	1,892	7,567
9	54,652	2,733	10,930
10	18,918	946	3,784
11	29,218	1,461	5,844
12	29,008	1,450	5,802
13	25,855	1,293	5,171
14	**698,732**	**34,937**	**139,746**

Line	13	14	15	16	17	18	19	20
34	$1,759,389	$1,812,171	$1,866,536	$1,922,532	$1,980,208	$2,039,614	$2,100,802	$2,163,826
35	$227,736	$232,352	$237,062	$241,867	$246,769	$251,771	$256,874	$262,081
36	$28,958	$29,744	$30,551	$31,380	$32,232	$33,107	$34,005	$34,928
37	$1,907,052	$1,954,729	$2,003,597	$2,053,687	$2,105,029	$2,157,655	$2,211,596	$2,266,886
38	$3,923,135	$4,028,995	$4,137,745	$4,249,466	$4,364,238	$4,482,146	$4,603,278	$4,727,721

Line	21	22	23	24	25	26	27	28	29
34	$2,228,741	$2,295,604	$2,364,472	$2,435,406	$2,508,468	$2,583,722	$2,661,234	$2,741,071	$2,823,303
35	$267,393	$272,813	$278,343	$283,985	$289,741	$295,614	$301,606	$307,719	$313,956
36	$35,876	$36,849	$37,849	$38,877	$39,932	$41,015	$42,128	$43,272	$44,446
37	$2,323,558	$2,381,647	$2,441,188	$2,502,218	$2,564,773	$2,628,893	$2,694,615	$2,761,980	$2,831,030
38	$4,855,568	$4,986,913	$5,121,852	$5,260,485	$5,402,914	$5,549,244	$5,699,583	$5,854,042	$6,012,735

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

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34	$2,908,002
35	$320,320
36	$45,652
37	$2,901,806
38	$6,175,780
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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas
Option No. 3 - New Underground Storage

Dollars in Thousands

Line	Project Name	Owner	State	Year in Service	Capacity (Dth)	Estimated Construction Cost[1]	HWI - Year In Service[2]	2021 HWI (2021)	Inflation Factor to 2021	Estimated Construction Cost in 2021$	Researched Cost[3]	Variance in Estimated To Researched Cost (2021$)
1	Bobcat Gas Storage Facility	Port Barre Investments, LLC, LNG Canada Development Inc.	LA	2008	38,510,000	$200,000	365.25	521	1.4264	$285,284		N/A
2	Eastern Market Expansion	Columbia Gas Transmission, LLC	OH	2009	5,511,198	$217,000	373.75	521	1.3940	$302,494		N/A
3	Four Mile Creek	Monroe Gas Storage Company, LLC	MS	2009	19,000,000	$100,000	373.75	521	1.3940	$139,398		N/A
4	Steckman Ridge Gas Storage Facility	Spectra Energy Partners, LP, Steckman Ridge, LP	PA	2009	17,700,000	$140,000	373.75	521	1.3940	$195,157	$250,000	($54,843)
5	Gill Ranch Storage	Pacific Gas and Electric Company, Gill Ranch Storage, LLC, Nopetro, LLC	CA	2010	23,500,000	$195,000	385.75	521	1.3506	$263,370	$214,700	$48,670
6	Golden Triangle Storage	Golden Triangle Storage, Inc, TotalEnergies SE, Mitsui & Co., Ltd., Sempra LNG LLC, Japan LNG Investments LLC	TX	2010	20,213,011	$132,500	385.75	521	1.3506	$178,957	$180,000	($1,043)
7	East Cheyenne Gas Storage	ENSTOR Gas, LLC	CO	2012	25,300,000	$300,000	406.50	521	1.2817	$384,502	$300,000	$84,502
8												
9				Average	21,391,000	Dth			Average	$249,880	$236,175	$19,322
10	Proxy Underground Storage Facility									Median	**$243,000**	

Line									
11	Keystone:								
12	Capacity	2,700,000	Dth/Day			Escalation factor to	2027	1.2393	
13	Max Deliverability[4]	190,000	Dth/Day				**2027 Dollars**	**$301,000**	
14									
15	*Nominal $*	*2017*				*2021*	*2027*		
16	O&M[5]	Annual Costs[1]	HWI - Year In Service[2]	2021 HWI	Escalation to 2021[2]	Annual Costs[1]	Escalation to Year 1	Year 1 O&M	
17	Fixed	$4,165,000	427	521	1.222	$5,088,000	1.2393	$6,305,000	
18	Variable	$318,000	427	521	1.222	$388,000	1.2393	$481,000	
19		$4,483,000				$5,476,000		$6,786,000	
20									

Line	O&M[5]	Escalation	1	2	3	4	5	6	7	8	9	10	11	12
22	Fixed	3.00%	$6,305,000	$6,494,150	$6,688,975	$6,889,644	$7,096,333	$7,309,223	$7,528,500	$7,754,355	$7,986,985	$8,226,595	$8,473,393	$8,727,595
23	Variable	2.03%	$481,000	$490,750	$500,697	$510,846	$521,200	$531,765	$542,543	$553,540	$564,760	$576,208	$587,887	$599,803
24	Total		$6,786,000	$6,984,900	$7,189,671	$7,400,489	$7,617,533	$7,840,988	$8,071,043	$8,307,895	$8,551,746	$8,802,802	$9,061,280	$9,327,398
25														

(Line 21 is the header row above.)

Line			
26	Property Taxes	1.3%	of Net Plant
27	Other Taxes	0.0%	of O&M
28			
29	Depreciable Life[6]	**30.0**	Years
30			

31 [1] S&P Global Market Intelligence. Screening criteria used: 1) estimated construction cost >$0; 2) U.S. facilities only, and 3) Year of service >=2000.
32 [2] Handy-Whitman Annual Index Bulletin No. 195, Storage Plant - Gas Holders, Plateau region.
33 [3] S&P Global Natural Gas Development Projects.
34 [4] Based on the Company's current contractual rights with the Keystone storage facility.
35 [5] Uses CINGSA storage facility as a proxy. See RCA Case No. U-18-043.
36 [6] Based on the actual useful life of the Company's former San Ysidro underground storage facility. Also consistent with CINGSA depreciation rates.

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New Mexico Gas Company
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22	$8,989,422	$9,259,105	$9,536,878	$9,822,985	$10,117,674	$10,421,204	$10,733,840	$11,055,856	$11,387,531
23	$611,961	$624,365	$637,020	$649,932	$663,106	$676,547	$690,260	$704,251	$718,526
24	$9,601,383	$9,883,470	$10,173,899	$10,472,917	$10,780,780	$11,097,751	$11,424,101	$11,760,107	$12,106,057
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Line									
21	22	23	24	25	26	27	28	29	30
22	$11,729,157	$12,081,032	$12,443,463	$12,816,767	$13,201,270	$13,597,308	$14,005,227	$14,425,384	$14,858,146
23	$733,090	$747,949	$763,110	$778,578	$794,359	$810,460	$826,888	$843,648	$860,749
24	$12,462,247	$12,828,981	$13,206,573	$13,595,345	$13,995,629	$14,407,768	$14,832,115	$15,269,032	$15,718,894

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New Mexico Gas Company
Application for a CCN
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New Mexico Gas Company
Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: LNG	30 Year NPV	1	2	3	4	5	6	7	8	9	10
			2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
1	**Annual Revenue Requirement**	**$300,378,457**	**$27,774,899**	**$27,388,626**	**$26,631,338**	**$25,953,045**	**$25,339,492**	**$24,768,734**	**$24,218,634**	**$23,692,978**	**$23,203,076**	**$22,732,778**
2												
3	O&M	$65,176,544	$3,768,000	$3,863,908	$3,962,310	$4,063,273	$4,166,864	$4,273,152	$4,382,211	$4,494,112	$4,608,933	$4,726,750
4	Supervision & Inspection Fees	$1,527,645	$141,256	$139,291	$135,440	$131,990	$128,870	$125,967	$123,170	$120,496	$118,005	$115,613
5	Property Tax and Other Taxes	$25,616,831	$2,624,464	$2,557,555	$2,490,646	$2,423,738	$2,356,829	$2,289,920	$2,223,011	$2,156,103	$2,089,194	$2,022,285
6	Depreciation	$67,167,988	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
7	Pre-Tax Income	$140,889,449	$16,127,135	$15,713,827	$14,928,898	$14,220,001	$13,572,885	$12,965,651	$12,376,199	$11,808,224	$11,272,900	$10,754,086
8												
9	SIT	$2,593,040	$269,583	($414,570)	($216,085)	($55,495)	$68,914	$110,435	$112,557	$176,851	$244,774	$220,076
10	FIT	$8,684,926	$902,921	($1,388,527)	($723,737)	($185,871)	$230,817	$369,881	$376,989	$592,330	$819,828	$737,105
11	Deferred Taxes	$17,893,519	$2,166,656	$5,056,681	$4,030,885	$3,185,649	$2,510,566	$2,204,252	$2,072,974	$1,675,740	$1,269,477	$1,269,477
12	**Utility Operating Income (UOI)**	**$111,717,965**	**$12,787,975**	**$12,460,243**	**$11,837,835**	**$11,275,717**	**$10,762,588**	**$10,281,083**	**$9,813,678**	**$9,363,304**	**$8,938,820**	**$8,527,428**
13												
14	Interest expense	$27,209,217	$3,114,546	$3,034,726	$2,883,137	$2,746,232	$2,621,258	$2,503,986	$2,390,148	$2,280,458	$2,177,074	$2,076,878
15	Net Income	$84,508,748	$9,673,428	$9,425,517	$8,954,698	$8,529,485	$8,141,330	$7,777,097	$7,423,530	$7,082,845	$6,761,746	$6,450,549
16												
17	Revenue Requirement											
21	Capital Additions	$193,255,459	$205,710,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$1,733,512,782	$198,429,300	$193,343,937	$183,686,110	$174,963,799	$167,001,647	$159,530,194	$152,277,537	$145,289,136	$138,702,484	$132,318,962
23												
24	Return on Rate Base	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%
25	Return on Equity	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%
26												
27	Allowed RORB	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%
28												
29												
30	**Use this button to goal seek the annual revenues necessary to achieve the**											
31	**annual ROR goal.**											
32												
33												
38												
39	Post-forecast value (PV of Undepreciated Asset)	$5,607,790										
40												

Line	State and Federal Income Taxes (Statutory)		1	2	3	4	5	6	7	8	9	10
42			2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
43	Operating Income Before Income Taxes		$16,127,135	$15,713,827	$14,928,898	$14,220,001	$13,572,885	$12,965,651	$12,376,199	$11,808,224	$11,272,900	$10,754,086
44	Add Back: Book Depreciation		5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044
45	Deduct: State Tax Depreciation		($13,557,426)	($24,819,750)	($20,822,258)	($17,528,406)	($14,897,630)	($13,703,934)	($13,192,350)	($11,644,342)	($10,061,152)	($10,061,152)
46	Deduct: ATL Interest		($3,114,546)	($3,034,726)	($2,883,137)	($2,746,232)	($2,621,258)	($2,503,986)	($2,390,148)	($2,280,458)	($2,177,074)	($2,076,878)
47	State Taxable Income		$4,569,207	($7,026,605)	($3,662,453)	($940,593)	$1,168,041	$1,871,775	$1,907,744	$2,997,467	$4,148,718	$3,730,100
48	Allowed Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense		$269,583	($414,570)	($216,085)	($55,495)	$68,914	$110,435	$112,557	$176,851	$244,774	$220,076
50												
51	Operating Income Before Income Taxes		$16,127,135	$15,713,827	$14,928,898	$14,220,001	$13,572,885	$12,965,651	$12,376,199	$11,808,224	$11,272,900	$10,754,086
52	Add Back: Book Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
53	Deduct: Federal Tax Depreciation		($13,557,426)	($24,819,750)	($20,822,258)	($17,528,406)	($14,897,630)	($13,703,934)	($13,192,350)	($11,644,342)	($10,061,152)	($10,061,152)
54	Deduct State Income Tax Expense		($269,583)	$414,570	$216,085	$55,495	($68,914)	($110,435)	($112,557)	($176,851)	($244,774)	($220,076)
55	Deduct: ATL Interest		($3,114,546)	($3,034,726)	($2,883,137)	($2,746,232)	($2,621,258)	($2,503,986)	($2,390,148)	($2,280,458)	($2,177,074)	($2,076,878)
56	Federal Taxable Income		$4,299,624	($6,612,035)	($3,446,369)	($885,098)	$1,099,127	$1,761,340	$1,795,187	$2,820,617	$3,903,944	$3,510,024
57	Allowed Tax Rate		21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense		$ 902,921	$ (1,388,527)	$ (723,737)	$ (185,871)	$ 230,817	$ 369,881	$ 376,989	$ 592,330	$ 819,828	$ 737,105
59												
60												
61		Total SIT and FIT	$1,172,504	($1,803,097)	($939,822)	($241,366)	$299,731	$480,316	$489,546	$769,180	$1,064,603	$957,181
62												
63												
64												

Line			1	2	3	4	5	6	7	8	9	10
65		Year	1	2	3	4	5	6	7	8	9	10
66			2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
67												
68	Cap Ex											
69	Tank (with contingency)		$69,341,000									

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New Mexico Gas Company
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New Mexico Gas Company
Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: LNG	11	12	13	14	15	16	17	18	19	20
		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
1	**Annual Revenue Requirement**	**$22,265,572**	**$21,801,540**	**$21,340,767**	**$20,883,340**	**$20,429,348**	**$20,030,715**	**$19,741,155**	**$19,508,932**	**$19,280,526**	**$19,056,037**
2											
3	O&M	$4,847,643	$4,971,694	$5,098,987	$5,229,609	$5,363,649	$5,501,197	$5,642,347	$5,787,195	$5,935,841	$6,088,384
4	Supervision & Inspection Fees	$113,237	$110,877	$108,533	$106,207	$103,898	$101,871	$100,398	$99,217	$98,056	$96,914
5	Property Tax and Other Taxes	$1,955,376	$1,888,468	$1,821,559	$1,754,650	$1,687,741	$1,620,833	$1,553,924	$1,487,015	$1,420,106	$1,353,198
6	Depreciation	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
7	Pre-Tax Income	$10,235,272	$9,716,458	$9,197,644	$8,678,830	$8,160,016	$7,692,771	$7,330,442	$7,021,460	$6,712,479	$6,403,497
8											
9	SIT	$195,377	$170,679	$145,980	$121,282	$96,583	$366,113	$650,699	$635,990	$621,281	$606,571
10	FIT	$654,382	$571,659	$488,936	$406,212	$323,489	$1,226,232	$2,179,401	$2,130,135	$2,080,868	$2,031,602
11	Deferred Taxes	$1,269,477	$1,269,477	$1,269,477	$1,269,477	$1,269,477	$461	($1,312,315)	($1,312,315)	($1,312,315)	($1,312,315)
12	**Utility Operating Income (UOI)**	**$8,116,035**	**$7,704,643**	**$7,293,251**	**$6,881,858**	**$6,470,466**	**$6,099,965**	**$5,812,657**	**$5,567,651**	**$5,322,645**	**$5,077,638**
13											
14	Interest expense	$1,976,683	$1,876,487	$1,776,291	$1,676,095	$1,575,900	$1,485,663	$1,415,689	$1,356,017	$1,296,345	$1,236,673
15	Net Income	$6,139,353	$5,828,156	$5,516,959	$5,205,763	$4,894,566	$4,614,302	$4,396,968	$4,211,634	$4,026,300	$3,840,966
16											
17	Revenue Requirement										
21	Capital Additions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$125,935,441	$119,551,920	$113,168,398	$106,784,877	$100,401,355	$94,652,342	$90,194,225	$86,392,496	$82,590,767	$78,789,037
23											
24	Return on Rate Base	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%
25	Return on Equity	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%
26											
27	Allowed RORB	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%
28											
29											
30	**Use this button to goal seek the annual revenues necessary to achieve the**										
31	**annual ROR goal.**										
32											
33											
38											
39	Post-forecast value (PV of Undepreciated Asset)										
40											
41	**State and Federal Income Taxes (Statutory)**	11	12	13	14	15	16	17	18	19	20
42		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
43	Operating Income Before Income Taxes	$10,235,272	$9,716,458	$9,197,644	$8,678,830	$8,160,016	$7,692,771	$7,330,442	$7,021,460	$6,712,479	$6,403,497
44	Add Back: Book Depreciation	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044
45	Deduct: State Tax Depreciation	($10,061,152)	($10,061,152)	($10,061,152)	($10,061,152)	($10,061,152)	($5,115,840)	$0	$0	$0	$0
46	Deduct: ATL Interest	($1,976,683)	($1,876,487)	($1,776,291)	($1,676,095)	($1,575,900)	($1,485,663)	($1,415,689)	($1,356,017)	($1,296,345)	($1,236,673)
47	State Taxable Income	$3,311,481	$2,892,863	$2,474,245	$2,055,626	$1,637,008	$6,205,312	$11,028,797	$10,779,488	$10,530,178	$10,280,868
48	Allowed Tax Rate	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense	$195,377	$170,679	$145,980	$121,282	$96,583	$366,113	$650,699	$635,990	$621,281	$606,571
50											
51	Operating Income Before Income Taxes	$10,235,272	$9,716,458	$9,197,644	$8,678,830	$8,160,016	$7,692,771	$7,330,442	$7,021,460	$6,712,479	$6,403,497
52	Add Back: Book Depreciation	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
53	Deduct: Federal Tax Depreciation	($10,061,152)	($10,061,152)	($10,061,152)	($10,061,152)	($10,061,152)	($5,115,840)	$0	$0	$0	$0
54	Deduct State Income Tax Expense	($195,377)	($170,679)	($145,980)	($121,282)	($96,583)	($366,113)	($650,699)	($635,990)	($621,281)	($606,571)
55	Deduct: ATL Interest	($1,976,683)	($1,876,487)	($1,776,291)	($1,676,095)	($1,575,900)	($1,485,663)	($1,415,689)	($1,356,017)	($1,296,345)	($1,236,673)
56	Federal Taxable Income	$3,116,104	$2,722,184	$2,328,264	$1,934,345	$1,540,425	$5,839,198	$10,378,098	$10,143,498	$9,908,898	$9,674,297
57	Allowed Tax Rate	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense	$ 654,382	$ 571,659	$ 488,936	$ 406,212	$ 323,489	$ 1,226,232	$ 2,179,401	$ 2,130,135	$ 2,080,868	$ 2,031,602
59											
60											
61		$849,759	$742,338	$634,916	$527,494	$420,073	$1,592,345	$2,830,100	$2,766,124	$2,702,149	$2,638,174
62											
63											
64											
65		11	12	13	14	15	16	17	18	19	20
66		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
67											
68	Cap Ex										
69	Tank (with contingency)										

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Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: LNG	21	22	23	24	25	26	27	28	29	30
		2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
1	**Annual Revenue Requirement**	**$18,835,573**	**$18,619,238**	**$18,407,145**	**$18,199,407**	**$17,996,141**	**$17,797,465**	**$17,603,504**	**$17,414,383**	**$17,230,233**	**$17,051,187**
2											
3	O&M	$6,244,931	$6,405,587	$6,570,463	$6,739,672	$6,913,330	$7,091,555	$7,274,471	$7,462,202	$7,654,879	$7,852,634
4	Supervision & Inspection Fees	$95,793	$94,692	$93,614	$92,557	$91,524	$90,513	$89,527	$88,565	$87,628	$86,718
5	Property Tax and Other Taxes	$1,286,289	$1,219,380	$1,152,471	$1,085,563	$1,018,654	$951,745	$884,836	$817,928	$751,019	$684,110
6	Depreciation	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
7	Pre-Tax Income	$6,094,516	$5,785,534	$5,476,552	$5,167,571	$4,858,589	$4,549,608	$4,240,626	$3,931,644	$3,622,663	$3,313,681
8											
9	SIT	$591,862	$577,153	$562,443	$547,734	$533,025	$518,316	$503,606	$488,897	$474,188	$459,479
10	FIT	$1,982,336	$1,933,070	$1,883,804	$1,834,538	$1,785,272	$1,736,006	$1,686,740	$1,637,474	$1,588,208	$1,538,942
11	Deferred Taxes	($1,312,315)	($1,312,315)	($1,312,315)	($1,312,315)	($1,312,315)	($1,312,315)	($1,312,315)	($1,312,315)	($1,312,315)	($1,312,315)
12	**Utility Operating Income (UOI)**	**$4,832,632**	**$4,587,626**	**$4,342,620**	**$4,097,613**	**$3,852,607**	**$3,607,601**	**$3,362,595**	**$3,117,588**	**$2,872,582**	**$2,627,576**
13											
14	Interest expense	$1,177,001	$1,117,329	$1,057,657	$997,985	$938,313	$878,641	$818,969	$759,297	$699,625	$639,953
15	Net Income	$3,655,631	$3,470,297	$3,284,963	$3,099,628	$2,914,294	$2,728,960	$2,543,625	$2,358,291	$2,172,957	$1,987,623
16											
17	Revenue Requirement										
21	Capital Additions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$74,987,308	$71,185,579	$67,383,850	$63,582,121	$59,780,391	$55,978,662	$52,176,933	$48,375,204	$44,573,475	$40,771,745
23											
24	Return on Rate Base	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%
25	Return on Equity	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%	9.375%
26											
27	Allowed RORB	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%	6.445%
28											
29											
30	**Use this button to goal seek the annual revenues necessary to achieve the**										
31	**annual ROR goal.**										
32											
33											
38											
39	Post-forecast value (PV of Undepreciated Asset)										
40											
41	**State and Federal Income Taxes (Statutory)**	21	22	23	24	25	26	27	28	29	30
42		2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
43	Operating Income Before Income Taxes	$6,094,516	$5,785,534	$5,476,552	$5,167,571	$4,858,589	$4,549,608	$4,240,626	$3,931,644	$3,622,663	$3,313,681
44	Add Back: Book Depreciation	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044	5,114,044
45	Deduct: State Tax Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
46	Deduct: ATL Interest	($1,177,001)	($1,117,329)	($1,057,657)	($997,985)	($938,313)	($878,641)	($818,969)	($759,297)	($699,625)	($639,953)
47	State Taxable Income	$10,031,559	$9,782,249	$9,532,939	$9,283,630	$9,034,320	$8,785,011	$8,535,701	$8,286,391	$8,037,082	$7,787,772
48	Allowed Tax Rate	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense	$591,862	$577,153	$562,443	$547,734	$533,025	$518,316	$503,606	$488,897	$474,188	$459,479
50											
51	Operating Income Before Income Taxes	$6,094,516	$5,785,534	$5,476,552	$5,167,571	$4,858,589	$4,549,608	$4,240,626	$3,931,644	$3,622,663	$3,313,681
52	Add Back: Book Depreciation	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
53	Deduct: Federal Tax Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
54	Deduct State Income Tax Expense	($591,862)	($577,153)	($562,443)	($547,734)	($533,025)	($518,316)	($503,606)	($488,897)	($474,188)	($459,479)
55	Deduct: ATL Interest	($1,177,001)	($1,117,329)	($1,057,657)	($997,985)	($938,313)	($878,641)	($818,969)	($759,297)	($699,625)	($639,953)
56	Federal Taxable Income	$9,439,697	$9,205,096	$8,970,496	$8,735,896	$8,501,295	$8,266,695	$8,032,095	$7,797,494	$7,562,894	$7,328,293
57	Allowed Tax Rate	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense	$ 1,982,336	$ 1,933,070	$ 1,883,804	$ 1,834,538	$ 1,785,272	$ 1,736,006	$ 1,686,740	$ 1,637,474	$ 1,588,208	$ 1,538,942
59											
60											
61		$2,574,198	$2,510,223	$2,446,248	$2,382,272	$2,318,297	$2,254,322	$2,190,346	$2,126,371	$2,062,396	$1,998,420
62											
63											
64											
65		21	22	23	24	25	26	27	28	29	30
66		2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
67											
68	Cap Ex										
69	Tank (with contingency)										

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70	Liquefaction		$30,001,000									
71	Vaporization		$15,067,000									
72	Compression		$11,928,000									
73	Buildings and Utilities and Other Contingency		$44,191,000									
74	Consumables, Services Site and Owner's Costs		$35,182,000									
75	Total		$205,710,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
76												
77	Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
78												
79	**Rate Base**											
80	Gross Plant		$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000
81	Accumulated Depreciation		$5,114,044	$10,228,088	$15,342,132	$20,456,176	$25,570,220	$30,684,264	$35,798,308	$40,912,352	$46,026,396	$51,140,440
82	Net Plant		$200,595,956	$195,481,912	$190,367,868	$185,253,824	$180,139,780	$175,025,736	$169,911,692	$164,797,648	$159,683,604	$154,569,560
83	Deferred Taxes		($2,166,656)	($7,223,337)	($11,254,222)	($14,439,872)	($16,950,438)	($19,154,689)	($21,227,663)	($22,903,403)	($24,172,881)	($25,442,358)
84	Rate Base - End of Period		$198,429,300	$188,258,574	$179,113,646	$170,813,952	$163,189,342	$155,871,046	$148,684,028	$141,894,244	$135,510,723	$129,127,202
85	Average Rate Base		$198,429,300	$193,343,937	$183,686,110	$174,963,799	$167,001,647	$159,530,194	$152,277,537	$145,289,136	$138,702,484	$132,318,962
86	Depreciation Rates - Book		1	2	3	4	5	6	7	8	9	10
87	Tank (with contingency)	70	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
88	Liquefaction	40	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
89	Vaporization	33	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
90	Compression	44	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
91	Buildings and Utilities and Other Contingency	30	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
92	Consumables, Services Site and Owner's Costs	30	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
93	Depreciation - Book		1	2	3	4	5	6	7	8	9	10
94	1		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
95	2			$0	$0	$0	$0	$0	$0	$0	$0	$0
96	3				$0	$0	$0	$0	$0	$0	$0	$0
97	4					$0	$0	$0	$0	$0	$0	$0
98	5						$0	$0	$0	$0	$0	$0
99	6							$0	$0	$0	$0	$0
100	7								$0	$0	$0	$0
101	8									$0	$0	$0
102	9										$0	$0
103	10											$0
104	11											
105	12											
106	13											
107	14											
108	15											
109	16											
110	17											
111	18											
112	19											
113	20											
114	Rate Base Book Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
115												
116	**Deferred Taxes Calculation**											
117												
118	Depreciation Rates - Federal Tax	Tax Life	1	2	3	4	5	6	7	8	9	10
119	Tank (with contingency)	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
120	Liquefaction	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
121	Vaporization	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
122	Compression	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
123	Buildings and Utilities and Other Contingency	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
124	Consumables, Services Site and Owner's Costs	7	14.30%	24.50%	17.50%	12.50%	8.90%	8.90%	8.90%	4.50%	0.00%	0.00%
125	Depreciation Rates - State Tax											
126	Tank (with contingency)	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
127	Liquefaction	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
128	Vaporization	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
129	Compression	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
130	Buildings and Utilities and Other Contingency	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
131	Consumables, Services Site and Owner's Costs	7	14.30%	24.50%	17.50%	12.50%	8.90%	8.90%	8.90%	4.50%	0.00%	0.00%
132	Calculation of Deferred Taxes:											
133	Federal Book Depreciation											
134	Year		1	2	3	4	5	6	7	8	9	10
135	1		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044

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70	Liquefaction										
71	Vaporization										
72	Compression										
73	Buildings and Utilities and Other Contingency										
74	Consumables, Services Site and Owner's Costs										
75	Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
76											
77	Depreciation	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
78											
79	**Rate Base**										
80	Gross Plant	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000
81	Accumulated Depreciation	$56,254,485	$61,368,529	$66,482,573	$71,596,617	$76,710,661	$81,824,705	$86,938,749	$92,052,793	$97,166,837	$102,280,881
82	Net Plant	$149,455,515	$144,341,471	$139,227,427	$134,113,383	$128,999,339	$123,885,295	$118,771,251	$113,657,207	$108,543,163	$103,429,119
83	Deferred Taxes	($26,711,835)	($27,981,313)	($29,250,790)	($30,520,267)	($31,789,745)	($31,790,206)	($30,477,891)	($29,165,576)	($27,853,261)	($26,540,946)
84	Rate Base - End of Period	$122,743,680	$116,360,159	$109,976,637	$103,593,116	$97,209,595	$92,095,090	$88,293,360	$84,491,631	$80,689,902	$76,888,173
85	Average Rate Base	$125,935,441	$119,551,920	$113,168,398	$106,784,877	$100,401,355	$94,652,342	$90,194,225	$86,392,496	$82,590,767	$78,789,037
86	Depreciation Rates - Book	11	12	13	14	15	16	17	18	19	20
87	Tank (with contingency)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
88	Liquefaction	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
89	Vaporization	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
90	Compression	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
91	Buildings and Utilities and Other Contingency	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
92	Consumables, Services Site and Owner's Costs	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
93	Depreciation - Book	11	12	13	14	15	16	17	18	19	20
94	1	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
95	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
96	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
97	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
98	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
99	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
100	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
101	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
102	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
103	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
104	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
105	12		$0	$0	$0	$0	$0	$0	$0	$0	$0
106	13			$0	$0	$0	$0	$0	$0	$0	$0
107	14				$0	$0	$0	$0	$0	$0	$0
108	15					$0	$0	$0	$0	$0	$0
109	16						$0	$0	$0	$0	$0
110	17							$0	$0	$0	$0
111	18								$0	$0	$0
112	19									$0	$0
113	20										
114	Rate Base Book Depreciation	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
115											
116	**Deferred Taxes Calculation**										
117											
118	Depreciation Rates - Federal Tax	11	12	13	14	15	16	17	18	19	20
119	Tank (with contingency)	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
120	Liquefaction	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
121	Vaporization	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
122	Compression	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
123	Buildings and Utilities and Other Contingency	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
124	Consumables, Services Site and Owner's Costs	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
125	Depreciation Rates - State Tax										
126	Tank (with contingency)	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
127	Liquefaction	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
128	Vaporization	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
129	Compression	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
130	Buildings and Utilities and Other Contingency	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
131	Consumables, Services Site and Owner's Costs	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
132	Calculation of Deferred Taxes:										
133	Federal Book Depreciation										
134	Year	11	12	13	14	15	16	17	18	19	20
135	1	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

Liquefaction										
Vaporization										
Compression										
Buildings and Utilities and Other Contingency										
Consumables, Services Site and Owner's Costs										
Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
Rate Base										
Gross Plant	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000	$205,710,000
Accumulated Depreciation	$107,394,925	$112,508,969	$117,623,013	$122,737,057	$127,851,101	$132,965,145	$138,079,189	$143,193,233	$148,307,277	$153,421,321
Net Plant	$98,315,075	$93,201,031	$88,086,987	$82,972,943	$77,858,899	$72,744,855	$67,630,811	$62,516,767	$57,402,723	$52,288,679
Deferred Taxes	($25,228,631)	($23,916,317)	($22,604,002)	($21,291,687)	($19,979,372)	($18,667,057)	($17,354,742)	($16,042,427)	($14,730,113)	($13,417,798)
Rate Base - End of Period	$73,086,444	$69,284,714	$65,482,985	$61,681,256	$57,879,527	$54,077,798	$50,276,068	$46,474,339	$42,672,610	$38,870,881
Average Rate Base	$74,987,308	$71,185,579	$67,383,850	$63,582,121	$59,780,391	$55,978,662	$52,176,933	$48,375,204	$44,573,475	$40,771,745
Depreciation Rates - Book	21	22	23	24	25	26	27	28	29	30
Tank (with contingency)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Liquefaction	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Vaporization	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Compression	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Buildings and Utilities and Other Contingency	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Consumables, Services Site and Owner's Costs	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Depreciation - Book	21	22	23	24	25	26	27	28	29	30
1	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20										
Rate Base Book Depreciation	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
Deferred Taxes Calculation										
Depreciation Rates - Federal Tax	21	22	23	24	25	26	27	28	29	30
Tank (with contingency)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Liquefaction	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Vaporization	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Compression	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Buildings and Utilities and Other Contingency	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Consumables, Services Site and Owner's Costs	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Depreciation Rates - State Tax										
Tank (with contingency)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Liquefaction	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Vaporization	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Compression	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Buildings and Utilities and Other Contingency	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Consumables, Services Site and Owner's Costs	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Calculation of Deferred Taxes:										
Federal Book Depreciation										
Year	21	22	23	24	25	26	27	28	29	30
1	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044

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136		2		$0	$0	$0	$0	$0	$0	$0	$0	$0
137		3			$0	$0	$0	$0	$0	$0	$0	$0
138		4				$0	$0	$0	$0	$0	$0	$0
139		5					$0	$0	$0	$0	$0	$0
140		6						$0	$0	$0	$0	$0
141		7							$0	$0	$0	$0
142		8								$0	$0	$0
143		9									$0	$0
144		10										$0
145		11										
146		12										
147		13										
148		14										
149		15										
150		16										
151		17										
152		18										
153		19										
154		20										
155	Federal Book Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
156	State Book Depreciation											
157	Year		1	2	3	4	5	6	7	8	9	10
158		1	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
159		2		$0	$0	$0	$0	$0	$0	$0	$0	$0
160		3			$0	$0	$0	$0	$0	$0	$0	$0
161		4				$0	$0	$0	$0	$0	$0	$0
162		5					$0	$0	$0	$0	$0	$0
163		6						$0	$0	$0	$0	$0
164		7							$0	$0	$0	$0
165		8								$0	$0	$0
166		9									$0	$0
167		10										$0
168		11										
169		12										
170		13										
171		14										
172		15										
173		16										
174		17										
175		18										
176		19										
177		20										

New Mexico Gas Company
Cost of Service Based Revenue Requirements

136		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
137		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
138		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
139		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
140		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
141		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
142		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
143		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
144		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
145		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
146		12		$0	$0	$0	$0	$0	$0	$0	$0	$0
147		13			$0	$0	$0	$0	$0	$0	$0	$0
148		14				$0	$0	$0	$0	$0	$0	$0
149		15					$0	$0	$0	$0	$0	$0
150		16						$0	$0	$0	$0	$0
151		17							$0	$0	$0	$0
152		18								$0	$0	$0
153		19									$0	$0
154		20										
155	Federal Book Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
156	State Book Depreciation											
157	Year		11	12	13	14	15	16	17	18	19	20
158		1	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
159		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
160		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
161		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
162		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
163		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
164		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
165		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
166		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
167		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
168		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
169		12		$0	$0	$0	$0	$0	$0	$0	$0	$0
170		13			$0	$0	$0	$0	$0	$0	$0	$0
171		14				$0	$0	$0	$0	$0	$0	$0
172		15					$0	$0	$0	$0	$0	$0
173		16						$0	$0	$0	$0	$0
174		17							$0	$0	$0	$0
175		18								$0	$0	$0
176		19									$0	$0
177		20										

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136		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
137		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
138		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
139		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
140		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
141		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
142		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
143		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
144		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
145		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
146		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
147		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
148		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
149		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
150		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
151		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
152		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
153		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
154		20										
155	Federal Book Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
156	State Book Depreciation											
157	Year		21	22	23	24	25	26	27	28	29	30
158		1	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
159		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
160		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
161		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
162		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
163		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
164		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
165		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
166		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
167		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
168		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
169		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
170		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
171		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
172		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
173		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
174		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
175		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
176		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
177		20										

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178	State Book Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
179	Federal Tax Depreciation											
180	Year		1	2	3	4	5	6	7	8	9	10
181		1	$13,557,426	$24,819,750	$20,822,258	$17,528,406	$14,897,630	$13,703,934	$13,192,350	$11,644,342	$10,061,152	$10,061,152
182		2		$0	$0	$0	$0	$0	$0	$0	$0	$0
183		3			$0	$0	$0	$0	$0	$0	$0	$0
184		4				$0	$0	$0	$0	$0	$0	$0
185		5					$0	$0	$0	$0	$0	$0
186		6						$0	$0	$0	$0	$0
187		7							$0	$0	$0	$0
188		8								$0	$0	$0
189		9									$0	$0
190		10										$0
191		11										
192		12										
193		13										
194		14										
195		15										
196		16										
197		17										
198		18										
199		19										
200		20										
201	Federal Tax Depreciation		$13,557,426	$24,819,750	$20,822,258	$17,528,406	$14,897,630	$13,703,934	$13,192,350	$11,644,342	$10,061,152	$10,061,152
202												
203	Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
204												
205	State Tax Depreciation											
206	Year		1	2	3	4	5	6	7	8	9	10
207		1	$13,557,426	$24,819,750	$20,822,258	$17,528,406	$14,897,630	$13,703,934	$13,192,350	$11,644,342	$10,061,152	$10,061,152
208		2		$0	$0	$0	$0	$0	$0	$0	$0	$0
209		3			$0	$0	$0	$0	$0	$0	$0	$0
210		4				$0	$0	$0	$0	$0	$0	$0
211		5					$0	$0	$0	$0	$0	$0
212		6						$0	$0	$0	$0	$0
213		7							$0	$0	$0	$0
214		8								$0	$0	$0
215		9									$0	$0
216		10										$0
217		11										
218		12										
219		13										
220		14										
221		15										
222		16										
223		17										
224		18										
225		19										
226		20										
227	State Tax Depreciation		$13,557,426	$24,819,750	$20,822,258	$17,528,406	$14,897,630	$13,703,934	$13,192,350	$11,644,342	$10,061,152	$10,061,152
228												
229	State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
230												
231	Federal Deferred Taxes		($1,668,497)	($3,894,045)	($3,104,100)	($2,453,202)	($1,933,334)	($1,697,448)	($1,596,354)	($1,290,452)	($977,598)	($977,598)
232	State Deferred Taxes		($498,160)	($1,162,637)	($926,785)	($732,447)	($577,232)	($506,804)	($476,620)	($385,288)	($291,879)	($291,879)
233	Total Deferred Taxes		($2,166,656)	($5,056,681)	($4,030,885)	($3,185,649)	($2,510,566)	($2,204,252)	($2,072,974)	($1,675,740)	($1,269,477)	($1,269,477)
234												
235												
236		MACRS	1	2	3	4	5	6	7	8	9	10
237		5	0.200	0.320	0.192	0.115	0.115	0.058				
238		7	0.143	0.245	0.175	0.125	0.089	0.089	0.089	0.045		
239		10	0.100	0.180	0.144	0.115	0.092	0.074	0.066	0.066	0.065	0.065
240		15	0.050	0.095	0.086	0.077	0.069	0.062	0.059	0.059	0.059	0.059
241		20	0.038	0.072	0.067	0.062	0.057	0.053	0.045	0.045	0.045	0.045

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

178	State Book Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
179	Federal Tax Depreciation											
180	Year		11	12	13	14	15	16	17	18	19	20
181		1	$10,061,152	$10,061,152	$10,061,152	$10,061,152	$10,061,152	$5,115,840	$0	$0	$0	$0
182		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
183		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
184		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
185		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
186		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
187		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
188		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
189		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
190		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
191		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
192		12		$0	$0	$0	$0	$0	$0	$0	$0	$0
193		13			$0	$0	$0	$0	$0	$0	$0	$0
194		14				$0	$0	$0	$0	$0	$0	$0
195		15					$0	$0	$0	$0	$0	$0
196		16						$0	$0	$0	$0	$0
197		17							$0	$0	$0	$0
198		18								$0	$0	$0
199		19									$0	$0
200		20										
201	Federal Tax Depreciation		$10,061,152	$10,061,152	$10,061,152	$10,061,152	$10,061,152	$5,115,840	$0	$0	$0	$0
202												
203	Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
204												
205	State Tax Depreciation											
206	Year		11	12	13	14	15	16	17	18	19	20
207		1	$10,061,152	$10,061,152	$10,061,152	$10,061,152	$10,061,152	$5,115,840	$0	$0	$0	$0
208		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
209		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
210		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
211		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
212		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
213		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
214		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
215		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
216		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
217		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
218		12		$0	$0	$0	$0	$0	$0	$0	$0	$0
219		13			$0	$0	$0	$0	$0	$0	$0	$0
220		14				$0	$0	$0	$0	$0	$0	$0
221		15					$0	$0	$0	$0	$0	$0
222		16						$0	$0	$0	$0	$0
223		17							$0	$0	$0	$0
224		18								$0	$0	$0
225		19									$0	$0
226		20										
227	State Tax Depreciation		$10,061,152	$10,061,152	$10,061,152	$10,061,152	$10,061,152	$5,115,840	$0	$0	$0	$0
228												
229	State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
230												
231	Federal Deferred Taxes		($977,598)	($977,598)	($977,598)	($977,598)	($977,598)	($355)	$1,010,586	$1,010,586	$1,010,586	$1,010,586
232	State Deferred Taxes		($291,879)	($291,879)	($291,879)	($291,879)	($291,879)	($106)	$301,729	$301,729	$301,729	$301,729
233	Total Deferred Taxes		($1,269,477)	($1,269,477)	($1,269,477)	($1,269,477)	($1,269,477)	($461)	$1,312,315	$1,312,315	$1,312,315	$1,312,315
234												
235												
236			11	12	13	14	15	16	17	18	19	20
237												
238												
239			0.033									
240			0.059	0.059	0.059	0.059	0.059	0.030				
241			0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

178	State Book Depreciation		$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044	$5,114,044
179	Federal Tax Depreciation											
180	Year		21	22	23	24	25	26	27	28	29	30
181		1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
182		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
183		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
184		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
185		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
186		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
187		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
188		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
189		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
190		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
191		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
192		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
193		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
194		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
195		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
196		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
197		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
198		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
199		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
200		20										
201	Federal Tax Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
202												
203	Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
204												
205	State Tax Depreciation											
206	Year		21	22	23	24	25	26	27	28	29	30
207		1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
208		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
209		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
210		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
211		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
212		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
213		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
214		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
215		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
216		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
217		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
218		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
219		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
220		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
221		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
222		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
223		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
224		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
225		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
226		20										
227	State Tax Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
228												
229	State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
230												
231	Federal Deferred Taxes		$1,010,586	$1,010,586	$1,010,586	$1,010,586	$1,010,586	$1,010,586	$1,010,586	$1,010,586	$1,010,586	$1,010,586
232	State Deferred Taxes		$301,729	$301,729	$301,729	$301,729	$301,729	$301,729	$301,729	$301,729	$301,729	$301,729
233	Total Deferred Taxes		$1,312,315	$1,312,315	$1,312,315	$1,312,315	$1,312,315	$1,312,315	$1,312,315	$1,312,315	$1,312,315	$1,312,315
234												
235												
236			21	22	23	24	25	26	27	28	29	30
237												
238												
239												
240												
241			0.021									

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: Propane Air	30 Year NPV	1 2027	2 2028	3 2029	4 2030	5 2031	6 2032	7 2033	8 2034	9 2035	10 2036
1	**Annual Revenue Requirement**	**$83,923,391**	**$6,365,109**	**$6,377,110**	**$6,339,806**	**$6,310,138**	**$6,287,861**	**$6,272,427**	**$6,262,376**	**$6,255,640**	**$6,251,371**	**$6,249,638**
2												
3	O&M	$49,903,040	$2,852,000	$2,928,668	$3,007,422	$3,088,319	$3,171,419	$3,256,781	$3,344,469	$3,434,545	$3,527,077	$3,622,131
4	Supervision & Inspection Fees	$426,813	$32,371	$32,432	$32,243	$32,092	$31,978	$31,900	$31,849	$31,815	$31,793	$31,784
5	Property Tax and Other Taxes	$3,413,359	$369,313	$358,451	$347,589	$336,727	$325,865	$315,003	$304,140	$293,278	$282,416	$271,554
6	Depreciation	$10,904,244	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
7	Pre-Tax Income	$19,275,936	$2,281,197	$2,227,330	$2,122,324	$2,022,772	$1,928,371	$1,838,515	$1,751,690	$1,665,773	$1,579,857	$1,493,940
8												
9	SIT	$469,100	$71,860	($7,853)	$2,578	$13,268	$22,490	$30,213	$31,223	$27,133	$23,043	$18,953
10	FIT	$1,571,167	$240,683	($26,303)	$8,634	$44,440	$75,325	$101,193	$104,576	$90,877	$77,177	$63,478
11	Deferred Taxes	$1,950,859	$159,784	$495,330	$428,220	$361,111	$301,459	$249,263	$226,893	$226,893	$226,893	$226,893
12	**Utility Operating Income (UOI)**	**$15,284,810**	**$1,808,870**	**$1,766,156**	**$1,682,892**	**$1,603,952**	**$1,529,097**	**$1,457,846**	**$1,388,998**	**$1,320,871**	**$1,252,744**	**$1,184,617**
13												
14	Interest expense	$3,722,657	$440,555	$430,152	$409,873	$390,647	$372,416	$355,062	$338,294	$321,702	$305,109	$288,517
15	Net Income	$11,562,152	$1,368,314	$1,336,004	$1,273,019	$1,213,305	$1,156,681	$1,102,784	$1,050,704	$999,169	$947,635	$896,100
16												
17	Revenue Requirement											
18	UOI at Allowed RORB	$15,284,810	$1,808,870	$1,766,156	$1,682,892	$1,603,952	$1,529,097	$1,457,846	$1,388,998	$1,320,871	$1,252,744	$1,184,617
19	Annual Deficiency / (Excess) UOI	**$0**	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
21	Capital Additions	$27,298,707	$29,058,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$237,172,354	$28,067,988	$27,405,209	$26,113,205	$24,888,311	$23,726,797	$22,621,208	$21,552,902	$20,495,780	$19,438,659	$18,381,538
23												
24	Return on Rate Base	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
25	Return on Equity	9.37%	9.38%	9.38%	9.38%	9.38%	9.37%	9.38%	9.38%	9.38%	9.37%	9.38%
26												
27	Allowed RORB	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%

30–31 **Use this button to goal seek the annual revenues necessary to achieve the annual ROR goal.**

Line			2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
34	Annual Revenue Requirement	$83,923,391	**$6,365,109**	**$6,377,110**	**$6,339,806**	**$6,310,138**	**$6,287,861**	**$6,272,427**	**$6,262,376**	**$6,255,640**	**$6,251,371**	**$6,249,638**
35	Levelized Revenue Requirement	$83,923,391	**$6,389,769**	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769
36		$0	($24,659)	($12,659)	($49,963)	($79,630)	($101,908)	($117,341)	($127,393)	($134,129)	($138,398)	($140,131)
39	Post-forecast value (PV of Undepreciated Asset)	$445,196										

Line	State and Federal Income Taxes (Statutory)		1 2027	2 2028	3 2029	4 2030	5 2031	6 2032	7 2033	8 2034	9 2035	10 2036
43	Operating Income Before Income Taxes		$2,281,197	$2,227,330	$2,122,324	$2,022,772	$1,928,371	$1,838,515	$1,751,690	$1,665,773	$1,579,857	$1,493,940
44	Add Back: Book Depreciation		830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229
45	Deduct: State Tax Depreciation		($1,452,900)	($2,760,510)	($2,498,988)	($2,237,466)	($2,005,002)	($1,801,596)	($1,714,422)	($1,714,422)	($1,714,422)	($1,714,422)
46	Deduct: ATL Interest		($440,555)	($430,152)	($409,873)	($390,647)	($372,416)	($355,062)	($338,294)	($321,702)	($305,109)	($288,517)
47	State Taxable Income		$1,217,970	($133,104)	$43,691	$224,887	$381,182	$512,085	$529,202	$459,878	$390,554	$321,230
48	Allowed Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense		$71,860	($7,853)	$2,578	$13,268	$22,490	$30,213	$31,223	$27,133	$23,043	$18,953
50												
51	Operating Income Before Income Taxes		$2,281,197	$2,227,330	$2,122,324	$2,022,772	$1,928,371	$1,838,515	$1,751,690	$1,665,773	$1,579,857	$1,493,940
52	Add Back: Book Depreciation		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
53	Deduct: Federal Tax Depreciation		($1,452,900)	($2,760,510)	($2,498,988)	($2,237,466)	($2,005,002)	($1,801,596)	($1,714,422)	($1,714,422)	($1,714,422)	($1,714,422)
54	Deduct State Income Tax Expense		($71,860)	$7,853	($2,578)	($13,268)	($22,490)	($30,213)	($31,223)	($27,133)	($23,043)	($18,953)
55	Deduct: ATL Interest		($440,555)	($430,152)	($409,873)	($390,647)	($372,416)	($355,062)	($338,294)	($321,702)	($305,109)	($288,517)
56	Federal Taxable Income		$1,146,110	($125,251)	$41,114	$211,619	$358,692	$481,872	$497,979	$432,745	$367,511	$302,278
57	Allowed Tax Rate		21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense		$ 240,683	$ (26,303)	$ 8,634	$ 44,440	$ 75,325	$ 101,193	$ 104,576	$ 90,877	$ 77,177	$ 63,478
61		Total SIT and FIT	$312,543	($34,156)	$11,212	$57,708	$97,815	$131,406	$135,799	$118,009	$100,220	$82,431

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: Propane Air	11	12	13	14	15	16	17	18	19	20
		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
1	**Annual Revenue Requirement**	**$6,250,510**	**$6,254,060**	**$6,260,361**	**$6,269,489**	**$6,281,521**	**$6,305,371**	**$6,350,259**	**$6,407,435**	**$6,467,851**	**$6,531,595**
2											
3	O&M	$3,719,778	$3,820,088	$3,923,135	$4,028,995	$4,137,745	$4,249,466	$4,364,238	$4,482,146	$4,603,278	$4,727,721
4	Supervision & Inspection Fees	$31,788	$31,806	$31,839	$31,885	$31,946	$32,067	$32,296	$32,587	$32,894	$33,218
5	Property Tax and Other Taxes	$260,692	$249,830	$238,967	$228,105	$217,243	$206,381	$195,519	$184,657	$173,795	$162,932
6	Depreciation	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
7	Pre-Tax Income	$1,408,024	$1,322,107	$1,236,191	$1,150,275	$1,064,358	$987,229	$927,978	$877,817	$827,656	$777,495
8											
9	SIT	$14,862	$10,772	$6,682	$2,592	($1,498)	$44,549	$93,160	$90,773	$88,385	$85,997
10	FIT	$49,779	$36,080	$22,381	$8,682	($5,017)	$149,207	$312,024	$304,026	$296,028	$288,030
11	Deferred Taxes	$226,893	$226,893	$226,893	$226,893	$226,893	$10,652	($213,045)	($213,045)	($213,045)	($213,045)
12	**Utility Operating Income (UOI)**	**$1,116,489**	**$1,048,362**	**$980,235**	**$912,108**	**$843,980**	**$782,821**	**$735,838**	**$696,063**	**$656,288**	**$616,513**
13											
14	Interest expense	$271,924	$255,331	$238,739	$222,146	$205,554	$190,658	$179,215	$169,528	$159,841	$150,153
15	Net Income	$844,565	$793,031	$741,496	$689,961	$638,427	$592,163	$556,622	$526,535	$496,447	$466,359
16											
17	Revenue Requirement										
18	UOI at Allowed RORB	$1,116,489	$1,048,362	$980,235	$912,108	$843,980	$782,821	$735,838	$696,063	$656,288	$616,513
19	Annual Deficiency / (Excess) UOI	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
21	Capital Additions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$17,324,416	$16,267,295	$15,210,173	$14,153,052	$13,095,930	$12,146,929	$11,417,897	$10,800,713	$10,183,530	$9,566,346
23											
24	Return on Rate Base	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
25	Return on Equity	9.38%	9.38%	9.38%	9.38%	9.38%	9.37%	9.37%	9.38%	9.37%	9.37%
26											
27	Allowed RORB	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
28											
29											
30	**Use this button to goal seek the annual revenues necessary to achieve the**										
31	**annual ROR goal.**										
32											
33											
34	Annual Revenue Requirement	**$6,250,510**	**$6,254,060**	**$6,260,361**	**$6,269,489**	**$6,281,521**	**$6,305,371**	**$6,350,259**	**$6,407,435**	**$6,467,851**	**$6,531,595**
35	Levelized Revenue Requirement	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769
36		($139,259)	($135,709)	($129,408)	($120,280)	($108,248)	($84,398)	($39,510)	$17,666	$78,082	$141,826
37											
38											
39	Post-forecast value (PV of Undepreciated Asset)										
40											

Line	State and Federal Income Taxes (Statutory)	11	12	13	14	15	16	17	18	19	19
42		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
43	Operating Income Before Income Taxes	$1,408,024	$1,322,107	$1,236,191	$1,150,275	$1,064,358	$987,229	$927,978	$877,817	$827,656	$777,495
44	Add Back: Book Depreciation	830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229
45	Deduct: State Tax Depreciation	($1,714,422)	($1,714,422)	($1,714,422)	($1,714,422)	($1,714,422)	($871,740)	$0	$0	$0	$0
46	Deduct: ATL Interest	($271,924)	($255,331)	($238,739)	($222,146)	($205,554)	($190,658)	($179,215)	($169,528)	($159,841)	($150,153)
47	State Taxable Income	$251,906	$182,583	$113,259	$43,935	($25,389)	$755,059	$1,578,991	$1,538,517	$1,498,044	$1,457,570
48	Allowed Tax Rate	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense	$14,862	$10,772	$6,682	$2,592	($1,498)	$44,549	$93,160	$90,773	$88,385	$85,997
50											
51	Operating Income Before Income Taxes	$1,408,024	$1,322,107	$1,236,191	$1,150,275	$1,064,358	$987,229	$927,978	$877,817	$827,656	$777,495
52	Add Back: Book Depreciation	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
53	Deduct: Federal Tax Depreciation	($1,714,422)	($1,714,422)	($1,714,422)	($1,714,422)	($1,714,422)	($871,740)	$0	$0	$0	$0
54	Deduct State Income Tax Expense	($14,862)	($10,772)	($6,682)	($2,592)	$1,498	($44,549)	($93,160)	($90,773)	($88,385)	($85,997)
55	Deduct: ATL Interest	($271,924)	($255,331)	($238,739)	($222,146)	($205,554)	($190,658)	($179,215)	($169,528)	($159,841)	($150,153)
56	Federal Taxable Income	$237,044	$171,810	$106,576	$41,343	($23,891)	$710,511	$1,485,830	$1,447,745	$1,409,659	$1,371,573
57	Allowed Tax Rate	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense	$ 49,779	$ 36,080	$ 22,381	$ 8,682	$ (5,017)	$ 149,207	$ 312,024	$ 304,026	$ 296,028	$ 288,030
59											
60											
61		$64,642	$46,853	$29,063	$11,274	($6,515)	$193,756	$405,185	$394,799	$384,413	$374,027
62											
63											

Prepared by: Concentric Energy Advisors, Inc.

New Mexico Gas Company
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New Mexico Gas Company
Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: Propane Air	21	22	23	24	25	26	27	28	29	30
		2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
1	**Annual Revenue Requirement**	**$6,598,761**	**$6,669,442**	**$6,743,736**	**$6,821,742**	**$6,903,564**	**$6,989,307**	**$7,079,079**	**$7,172,993**	**$7,271,162**	**$5,918,245**
3	O&M	$4,855,568	$4,986,913	$5,121,852	$5,260,485	$5,402,914	$5,549,244	$5,699,583	$5,854,042	$6,012,735	$4,727,721
4	Supervision & Inspection Fees	$33,560	$33,919	$34,297	$34,694	$35,110	$35,546	$36,002	$36,480	$36,979	$30,099
5	Property Tax and Other Taxes	$152,070	$141,208	$130,346	$119,484	$108,622	$97,759	$86,897	$76,035	$65,173	$54,311
6	Depreciation	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
7	Pre-Tax Income	$727,334	$677,173	$627,012	$576,851	$526,690	$476,529	$426,368	$376,207	$326,046	$275,885
9	SIT	$83,609	$81,221	$78,833	$76,445	$74,057	$71,669	$69,281	$66,893	$64,505	$62,117
10	FIT	$280,032	$272,034	$264,036	$256,038	$248,040	$240,042	$232,044	$224,046	$216,048	$208,050
11	Deferred Taxes	($213,045)	($213,045)	($213,045)	($213,045)	($213,045)	($213,045)	($213,045)	($213,045)	($213,045)	($213,045)
12	**Utility Operating Income (UOI)**	**$576,738**	**$536,963**	**$497,188**	**$457,413**	**$417,638**	**$377,863**	**$338,088**	**$298,313**	**$258,538**	**$218,763**
14	Interest expense	$140,466	$130,779	$121,091	$111,404	$101,717	$92,029	$82,342	$72,655	$62,968	$53,280
15	Net Income	$436,272	$406,184	$376,096	$346,009	$315,921	$285,833	$255,745	$225,658	$195,570	$165,482
17	Revenue Requirement										
18	UOI at Allowed RORB	$576,738	$536,963	$497,188	$457,413	$417,638	$377,863	$338,088	$298,313	$258,538	$218,763
19	Annual Deficiency / (Excess) UOI	$0	$0	$0	($0)	$0	($0)	$0	$0	$0	($0)
21	Capital Additions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$8,949,162	$8,331,979	$7,714,795	$7,097,612	$6,480,428	$5,863,244	$5,246,061	$4,628,877	$4,011,694	$3,394,510
24	Return on Rate Base	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
25	Return on Equity	9.38%	9.38%	9.38%	9.38%	9.38%	9.38%	9.37%	9.37%	9.37%	9.38%
27	Allowed RORB	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
30–31	**Use this button to goal seek the annual revenues necessary to achieve the annual ROR goal.**										
34	Annual Revenue Requirement	**$6,598,761**	**$6,669,442**	**$6,743,736**	**$6,821,742**	**$6,903,564**	**$6,989,307**	**$7,079,079**	**$7,172,993**	**$7,271,162**	**$5,918,245**
35	Levelized Revenue Requirement	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769	$6,389,769
36		$208,992	$279,673	$353,967	$431,974	$513,795	$599,538	$689,310	$783,224	$881,393	($471,524)
39	Post-forecast value (PV of Undepreciated Asset)										

Line	State and Federal Income Taxes (Statutory)	19	19	19	19	19	19	19	19	19	20
42		2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
43	Operating Income Before Income Taxes	$727,334	$677,173	$627,012	$576,851	$526,690	$476,529	$426,368	$376,207	$326,046	$275,885
44	Add Back: Book Depreciation	830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229	830,229
45	Deduct: State Tax Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
46	Deduct: ATL Interest	($140,466)	($130,779)	($121,091)	($111,404)	($101,717)	($92,029)	($82,342)	($72,655)	($62,968)	($53,280)
47	State Taxable Income	$1,417,096	$1,376,623	$1,336,149	$1,295,675	$1,255,202	$1,214,728	$1,174,255	$1,133,781	$1,093,307	$1,052,834
48	Allowed Tax Rate	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense	$83,609	$81,221	$78,833	$76,445	$74,057	$71,669	$69,281	$66,893	$64,505	$62,117
51	Operating Income Before Income Taxes	$727,334	$677,173	$627,012	$576,851	$526,690	$476,529	$426,368	$376,207	$326,046	$275,885
52	Add Back: Book Depreciation	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
53	Deduct: Federal Tax Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
54	Deduct State Income Tax Expense	($83,609)	($81,221)	($78,833)	($76,445)	($74,057)	($71,669)	($69,281)	($66,893)	($64,505)	($62,117)
55	Deduct: ATL Interest	($140,466)	($130,779)	($121,091)	($111,404)	($101,717)	($92,029)	($82,342)	($72,655)	($62,968)	($53,280)
56	Federal Taxable Income	$1,333,488	$1,295,402	$1,257,316	$1,219,231	$1,181,145	$1,143,059	$1,104,974	$1,066,888	$1,028,802	$990,716
57	Allowed Tax Rate	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense	$ 280,032	$ 272,034	$ 264,036	$ 256,038	$ 248,040	$ 240,042	$ 232,044	$ 224,046	$ 216,048	$208,050
61		$363,641	$353,255	$342,869	$332,483	$322,097	$311,711	$301,325	$290,940	$280,554	$270,168

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

		Year	1	2	3	4	5	6	7	8	9	10
			2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Cap Ex												
	Total - All systems		$29,058,000									
	Total		$29,058,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation			$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
Rate Base												
Gross Plant			$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000
Accumulated Depreciation			$830,229	$1,660,457	$2,490,686	$3,320,914	$4,151,143	$4,981,371	$5,811,600	$6,641,829	$7,472,057	$8,302,286
Net Plant			$28,227,771	$27,397,543	$26,567,314	$25,737,086	$24,906,857	$24,076,629	$23,246,400	$22,416,171	$21,585,943	$20,755,714
Deferred Taxes			($159,784)	($655,113)	($1,083,334)	($1,444,445)	($1,745,903)	($1,995,166)	($2,222,059)	($2,448,952)	($2,675,845)	($2,902,737)
Rate Base - End of Period			$28,067,988	$26,742,430	$25,483,981	$24,292,641	$23,160,954	$22,081,463	$21,024,341	$19,967,220	$18,910,098	$17,852,977
Average Rate Base			$28,067,988	$27,405,209	$26,113,205	$24,888,311	$23,726,797	$22,621,208	$21,552,902	$20,495,780	$19,438,659	$18,381,538
Depreciation Rates - Book			1	2	3	4	5	6	7	8	9	10
	Total - All systems	35	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	35	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	35	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	35	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	35	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	35	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Depreciation - Book			1	2	3	4	5	6	7	8	9	10
	1		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
	2			$0	$0	$0	$0	$0	$0	$0	$0	$0
	3				$0	$0	$0	$0	$0	$0	$0	$0
	4					$0	$0	$0	$0	$0	$0	$0
	5						$0	$0	$0	$0	$0	$0
	6							$0	$0	$0	$0	$0
	7								$0	$0	$0	$0
	8									$0	$0	$0
	9										$0	$0
	10											$0
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
Rate Base Book Depreciation			$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
Deferred Taxes Calculation												
Depreciation Rates - Federal Tax		Tax Life	1	2	3	4	5	6	7	8	9	10
	Total - All systems	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
Depreciation Rates - State Tax												
	Total - All systems	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%

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	11	12	13	14	15	16	17	18	19	20
	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
Cap Ex										
Total - All systems										
Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
Rate Base										
Gross Plant	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000
Accumulated Depreciation	$9,132,514	$9,962,743	$10,792,971	$11,623,200	$12,453,429	$13,283,657	$14,113,886	$14,944,114	$15,774,343	$16,604,571
Net Plant	$19,925,486	$19,095,257	$18,265,029	$17,434,800	$16,604,571	$15,774,343	$14,944,114	$14,113,886	$13,283,657	$12,453,429
Deferred Taxes	($3,129,630)	($3,356,523)	($3,583,416)	($3,810,309)	($4,037,202)	($4,047,854)	($3,834,809)	($3,621,764)	($3,408,719)	($3,195,674)
Rate Base - End of Period	$16,795,855	$15,738,734	$14,681,612	$13,624,491	$12,567,370	$11,726,489	$11,109,305	$10,492,122	$9,874,938	$9,257,754
Average Rate Base	$17,324,416	$16,267,295	$15,210,173	$14,153,052	$13,095,930	$12,146,929	$11,417,897	$10,800,713	$10,183,530	$9,566,346
Depreciation Rates - Book	11	12	13	14	15	16	17	18	19	20
Total - All systems	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Depreciation - Book	11	12	13	14	15	16	17	18	19	20
1	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
12		$0	$0	$0	$0	$0	$0	$0	$0	$0
13			$0	$0	$0	$0	$0	$0	$0	$0
14				$0	$0	$0	$0	$0	$0	$0
15					$0	$0	$0	$0	$0	$0
16						$0	$0	$0	$0	$0
17							$0	$0	$0	$0
18								$0	$0	$0
19									$0	$0
20										
Rate Base Book Depreciation	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
Deferred Taxes Calculation										
Depreciation Rates - Federal Tax	11	12	13	14	15	16	17	18	19	20
Total - All systems	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
Depreciation Rates - State Tax										
Total - All systems	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%

New Mexico Gas Company
Cost of Service Based Revenue Requirements

		21	22	23	24	25	26	27	28	29	30
		2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
Cap Ex											
	Total - All systems										
	Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
Rate Base											
Gross Plant		$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000	$29,058,000
Accumulated Depreciation		$17,434,800	$18,265,029	$19,095,257	$19,925,486	$20,755,714	$21,585,943	$22,416,171	$23,246,400	$24,076,629	$24,906,857
Net Plant		$11,623,200	$10,792,971	$9,962,743	$9,132,514	$8,302,286	$7,472,057	$6,641,829	$5,811,600	$4,981,371	$4,151,143
Deferred Taxes		($2,982,629)	($2,769,584)	($2,556,539)	($2,343,494)	($2,130,450)	($1,917,405)	($1,704,360)	($1,491,315)	($1,278,270)	($1,065,225)
Rate Base - End of Period		$8,640,571	$8,023,387	$7,406,203	$6,789,020	$6,171,836	$5,554,653	$4,937,469	$4,320,285	$3,703,102	$3,085,918
Average Rate Base		$8,949,162	$8,331,979	$7,714,795	$7,097,612	$6,480,428	$5,863,244	$5,246,061	$4,628,877	$4,011,694	$3,394,510
Depreciation Rates - Book		21	22	23	24	25	26	27	28	29	30
	Total - All systems	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Depreciation - Book		21	22	23	24	25	26	27	28	29	30
	1	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	20										
Rate Base Book Depreciation		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
Deferred Taxes Calculation											
Depreciation Rates - Federal Tax		21	22	23	24	25	26	27	28	29	30
	Total - All systems	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Depreciation Rates - State Tax											
	Total - All systems	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
	0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
Calculation of Deferred Taxes:												
Federal Book Depreciation												
Year			1	2	3	4	5	6	7	8	9	10
	1		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
	2			$0	$0	$0	$0	$0	$0	$0	$0	$0
	3				$0	$0	$0	$0	$0	$0	$0	$0
	4					$0	$0	$0	$0	$0	$0	$0
	5						$0	$0	$0	$0	$0	$0
	6							$0	$0	$0	$0	$0
	7								$0	$0	$0	$0
	8									$0	$0	$0
	9										$0	$0
	10											$0
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
Federal Book Depreciation			$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
State Book Depreciation												
Year			1	2	3	4	5	6	7	8	9	10
	1		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
	2			$0	$0	$0	$0	$0	$0	$0	$0	$0
	3				$0	$0	$0	$0	$0	$0	$0	$0
	4					$0	$0	$0	$0	$0	$0	$0
	5						$0	$0	$0	$0	$0	$0
	6							$0	$0	$0	$0	$0
	7								$0	$0	$0	$0
	8									$0	$0	$0
	9										$0	$0
	10											$0
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
State Book Depreciation			$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
Federal Tax Depreciation												
Year			1	2	3	4	5	6	7	8	9	10
	1		$1,452,900	$2,760,510	$2,498,988	$2,237,466	$2,005,002	$1,801,596	$1,714,422	$1,714,422	$1,714,422	$1,714,422
	2			$0	$0	$0	$0	$0	$0	$0	$0	$0
	3				$0	$0	$0	$0	$0	$0	$0	$0
	4					$0	$0	$0	$0	$0	$0	$0
	5						$0	$0	$0	$0	$0	$0
	6							$0	$0	$0	$0	$0
	7								$0	$0	$0	$0
	8									$0	$0	$0
	9										$0	$0
	10											$0
	11											
	12											
	13											
	14											
	15											

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
Calculation of Deferred Taxes:											
Federal Book Depreciation											
Year		11	12	13	14	15	16	17	18	19	20
	1	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	12		$0	$0	$0	$0	$0	$0	$0	$0	$0
	13			$0	$0	$0	$0	$0	$0	$0	$0
	14				$0	$0	$0	$0	$0	$0	$0
	15					$0	$0	$0	$0	$0	$0
	16						$0	$0	$0	$0	$0
	17							$0	$0	$0	$0
	18								$0	$0	$0
	19									$0	$0
	20										
Federal Book Depreciation		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
State Book Depreciation											
Year		11	12	13	14	15	16	17	18	19	20
	1	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	12		$0	$0	$0	$0	$0	$0	$0	$0	$0
	13			$0	$0	$0	$0	$0	$0	$0	$0
	14				$0	$0	$0	$0	$0	$0	$0
	15					$0	$0	$0	$0	$0	$0
	16						$0	$0	$0	$0	$0
	17							$0	$0	$0	$0
	18								$0	$0	$0
	19									$0	$0
	20										
State Book Depreciation		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
Federal Tax Depreciation											
Year		11	12	13	14	15	16	17	18	19	20
	1	$1,714,422	$1,714,422	$1,714,422	$1,714,422	$1,714,422	$871,740	$0	$0	$0	$0
	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	12		$0	$0	$0	$0	$0	$0	$0	$0	$0
	13			$0	$0	$0	$0	$0	$0	$0	$0
	14				$0	$0	$0	$0	$0	$0	$0
	15					$0	$0	$0	$0	$0	$0

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Cost of Service Based Revenue Requirements

130		0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
131		0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
132	Calculation of Deferred Taxes:											
133	Federal Book Depreciation											
134	Year		21	22	23	24	25	26	27	28	29	30
135		1	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
136		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
137		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
138		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
139		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
140		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
141		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
142		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
143		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
144		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
145		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
146		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
147		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
148		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
149		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
150		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
151		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
152		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
153		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
154		20										
155	Federal Book Depreciation		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
156	State Book Depreciation											
157	Year		21	22	23	24	25	26	27	28	29	30
158		1	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
159		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
160		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
161		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
162		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
163		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
164		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
165		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
166		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
167		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
168		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
169		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
170		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
171		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
172		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
173		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
174		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
175		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
176		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
177		20										
178	State Book Depreciation		$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229	$830,229
179	Federal Tax Depreciation											
180	Year		21	22	23	24	25	26	27	28	29	30
181		1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
182		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
183		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
184		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
185		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
186		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
187		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
188		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
189		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
190		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
191		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
192		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
193		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
194		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
195		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

	16										
	17										
	18										
	19										
	20										
Federal Tax Depreciation		$1,452,900	$2,760,510	$2,498,988	$2,237,466	$2,005,002	$1,801,596	$1,714,422	$1,714,422	$1,714,422	$1,714,422
Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
State Tax Depreciation											
Year		1	2	3	4	5	6	7	8	9	10
	1	$1,452,900	$2,760,510	$2,498,988	$2,237,466	$2,005,002	$1,801,596	$1,714,422	$1,714,422	$1,714,422	$1,714,422
	2		$0	$0	$0	$0	$0	$0	$0	$0	$0
	3			$0	$0	$0	$0	$0	$0	$0	$0
	4				$0	$0	$0	$0	$0	$0	$0
	5					$0	$0	$0	$0	$0	$0
	6						$0	$0	$0	$0	$0
	7							$0	$0	$0	$0
	8								$0	$0	$0
	9									$0	$0
	10										$0
	11										
	12										
	13										
	14										
	15										
	16										
	17										
	18										
	19										
	20										
State Tax Depreciation		$1,452,900	$2,760,510	$2,498,988	$2,237,466	$2,005,002	$1,801,596	$1,714,422	$1,714,422	$1,714,422	$1,714,422
State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
Federal Deferred Taxes		($123,046)	($381,443)	($329,764)	($278,084)	($232,147)	($191,952)	($174,725)	($174,725)	($174,725)	($174,725)
State Deferred Taxes		($36,738)	($113,887)	($98,457)	($83,027)	($69,312)	($57,311)	($52,167)	($52,167)	($52,167)	($52,167)
Total Deferred Taxes		($159,784)	($495,330)	($428,220)	($361,111)	($301,459)	($249,263)	($226,893)	($226,893)	($226,893)	($226,893)

MACRS	1	2	3	4	5	6	7	8	9	10
5	0.200	0.320	0.192	0.115	0.115	0.058				
7	0.143	0.245	0.175	0.125	0.089	0.089	0.089	0.045		
10	0.100	0.180	0.144	0.115	0.092	0.074	0.066	0.066	0.065	0.065
15	0.050	0.095	0.086	0.077	0.069	0.062	0.059	0.059	0.059	0.059
20	0.038	0.072	0.067	0.062	0.057	0.053	0.045	0.045	0.045	0.045

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New Mexico Gas Company
Application for a CCN
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New Mexico Gas Company
Cost of Service Based Revenue Requirements

196		16						$0	$0	$0	$0	$0
197		17							$0	$0	$0	$0
198		18								$0	$0	$0
199		19									$0	$0
200		20										
201	Federal Tax Depreciation		$1,714,422	$1,714,422	$1,714,422	$1,714,422	$1,714,422	$871,740	$0	$0	$0	$0
202												
203	Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
204												
205	State Tax Depreciation											
206	Year		11	12	13	14	15	16	17	18	19	20
207		1	$1,714,422	$1,714,422	$1,714,422	$1,714,422	$1,714,422	$871,740	$0	$0	$0	$0
208		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
209		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
210		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
211		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
212		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
213		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
214		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
215		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
216		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
217		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
218		12		$0	$0	$0	$0	$0	$0	$0	$0	$0
219		13			$0	$0	$0	$0	$0	$0	$0	$0
220		14				$0	$0	$0	$0	$0	$0	$0
221		15					$0	$0	$0	$0	$0	$0
222		16						$0	$0	$0	$0	$0
223		17							$0	$0	$0	$0
224		18								$0	$0	$0
225		19									$0	$0
226		20										
227	State Tax Depreciation		$1,714,422	$1,714,422	$1,714,422	$1,714,422	$1,714,422	$871,740	$0	$0	$0	$0
228												
229	State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
230												
231	Federal Deferred Taxes		($174,725)	($174,725)	($174,725)	($174,725)	($174,725)	($8,203)	$164,061	$164,061	$164,061	$164,061
232	State Deferred Taxes		($52,167)	($52,167)	($52,167)	($52,167)	($52,167)	($2,449)	$48,983	$48,983	$48,983	$48,983
233	Total Deferred Taxes		($226,893)	($226,893)	($226,893)	($226,893)	($226,893)	($10,652)	$213,045	$213,045	$213,045	$213,045
234												
235												
236			11	12	13	14	15	16	17	18	19	20
237												
238												
239			0.033									
240			0.059	0.059	0.059	0.059	0.059	0.030				
241			0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045

New Mexico Gas Company
Cost of Service Based Revenue Requirements

	16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	20										
Federal Tax Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
State Tax Depreciation											
Year		21	22	23	24	25	26	27	28	29	30
	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	20										
State Tax Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
Federal Deferred Taxes		$164,061	$164,061	$164,061	$164,061	$164,061	$164,061	$164,061	$164,061	$164,061	$164,061
State Deferred Taxes		$48,983	$48,983	$48,983	$48,983	$48,983	$48,983	$48,983	$48,983	$48,983	$48,983
Total Deferred Taxes		$213,045	$213,045	$213,045	$213,045	$213,045	$213,045	$213,045	$213,045	$213,045	$213,045

21	22	23	24	25	26	27	28	29	30
0.021									

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: Underground Storage	30 Year NPV	1 2027	2 2028	3 2029	4 2030	5 2031	6 2032	7 2033	8 2034	9 2035	10 2036
1	**Annual Revenue Requirement**	**$477,087,210**	**$44,395,317**	**$43,858,937**	**$42,752,496**	**$41,708,918**	**$40,725,231**	**$39,795,309**	**$38,903,571**	**$38,028,128**	**$37,159,719**	**$36,298,555**
2												
3	O&M	$122,648,858	$6,786,000	$6,984,900	$7,189,671	$7,400,489	$7,617,533	$7,840,988	$8,071,043	$8,307,895	$8,551,746	$8,802,802
4	Supervision & Inspection Fees	$2,426,338	$225,783	$223,055	$217,428	$212,120	$207,118	$202,388	$197,853	$193,401	$188,984	$184,605
5	Property Tax and Other Taxes	$32,630,045	$3,806,814	$3,675,544	$3,544,275	$3,413,006	$3,281,736	$3,150,467	$3,019,197	$2,887,928	$2,756,658	$2,625,389
6	Depreciation	$131,778,063	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
7	Pre-Tax Income	$187,603,905	$23,543,387	$22,942,104	$21,767,788	$20,649,970	$19,585,511	$18,568,134	$17,582,144	$16,605,571	$15,628,998	$14,652,425
8												
9	SIT	$5,395,429	$824,815	($2,965)	$100,962	$207,579	$298,977	$374,857	$381,195	$334,705	$288,214	$241,724
10	FIT	$18,071,028	$2,762,571	($9,929)	$338,155	$695,249	$1,001,369	$1,255,516	$1,276,745	$1,121,034	$965,322	$809,611
11	Deferred Taxes	$15,377,363	$1,287,327	$4,763,109	$4,067,953	$3,372,796	$2,754,879	$2,214,202	$1,982,483	$1,982,483	$1,982,483	$1,982,483
12	**Utility Operating Income (UOI)**	**$148,760,085**	**$18,668,675**	**$18,191,889**	**$17,260,717**	**$16,374,346**	**$15,530,286**	**$14,723,559**	**$13,941,721**	**$13,167,349**	**$12,392,978**	**$11,618,607**
13												
14	Interest expense	$36,230,927	$4,546,807	$4,430,684	$4,203,895	$3,988,017	$3,782,444	$3,585,963	$3,395,544	$3,206,944	$3,018,344	$2,829,744
15	Net Income	$112,529,159	$14,121,868	$13,761,205	$13,056,822	$12,386,329	$11,747,842	$11,137,596	$10,546,176	$9,960,405	$9,374,634	$8,788,863
16												
17	Revenue Requirement											
18	UOI at Allowed RORB	$148,760,085	$18,668,675	$18,191,889	$17,260,717	$16,374,346	$15,530,286	$14,723,559	$13,941,721	$13,167,349	$12,392,978	$11,618,607
19	Annual Deficiency / (Excess) UOI	**($0)**	($0)	($0)	($0)	$0	$0	$0	($0)	($0)	$0	($0)
21	Capital Additions	$282,776,205	$301,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$2,308,290,434	$289,679,340	$282,281,119	$267,832,254	$254,078,546	$240,981,375	$228,463,501	$216,331,825	$204,316,008	$192,300,192	$180,284,375
23												
24	Return on Rate Base	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
25	Return on Equity	9.38%	9.38%	9.38%	9.38%	9.38%	9.38%	9.38%	9.38%	9.38%	9.37%	9.38%
26												
27	Allowed RORB	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%

Use this button to goal seek the annual revenues necessary to achieve the annual ROR goal.

Line		30 Year NPV	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
34	Annual Revenue Requirement	**$477,087,210**	**$44,395,317**	**$43,858,937**	**$42,752,496**	**$41,708,918**	**$40,725,231**	**$39,795,309**	**$38,903,571**	**$38,028,128**	**$37,159,719**	**$36,298,555**
35	Levelized Revenue Requirement	$477,087,210	**$36,324,521**	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521
36		$0	$8,070,796	$7,534,416	$6,427,975	$5,384,397	$4,400,710	$3,470,788	$2,579,050	$1,703,607	$835,198	($25,966)
39	Post-forecast value (PV of Undepreciated Asset)	$0										

Line	State and Federal Income Taxes (Statutory)	1 2027	2 2028	3 2029	4 2030	5 2031	6 2032	7 2033	8 2034	9 2035	10 2036
43	Operating Income Before Income Taxes	$23,543,387	$22,942,104	$21,767,788	$20,649,970	$19,585,511	$18,568,134	$17,582,144	$16,605,571	$15,628,998	$14,652,425
44	Add Back: Book Depreciation	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333
45	Deduct: State Tax Depreciation	($15,050,000)	($28,595,000)	($25,886,000)	($23,177,000)	($20,769,000)	($18,662,000)	($17,759,000)	($17,759,000)	($17,759,000)	($17,759,000)
46	Deduct: ATL Interest	($4,546,807)	($4,430,684)	($4,203,895)	($3,988,017)	($3,782,444)	($3,585,963)	($3,395,544)	($3,206,944)	($3,018,344)	($2,829,744)
47	State Taxable Income	$13,979,914	($50,247)	$1,711,226	$3,518,286	$5,067,400	$6,353,504	$6,460,933	$5,672,960	$4,884,988	$4,097,015
48	Allowed Tax Rate	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense	$824,815	($2,965)	$100,962	$207,579	$298,977	$374,857	$381,195	$334,705	$288,214	$241,724
50											
51	Operating Income Before Income Taxes	$23,543,387	$22,942,104	$21,767,788	$20,649,970	$19,585,511	$18,568,134	$17,582,144	$16,605,571	$15,628,998	$14,652,425
52	Add Back: Book Depreciation	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
53	Deduct: Federal Tax Depreciation	($15,050,000)	($28,595,000)	($25,886,000)	($23,177,000)	($20,769,000)	($18,662,000)	($17,759,000)	($17,759,000)	($17,759,000)	($17,759,000)
54	Deduct State Income Tax Expense	($824,815)	$2,965	($100,962)	($207,579)	($298,977)	($374,857)	($381,195)	($334,705)	($288,214)	($241,724)
55	Deduct: ATL Interest	($4,546,807)	($4,430,684)	($4,203,895)	($3,988,017)	($3,782,444)	($3,585,963)	($3,395,544)	($3,206,944)	($3,018,344)	($2,829,744)
56	Federal Taxable Income	$13,155,099	($47,282)	$1,610,264	$3,310,707	$4,768,424	$5,978,647	$6,079,738	$5,338,256	$4,596,773	$3,855,291
57	Allowed Tax Rate	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense	$ 2,762,571	$ (9,929)	$ 338,155	$ 695,249	$ 1,001,369	$ 1,255,516	$ 1,276,745	$ 1,121,034	$ 965,322	$ 809,611
61	Total SIT and FIT	$3,587,386	($12,894)	$439,118	$902,827	$1,300,346	$1,630,373	$1,657,940	$1,455,738	$1,253,537	$1,051,335

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: Underground Storage	11	12	13	14	15	16	17	18	19	20
		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
1	**Annual Revenue Requirement**	**$35,444,848**	**$34,598,820**	**$33,760,701**	**$32,930,724**	**$32,109,132**	**$31,387,663**	**$30,861,220**	**$30,438,575**	**$30,025,358**	**$29,621,846**
2											
3	O&M	$9,061,280	$9,327,398	$9,601,383	$9,883,470	$10,173,899	$10,472,917	$10,780,780	$11,097,751	$11,424,101	$11,760,107
4	Supervision & Inspection Fees	$180,263	$175,960	$171,698	$167,477	$163,298	$159,629	$156,952	$154,802	$152,701	$150,649
5	Property Tax and Other Taxes	$2,494,119	$2,362,850	$2,231,581	$2,100,311	$1,969,042	$1,837,772	$1,706,503	$1,575,233	$1,443,964	$1,312,694
6	Depreciation	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
7	Pre-Tax Income	$13,675,852	$12,699,279	$11,722,706	$10,746,133	$9,769,560	$8,884,012	$8,183,652	$7,577,455	$6,971,259	$6,365,063
8											
9	SIT	$195,233	$148,743	$102,253	$55,762	$9,272	$482,126	$981,555	$952,696	$923,838	$894,980
10	FIT	$653,900	$498,189	$342,477	$186,766	$31,055	$1,614,795	$3,287,543	$3,190,887	$3,094,231	$2,997,575
11	Deferred Taxes	$1,982,483	$1,982,483	$1,982,483	$1,982,483	$1,982,483	($257,465)	($2,574,654)	($2,574,654)	($2,574,654)	($2,574,654)
12	**Utility Operating Income (UOI)**	**$10,844,236**	**$10,069,864**	**$9,295,493**	**$8,521,122**	**$7,746,750**	**$7,044,557**	**$6,489,208**	**$6,008,526**	**$5,527,844**	**$5,047,162**
13											
14	Interest expense	$2,641,143	$2,452,543	$2,263,943	$2,075,343	$1,886,742	$1,715,721	$1,580,464	$1,463,393	$1,346,322	$1,229,250
15	Net Income	$8,203,092	$7,617,321	$7,031,550	$6,445,779	$5,860,008	$5,328,836	$4,908,744	$4,545,133	$4,181,522	$3,817,912
16											
17	Revenue Requirement										
18	UOI at Allowed RORB	$10,844,236	$10,069,864	$9,295,493	$8,521,122	$7,746,750	$7,044,557	$6,489,208	$6,008,526	$5,527,844	$5,047,162
19	Annual Deficiency / (Excess) UOI	$0	$0	($0)	$0	$0	$0	($0)	$0	$0	($0)
21	Capital Additions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$168,268,558	$156,252,742	$144,236,925	$132,221,108	$120,205,292	$109,309,449	$100,692,176	$93,233,496	$85,774,816	$78,316,137
23											
24	Return on Rate Base	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
25	Return on Equity	9.37%	9.37%	9.38%	9.38%	9.38%	9.37%	9.38%	9.38%	9.37%	9.38%
26											
27	Allowed RORB	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
28											
29											
30	**Use this button to goal seek the annual revenues necessary to achieve the**										
31	**annual ROR goal.**										
32											
33											
34	Annual Revenue Requirement	**$35,444,848**	**$34,598,820**	**$33,760,701**	**$32,930,724**	**$32,109,132**	**$31,387,663**	**$30,861,220**	**$30,438,575**	**$30,025,358**	**$29,621,846**
35	Levelized Revenue Requirement	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521
36		($879,673)	($1,725,701)	($2,563,820)	($3,393,797)	($4,215,389)	($4,936,858)	($5,463,301)	($5,885,946)	($6,299,163)	($6,702,675)
37											
38											
39	Post-forecast value (PV of Undepreciated Asset)										
40											

Line	State and Federal Income Taxes (Statutory)	11	12	13	14	15	16	17	18	19	19
42		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
43	Operating Income Before Income Taxes	$13,675,852	$12,699,279	$11,722,706	$10,746,133	$9,769,560	$8,884,012	$8,183,652	$7,577,455	$6,971,259	$6,365,063
44	Add Back: Book Depreciation	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333
45	Deduct: State Tax Depreciation	($17,759,000)	($17,759,000)	($17,759,000)	($17,759,000)	($17,759,000)	($9,030,000)	$0	$0	$0	$0
46	Deduct: ATL Interest	($2,641,143)	($2,452,543)	($2,263,943)	($2,075,343)	($1,886,742)	($1,715,721)	($1,580,464)	($1,463,393)	($1,346,322)	($1,229,250)
47	State Taxable Income	$3,309,042	$2,521,069	$1,733,097	$945,124	$157,151	$8,171,624	$16,636,521	$16,147,396	$15,658,271	$15,169,146
48	Allowed Tax Rate	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense	$195,233	$148,743	$102,253	$55,762	$9,272	$482,126	$981,555	$952,696	$923,838	$894,980
50											
51	Operating Income Before Income Taxes	$13,675,852	$12,699,279	$11,722,706	$10,746,133	$9,769,560	$8,884,012	$8,183,652	$7,577,455	$6,971,259	$6,365,063
52	Add Back: Book Depreciation	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
53	Deduct: Federal Tax Depreciation	($17,759,000)	($17,759,000)	($17,759,000)	($17,759,000)	($17,759,000)	($9,030,000)	$0	$0	$0	$0
54	Deduct State Income Tax Expense	($195,233)	($148,743)	($102,253)	($55,762)	($9,272)	($482,126)	($981,555)	($952,696)	($923,838)	($894,980)
55	Deduct: ATL Interest	($2,641,143)	($2,452,543)	($2,263,943)	($2,075,343)	($1,886,742)	($1,715,721)	($1,580,464)	($1,463,393)	($1,346,322)	($1,229,250)
56	Federal Taxable Income	$3,113,809	$2,372,326	$1,630,844	$889,362	$147,879	$7,689,498	$15,654,966	$15,194,699	$14,734,433	$14,274,166
57	Allowed Tax Rate	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense	$ 653,900	$ 498,189	$ 342,477	$ 186,766	$ 31,055	$ 1,614,795	$ 3,287,543	$ 3,190,887	$ 3,094,231	$ 2,997,575
59											
60											
61		$849,133	$646,932	$444,730	$242,528	$40,327	$2,096,920	$4,269,098	$4,143,583	$4,018,069	$3,892,555
62											
63											

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

Line	Revenue Requirements Analysis: Underground Storage	21	22	23	24	25	26	27	28	29	30
		2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
1	**Annual Revenue Requirement**	**$29,228,330**	**$28,845,105**	**$28,472,477**	**$28,110,764**	**$27,760,287**	**$27,421,382**	**$27,094,392**	**$26,779,672**	**$26,477,588**	**$26,188,514**
2											
3	O&M	$12,106,057	$12,462,247	$12,828,981	$13,206,573	$13,595,345	$13,995,629	$14,407,768	$14,832,115	$15,269,032	$15,718,894
4	Supervision & Inspection Fees	$148,648	$146,699	$144,803	$142,964	$141,181	$139,458	$137,795	$136,194	$134,658	$133,188
5	Property Tax and Other Taxes	$1,181,425	$1,050,156	$918,886	$787,617	$656,347	$525,078	$393,808	$262,539	$131,269	$0
6	Depreciation	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
7	Pre-Tax Income	$5,758,866	$5,152,670	$4,546,473	$3,940,277	$3,334,080	$2,727,884	$2,121,688	$1,515,491	$909,295	$303,098
8											
9	SIT	$866,121	$837,263	$808,404	$779,546	$750,688	$721,829	$692,971	$664,113	$635,254	$606,396
10	FIT	$2,900,919	$2,804,263	$2,707,607	$2,610,951	$2,514,295	$2,417,639	$2,320,983	$2,224,327	$2,127,671	$2,031,015
11	Deferred Taxes	($2,574,654)	($2,574,654)	($2,574,654)	($2,574,654)	($2,574,654)	($2,574,654)	($2,574,654)	($2,574,654)	($2,574,654)	($2,574,654)
12	**Utility Operating Income (UOI)**	**$4,566,480**	**$4,085,798**	**$3,605,116**	**$3,124,433**	**$2,643,751**	**$2,163,069**	**$1,682,387**	**$1,201,705**	**$721,023**	**$240,341**
13											
14	Interest expense	$1,112,179	$995,107	$878,036	$760,964	$643,893	$526,821	$409,750	$292,679	$175,607	$58,536
15	Net Income	$3,454,301	$3,090,690	$2,727,080	$2,363,469	$1,999,858	$1,636,248	$1,272,637	$909,027	$545,416	$181,805
16											
17	Revenue Requirement										
18	UOI at Allowed RORB	$4,566,480	$4,085,798	$3,605,116	$3,124,433	$2,643,751	$2,163,069	$1,682,387	$1,201,705	$721,023	$240,341
19	Annual Deficiency / (Excess) UOI	$0	$0	$0	$0	$0	($0)	$0	$0	$0	$0
21	Capital Additions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Average Rate Base	$70,857,457	$63,398,777	$55,940,097	$48,481,418	$41,022,738	$33,564,058	$26,105,379	$18,646,699	$11,188,019	$3,729,340
23											
24	Return on Rate Base	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
25	Return on Equity	9.38%	9.38%	9.38%	9.37%	9.38%	9.38%	9.38%	9.37%	9.38%	9.37%
26											
27	Allowed RORB	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%	6.44%
28											
29											
30	**Use this button to goal seek the annual revenues necessary to achieve the**										
31	**annual ROR goal.**										
32											
33											
34	Annual Revenue Requirement	**$29,228,330**	**$28,845,105**	**$28,472,477**	**$28,110,764**	**$27,760,287**	**$27,421,382**	**$27,094,392**	**$26,779,672**	**$26,477,588**	**$26,188,514**
35	Levelized Revenue Requirement	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521	$36,324,521
36		($7,096,191)	($7,479,416)	($7,852,044)	($8,213,757)	($8,564,234)	($8,903,139)	($9,230,129)	($9,544,849)	($9,846,933)	($10,136,007)
37											
38											
39	Post-forecast value (PV of Undepreciated Asset)										
40											
41	**State and Federal Income Taxes (Statutory)**	19	19	19	19	19	19	19	19	19	20
42		2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
43	Operating Income Before Income Taxes	$5,758,866	$5,152,670	$4,546,473	$3,940,277	$3,334,080	$2,727,884	$2,121,688	$1,515,491	$909,295	$303,098
44	Add Back: Book Depreciation	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333	10,033,333
45	Deduct: State Tax Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
46	Deduct: ATL Interest	($1,112,179)	($995,107)	($878,036)	($760,964)	($643,893)	($526,821)	($409,750)	($292,679)	($175,607)	($58,536)
47	State Taxable Income	$14,680,021	$14,190,896	$13,701,771	$13,212,646	$12,723,521	$12,234,396	$11,745,271	$11,256,146	$10,767,021	$10,277,896
48	Allowed Tax Rate	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
49	Current State Income Tax (SIT) Expense	$866,121	$837,263	$808,404	$779,546	$750,688	$721,829	$692,971	$664,113	$635,254	$606,396
50											
51	Operating Income Before Income Taxes	$5,758,866	$5,152,670	$4,546,473	$3,940,277	$3,334,080	$2,727,884	$2,121,688	$1,515,491	$909,295	$303,098
52	Add Back: Book Depreciation	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
53	Deduct: Federal Tax Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
54	Deduct State Income Tax Expense	($866,121)	($837,263)	($808,404)	($779,546)	($750,688)	($721,829)	($692,971)	($664,113)	($635,254)	($606,396)
55	Deduct: ATL Interest	($1,112,179)	($995,107)	($878,036)	($760,964)	($643,893)	($526,821)	($409,750)	($292,679)	($175,607)	($58,536)
56	Federal Taxable Income	$13,813,900	$13,353,633	$12,893,366	$12,433,100	$11,972,833	$11,512,566	$11,052,300	$10,592,033	$10,131,767	$9,671,500
57	Allowed Tax Rate	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
58	Current Federal Income Tax (FIT) Expense	$ 2,900,919	$ 2,804,263	$ 2,707,607	$ 2,610,951	$ 2,514,295	$ 2,417,639	$ 2,320,983	$ 2,224,327	$ 2,127,671	$2,031,015
59											
60											
61		$3,767,040	$3,641,526	$3,516,011	$3,390,497	$3,264,983	$3,139,468	$3,013,954	$2,888,440	$2,762,925	$2,637,411
62											
63											

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

Row	Item		Life	1	2	3	4	5	6	7	8	9	10
64													
65			Year	1	2	3	4	5	6	7	8	9	10
66				2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
67													
68	Cap Ex												
69		Proxy Underground Storage Facility		$301,000,000									
70													
71													
72													
73													
74													
75		Total		$301,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
76													
77	Depreciation			$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
78													
79	**Rate Base**												
80	Gross Plant			$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000
81	Accumulated Depreciation			$10,033,333	$20,066,667	$30,100,000	$40,133,333	$50,166,667	$60,200,000	$70,233,333	$80,266,667	$90,300,000	$100,333,333
82	Net Plant			$290,966,667	$280,933,333	$270,900,000	$260,866,667	$250,833,333	$240,800,000	$230,766,667	$220,733,333	$210,700,000	$200,666,667
83	Deferred Taxes			($1,287,327)	($6,050,436)	($10,118,389)	($13,491,185)	($16,246,065)	($18,460,267)	($20,442,750)	($22,425,233)	($24,407,717)	($26,390,200)
84	Rate Base - End of Period			$289,679,340	$274,882,897	$260,781,611	$247,375,481	$234,587,269	$222,339,733	$210,323,917	$198,308,100	$186,292,283	$174,276,467
85	Average Rate Base			$289,679,340	$282,281,119	$267,832,254	$254,078,546	$240,981,375	$228,463,501	$216,331,825	$204,316,008	$192,300,192	$180,284,375
86	Depreciation Rates - Book			1	2	3	4	5	6	7	8	9	10
87		Proxy Underground Storage Facility	30	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
88		0	30	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
89		0	30	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
90		0	30	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
91		0	30	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
92		0	30	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
93	Depreciation - Book			1	2	3	4	5	6	7	8	9	10
94		1		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
95		2			$0	$0	$0	$0	$0	$0	$0	$0	$0
96		3				$0	$0	$0	$0	$0	$0	$0	$0
97		4					$0	$0	$0	$0	$0	$0	$0
98		5						$0	$0	$0	$0	$0	$0
99		6							$0	$0	$0	$0	$0
100		7								$0	$0	$0	$0
101		8									$0	$0	$0
102		9										$0	$0
103		10											$0
104		11											
105		12											
106		13											
107		14											
108		15											
109		16											
110		17											
111		18											
112		19											
113		20											
114	Rate Base Book Depreciation			$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
115													
116	**Deferred Taxes Calculation**												
117													
118	Depreciation Rates - Federal Tax		Tax Life	1	2	3	4	5	6	7	8	9	10
119		Proxy Underground Storage Facility	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
120		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
121		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
122		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
123		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
124		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
125	Depreciation Rates - State Tax												
126		Proxy Underground Storage Facility	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
127		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
128		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
129		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%

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New Mexico Gas Company
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New Mexico Gas Company
Cost of Service Based Revenue Requirements

		11	12	13	14	15	16	17	18	19	20
		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
Cap Ex											
	Proxy Underground Storage Facility										
	Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
Rate Base											
Gross Plant		$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000
Accumulated Depreciation		$110,366,667	$120,400,000	$130,433,333	$140,466,667	$150,500,000	$160,533,333	$170,566,667	$180,600,000	$190,633,333	$200,666,667
Net Plant		$190,633,333	$180,600,000	$170,566,667	$160,533,333	$150,500,000	$140,466,667	$130,433,333	$120,400,000	$110,366,667	$100,333,333
Deferred Taxes		($28,372,683)	($30,355,167)	($32,337,650)	($34,320,133)	($36,302,617)	($36,045,151)	($33,470,498)	($30,895,844)	($28,321,190)	($25,746,537)
Rate Base - End of Period		$162,260,650	$150,244,833	$138,229,017	$126,213,200	$114,197,383	$104,421,515	$96,962,836	$89,504,156	$82,045,476	$74,586,797
Average Rate Base		$168,268,558	$156,252,742	$144,236,925	$132,221,108	$120,205,292	$109,309,449	$100,692,176	$93,233,496	$85,774,816	$78,316,137
Depreciation Rates - Book		11	12	13	14	15	16	17	18	19	20
	Proxy Underground Storage Facility	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
	0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Depreciation - Book		11	12	13	14	15	16	17	18	19	20
	1	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	12		$0	$0	$0	$0	$0	$0	$0	$0	$0
	13			$0	$0	$0	$0	$0	$0	$0	$0
	14				$0	$0	$0	$0	$0	$0	$0
	15					$0	$0	$0	$0	$0	$0
	16						$0	$0	$0	$0	$0
	17							$0	$0	$0	$0
	18								$0	$0	$0
	19									$0	$0
	20										
Rate Base Book Depreciation		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
Deferred Taxes Calculation											
Depreciation Rates - Federal Tax		11	12	13	14	15	16	17	18	19	20
	Proxy Underground Storage Facility	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
Depreciation Rates - State Tax											
	Proxy Underground Storage Facility	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
	0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

	21	22	23	24	25	26	27	28	29	30
	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
Cap Ex										
Proxy Underground Storage Facility										
Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
Rate Base										
Gross Plant	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000	$301,000,000
Accumulated Depreciation	$210,700,000	$220,733,333	$230,766,667	$240,800,000	$250,833,333	$260,866,667	$270,900,000	$280,933,333	$290,966,667	$301,000,000
Net Plant	$90,300,000	$80,266,667	$70,233,333	$60,200,000	$50,166,667	$40,133,333	$30,100,000	$20,066,667	$10,033,333	$0
Deferred Taxes	($23,171,883)	($20,597,229)	($18,022,576)	($15,447,922)	($12,873,268)	($10,298,615)	($7,723,961)	($5,149,307)	($2,574,654)	$0
Rate Base - End of Period	$67,128,117	$59,669,437	$52,210,758	$44,752,078	$37,293,398	$29,834,719	$22,376,039	$14,917,359	$7,458,680	$0
Average Rate Base	$70,857,457	$63,398,777	$55,940,097	$48,481,418	$41,022,738	$33,564,058	$26,105,379	$18,646,699	$11,188,019	$3,729,340
Depreciation Rates - Book	21	22	23	24	25	26	27	28	29	30
Proxy Underground Storage Facility	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
0	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Depreciation - Book	21	22	23	24	25	26	27	28	29	30
1	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20										
Rate Base Book Depreciation	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
Deferred Taxes Calculation										
Depreciation Rates - Federal Tax	21	22	23	24	25	26	27	28	29	30
Proxy Underground Storage Facility	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Depreciation Rates - State Tax										
Proxy Underground Storage Facility	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

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Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

130		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
131		0	15	5.00%	9.50%	8.60%	7.70%	6.90%	6.20%	5.90%	5.90%	5.90%	5.90%
132	Calculation of Deferred Taxes:												
133	Federal Book Depreciation												
134	Year			1	2	3	4	5	6	7	8	9	10
135		1		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
136		2			$0	$0	$0	$0	$0	$0	$0	$0	$0
137		3				$0	$0	$0	$0	$0	$0	$0	$0
138		4					$0	$0	$0	$0	$0	$0	$0
139		5						$0	$0	$0	$0	$0	$0
140		6							$0	$0	$0	$0	$0
141		7								$0	$0	$0	$0
142		8									$0	$0	$0
143		9										$0	$0
144		10											$0
145		11											
146		12											
147		13											
148		14											
149		15											
150		16											
151		17											
152		18											
153		19											
154		20											
155	Federal Book Depreciation			$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
156	State Book Depreciation												
157	Year			1	2	3	4	5	6	7	8	9	10
158		1		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
159		2			$0	$0	$0	$0	$0	$0	$0	$0	$0
160		3				$0	$0	$0	$0	$0	$0	$0	$0
161		4					$0	$0	$0	$0	$0	$0	$0
162		5						$0	$0	$0	$0	$0	$0
163		6							$0	$0	$0	$0	$0
164		7								$0	$0	$0	$0
165		8									$0	$0	$0
166		9										$0	$0
167		10											$0
168		11											
169		12											
170		13											
171		14											
172		15											
173		16											
174		17											
175		18											
176		19											
177		20											
178	State Book Depreciation			$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
179	Federal Tax Depreciation												
180	Year			1	2	3	4	5	6	7	8	9	10
181		1		$15,050,000	$28,595,000	$25,886,000	$23,177,000	$20,769,000	$18,662,000	$17,759,000	$17,759,000	$17,759,000	$17,759,000
182		2			$0	$0	$0	$0	$0	$0	$0	$0	$0
183		3				$0	$0	$0	$0	$0	$0	$0	$0
184		4					$0	$0	$0	$0	$0	$0	$0
185		5						$0	$0	$0	$0	$0	$0
186		6							$0	$0	$0	$0	$0
187		7								$0	$0	$0	$0
188		8									$0	$0	$0
189		9										$0	$0
190		10											$0
191		11											
192		12											
193		13											
194		14											
195		15											

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New Mexico Gas Company
Cost of Service Based Revenue Requirements

130		0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
131		0	5.90%	5.90%	5.90%	5.90%	5.90%	3.00%	0.00%	0.00%	0.00%	0.00%
132	Calculation of Deferred Taxes:											
133	Federal Book Depreciation											
134	Year		11	12	13	14	15	16	17	18	19	20
135		1	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
136		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
137		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
138		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
139		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
140		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
141		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
142		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
143		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
144		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
145		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
146		12		$0	$0	$0	$0	$0	$0	$0	$0	$0
147		13			$0	$0	$0	$0	$0	$0	$0	$0
148		14				$0	$0	$0	$0	$0	$0	$0
149		15					$0	$0	$0	$0	$0	$0
150		16						$0	$0	$0	$0	$0
151		17							$0	$0	$0	$0
152		18								$0	$0	$0
153		19									$0	$0
154		20										
155	Federal Book Depreciation		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
156	State Book Depreciation											
157	Year		11	12	13	14	15	16	17	18	19	20
158		1	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
159		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
160		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
161		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
162		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
163		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
164		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
165		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
166		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
167		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
168		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
169		12		$0	$0	$0	$0	$0	$0	$0	$0	$0
170		13			$0	$0	$0	$0	$0	$0	$0	$0
171		14				$0	$0	$0	$0	$0	$0	$0
172		15					$0	$0	$0	$0	$0	$0
173		16						$0	$0	$0	$0	$0
174		17							$0	$0	$0	$0
175		18								$0	$0	$0
176		19									$0	$0
177		20										
178	State Book Depreciation		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
179	Federal Tax Depreciation											
180	Year		11	12	13	14	15	16	17	18	19	20
181		1	$17,759,000	$17,759,000	$17,759,000	$17,759,000	$17,759,000	$9,030,000	$0	$0	$0	$0
182		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
183		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
184		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
185		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
186		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
187		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
188		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
189		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
190		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
191		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
192		12		$0	$0	$0	$0	$0	$0	$0	$0	$0
193		13			$0	$0	$0	$0	$0	$0	$0	$0
194		14				$0	$0	$0	$0	$0	$0	$0
195		15					$0	$0	$0	$0	$0	$0

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

130		0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
131		0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
132	Calculation of Deferred Taxes:											
133	Federal Book Depreciation											
134	Year		21	22	23	24	25	26	27	28	29	30
135		1	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
136		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
137		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
138		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
139		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
140		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
141		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
142		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
143		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
144		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
145		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
146		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
147		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
148		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
149		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
150		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
151		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
152		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
153		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
154		20										
155	Federal Book Depreciation		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
156	State Book Depreciation											
157	Year		21	22	23	24	25	26	27	28	29	30
158		1	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
159		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
160		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
161		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
162		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
163		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
164		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
165		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
166		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
167		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
168		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
169		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
170		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
171		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
172		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
173		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
174		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
175		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
176		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
177		20										
178	State Book Depreciation		$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333	$10,033,333
179	Federal Tax Depreciation											
180	Year		21	22	23	24	25	26	27	28	29	30
181		1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
182		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
183		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
184		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
185		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
186		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
187		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
188		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
189		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
190		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
191		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
192		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
193		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
194		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
195		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

196		16										
197		17										
198		18										
199		19										
200		20										
201	Federal Tax Depreciation		$15,050,000	$28,595,000	$25,886,000	$23,177,000	$20,769,000	$18,662,000	$17,759,000	$17,759,000	$17,759,000	$17,759,000
202												
203	Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
204												
205	State Tax Depreciation											
206	Year		1	2	3	4	5	6	7	8	9	10
207		1	$15,050,000	$28,595,000	$25,886,000	$23,177,000	$20,769,000	$18,662,000	$17,759,000	$17,759,000	$17,759,000	$17,759,000
208		2		$0	$0	$0	$0	$0	$0	$0	$0	$0
209		3			$0	$0	$0	$0	$0	$0	$0	$0
210		4				$0	$0	$0	$0	$0	$0	$0
211		5					$0	$0	$0	$0	$0	$0
212		6						$0	$0	$0	$0	$0
213		7							$0	$0	$0	$0
214		8								$0	$0	$0
215		9									$0	$0
216		10										$0
217		11										
218		12										
219		13										
220		14										
221		15										
222		16										
223		17										
224		18										
225		19										
226		20										
227	State Tax Depreciation		$15,050,000	$28,595,000	$25,886,000	$23,177,000	$20,769,000	$18,662,000	$17,759,000	$17,759,000	$17,759,000	$17,759,000
228												
229	State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
230												
231	Federal Deferred Taxes		($991,344)	($3,667,971)	($3,132,645)	($2,597,320)	($2,121,475)	($1,705,111)	($1,526,669)	($1,526,669)	($1,526,669)	($1,526,669)
232	State Deferred Taxes		($295,983)	($1,095,138)	($935,307)	($775,476)	($633,404)	($509,091)	($455,814)	($455,814)	($455,814)	($455,814)
233	Total Deferred Taxes		($1,287,327)	($4,763,109)	($4,067,953)	($3,372,796)	($2,754,879)	($2,214,202)	($1,982,483)	($1,982,483)	($1,982,483)	($1,982,483)
234												
235												
236		MACRS	1	2	3	4	5	6	7	8	9	10
237		5	0.200	0.320	0.192	0.115	0.115	0.058				
238		7	0.143	0.245	0.175	0.125	0.089	0.089	0.089	0.045		
239		10	0.100	0.180	0.144	0.115	0.092	0.074	0.066	0.066	0.065	0.065
240		15	0.050	0.095	0.086	0.077	0.069	0.062	0.059	0.059	0.059	0.059
241		20	0.038	0.072	0.067	0.062	0.057	0.053	0.045	0.045	0.045	0.045

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

	16						$0	$0	$0	$0	$0
	17							$0	$0	$0	$0
	18								$0	$0	$0
	19									$0	$0
	20										
Federal Tax Depreciation		$17,759,000	$17,759,000	$17,759,000	$17,759,000	$17,759,000	$9,030,000	$0	$0	$0	$0
Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
State Tax Depreciation											
Year		11	12	13	14	15	16	17	18	19	20
	1	$17,759,000	$17,759,000	$17,759,000	$17,759,000	$17,759,000	$9,030,000	$0	$0	$0	$0
	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	12		$0	$0	$0	$0	$0	$0	$0	$0	$0
	13			$0	$0	$0	$0	$0	$0	$0	$0
	14				$0	$0	$0	$0	$0	$0	$0
	15					$0	$0	$0	$0	$0	$0
	16						$0	$0	$0	$0	$0
	17							$0	$0	$0	$0
	18								$0	$0	$0
	19									$0	$0
	20										
State Tax Depreciation		$17,759,000	$17,759,000	$17,759,000	$17,759,000	$17,759,000	$9,030,000	$0	$0	$0	$0
State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
Federal Deferred Taxes		($1,526,669)	($1,526,669)	($1,526,669)	($1,526,669)	($1,526,669)	$198,269	$1,982,687	$1,982,687	$1,982,687	$1,982,687
State Deferred Taxes		($455,814)	($455,814)	($455,814)	($455,814)	($455,814)	$59,197	$591,967	$591,967	$591,967	$591,967
Total Deferred Taxes		($1,982,483)	($1,982,483)	($1,982,483)	($1,982,483)	($1,982,483)	$257,465	$2,574,654	$2,574,654	$2,574,654	$2,574,654
		11	12	13	14	15	16	17	18	19	20
		0.033									
		0.059	0.059	0.059	0.059	0.059	0.030				
		0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas Company
Cost of Service Based Revenue Requirements

196		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
197		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
198		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
199		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
200		20										
201	Federal Tax Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
202												
203	Federal Tax Rate (net of SIT)		19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%	19.76%
204												
205	State Tax Depreciation											
206	Year		21	22	23	24	25	26	27	28	29	30
207		1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
208		2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
209		3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
210		4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
211		5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
212		6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
213		7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
214		8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
215		9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
216		10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
217		11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
218		12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
219		13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
220		14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
221		15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
222		16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
223		17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
224		18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
225		19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
226		20										
227	State Tax Depreciation		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
228												
229	State Tax Rate		5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%	5.90%
230												
231	Federal Deferred Taxes		$1,982,687	$1,982,687	$1,982,687	$1,982,687	$1,982,687	$1,982,687	$1,982,687	$1,982,687	$1,982,687	$1,982,687
232	State Deferred Taxes		$591,967	$591,967	$591,967	$591,967	$591,967	$591,967	$591,967	$591,967	$591,967	$591,967
233	Total Deferred Taxes		$2,574,654	$2,574,654	$2,574,654	$2,574,654	$2,574,654	$2,574,654	$2,574,654	$2,574,654	$2,574,654	$2,574,654
234												
235												
236			21	22	23	24	25	26	27	28	29	30
237												
238												
239												
240												
241			0.021									

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas
Pro Forma Cost of Keystone Storage

Annual Assumed Cost Increase[2]

Line No.	Calculation		30-Year NPV	1	2	3	4
		Status Quo[1]		2027	2028	2029	2030
1	*Contract*	Annual Reservation Quantity (Mcf)		$2,700,000	2,700,000	2,700,000	2,700,000
2	*Contract + Growth*	Annual Reservation Charge		$8,748,000	$9,290,000	$9,866,000	$10,478,000
3	*Assumption*	Injection/Withdrawal Fees[3]		$57,952	$57,952	$57,952	$57,952
4	*Line 2 + 3*	Total Cost of Storage	**$239,274,972**	$8,805,952	$9,347,952	$9,923,952	$10,535,952
5		**LNG Case**					
6	*Assumption*	Proposed Reservation Quantity (Mcf)		2,700,000	1,350,000	-	-
7	*Line (2 / 1) * 6*	Annual Reservation Charge		$8,748,000	$4,645,000	$0	$0
8	*Line (3 / 1) * 6*	Injection/Withdrawal Fees[3]		$57,952	$28,976	$0	$0
9	*Line 7 + 8*	Total Cost of Storage	**$12,397,948**	$8,805,952	$4,673,976	$0	$0
10		**Propane Air**					
11	*Assumption*	Proposed Reservation Quantity (Mcf)		2,700,000	2,700,000	2,700,000	2,700,000
12	*Line (2 / 1) * 11*	Annual Reservation Charge		$8,748,000	$9,290,000	$9,866,000	$10,478,000
13	*Line (3 / 1) * 11*	Injection/Withdrawal Fees[3]		$57,952	$57,952	$57,952	$57,952
14	*Line 12 + 13*	Total Cost of Storage	**$239,274,972**	$8,805,952	$9,347,952	$9,923,952	$10,535,952
15		**New Underground Storage**					
16	*Assumption*	Proposed Reservation Quantity (Mcf)		2,700,000	-	-	-
17	*Line (2 / 1) * 16*	Annual Reservation Charge		$8,748,000	$0	$0	$0
18	*Line (3 / 1) * 16*	Injection/Withdrawal Fees[3]		$57,952	$0	$0	$0
19	*Line 17 + 18*	Total Cost of Storage	**$8,272,803**	$8,805,952	$0	$0	$0

[1] Last annualized year of Keystone contract, pursuant to Section 6 "Special Terms and Conditions".
[2] T. Bullard testimony .
[3] Based on historical averages 2014 - 2022.

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New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

New Mexico Gas
Pro Forma Cost of Keystone Storage

6.20%

Line No.	Calculation		5	6	7	8	9
		Status Quo [1]	2031	2032	2033	2034	2035
1	*Contract*	Annual Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
2	*Contract + Growth*	Annual Reservation Charge	$11,128,000	$11,818,000	$12,551,000	$13,329,000	$14,155,000
3	*Assumption*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
4	*Line 2 + 3*	Total Cost of Storage	$11,185,952	$11,875,952	$12,608,952	$13,386,952	$14,212,952
5		**LNG Case**					
6	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
7	*Line (2 / 1) * 6*	Annual Reservation Charge	$0	$0	$0	$0	$0
8	*Line (3 / 1) * 6*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
9	*Line 7 + 8*	Total Cost of Storage	$0	$0	$0	$0	$0
10		**Propane Air**					
11	*Assumption*	Proposed Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
12	*Line (2 / 1) * 11*	Annual Reservation Charge	$11,128,000	$11,818,000	$12,551,000	$13,329,000	$14,155,000
13	*Line (3 / 1) * 11*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
14	*Line 12 + 13*	Total Cost of Storage	$11,185,952	$11,875,952	$12,608,952	$13,386,952	$14,212,952
15		**New Underground Storage**					
16	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
17	*Line (2 / 1) * 16*	Annual Reservation Charge	$0	$0	$0	$0	$0
18	*Line (3 / 1) * 16*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
19	*Line 17 + 18*	Total Cost of Storage	$0	$0	$0	$0	$0

[1] Last annualized year of Keystone contrac
[2] T. Bullard testimony .
[3] Based on historical averages 2014 - 2022

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New Mexico Gas
Pro Forma Cost of Keystone Storage

Line No.	Calculation		10	11	12	13	14
		Status Quo [1]	2036	2037	2038	2039	2040
1	*Contract*	Annual Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
2	*Contract + Growth*	Annual Reservation Charge	$15,033,000	$15,965,000	$16,955,000	$18,006,000	$19,122,000
3	*Assumption*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
4	*Line 2 + 3*	Total Cost of Storage	$15,090,952	$16,022,952	$17,012,952	$18,063,952	$19,179,952
5		**LNG Case**					
6	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
7	*Line (2 / 1) * 6*	Annual Reservation Charge	$0	$0	$0	$0	$0
8	*Line (3 / 1) * 6*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
9	*Line 7 + 8*	Total Cost of Storage	$0	$0	$0	$0	$0
10		**Propane Air**					
11	*Assumption*	Proposed Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
12	*Line (2 / 1) * 11*	Annual Reservation Charge	$15,033,000	$15,965,000	$16,955,000	$18,006,000	$19,122,000
13	*Line (3 / 1) * 11*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
14	*Line 12 + 13*	Total Cost of Storage	$15,090,952	$16,022,952	$17,012,952	$18,063,952	$19,179,952
15		**New Underground Storage**					
16	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
17	*Line (2 / 1) * 16*	Annual Reservation Charge	$0	$0	$0	$0	$0
18	*Line (3 / 1) * 16*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
19	*Line 17 + 18*	Total Cost of Storage	$0	$0	$0	$0	$0

[1] Last annualized year of Keystone contrac
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New Mexico Gas
Pro Forma Cost of Keystone Storage

Line No.	Calculation		15	16	17	18	19
		Status Quo[1]	2041	2042	2043	2044	2045
1	*Contract*	Annual Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
2	*Contract + Growth*	Annual Reservation Charge	$20,308,000	$21,567,000	$22,904,000	$24,324,000	$25,832,000
3	*Assumption*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
4	*Line 2 + 3*	Total Cost of Storage	$20,365,952	$21,624,952	$22,961,952	$24,381,952	$25,889,952
5		**LNG Case**					
6	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
7	*Line (2 / 1) * 6*	Annual Reservation Charge	$0	$0	$0	$0	$0
8	*Line (3 / 1) * 6*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
9	*Line 7 + 8*	Total Cost of Storage	$0	$0	$0	$0	$0
10		**Propane Air**					
11	*Assumption*	Proposed Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
12	*Line (2 / 1) * 11*	Annual Reservation Charge	$20,308,000	$21,567,000	$22,904,000	$24,324,000	$25,832,000
13	*Line (3 / 1) * 11*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
14	*Line 12 + 13*	Total Cost of Storage	$20,365,952	$21,624,952	$22,961,952	$24,381,952	$25,889,952
15		**New Underground Storage**					
16	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
17	*Line (2 / 1) * 16*	Annual Reservation Charge	$0	$0	$0	$0	$0
18	*Line (3 / 1) * 16*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
19	*Line 17 + 18*	Total Cost of Storage	$0	$0	$0	$0	$0

[1] Last annualized year of Keystone contrac
[2] T. Bullard testimony .
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New Mexico Gas
Pro Forma Cost of Keystone Storage

Line No.	Calculation		20	21	22	23	24
		Status Quo [1]	2046	2046	2046	2046	2046
1	*Contract*	Annual Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
2	*Contract + Growth*	Annual Reservation Charge	$27,434,000	$29,135,000	$30,941,000	$32,859,000	$34,896,000
3	*Assumption*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
4	*Line 2 + 3*	Total Cost of Storage	$27,491,952	$29,192,952	$30,998,952	$32,916,952	$34,953,952
5		**LNG Case**					
6	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
7	*Line (2 / 1) * 6*	Annual Reservation Charge	$0	$0	$0	$0	$0
8	*Line (3 / 1) * 6*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
9	*Line 7 + 8*	Total Cost of Storage	$0	$0	$0	$0	$0
10		**Propane Air**					
11	*Assumption*	Proposed Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
12	*Line (2 / 1) * 11*	Annual Reservation Charge	$27,434,000	$29,135,000	$30,941,000	$32,859,000	$34,896,000
13	*Line (3 / 1) * 11*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
14	*Line 12 + 13*	Total Cost of Storage	$27,491,952	$29,192,952	$30,998,952	$32,916,952	$34,953,952
15		**New Underground Storage**					
16	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
17	*Line (2 / 1) * 16*	Annual Reservation Charge	$0	$0	$0	$0	$0
18	*Line (3 / 1) * 16*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
19	*Line 17 + 18*	Total Cost of Storage	$0	$0	$0	$0	$0

[1] Last annualized year of Keystone contrac

[2] T. Bullard testimony .

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New Mexico Gas
Pro Forma Cost of Keystone Storage

Line No.	Calculation		25	26	27	28	29
		Status Quo [1]	2046	2046	2046	2046	2046
1	*Contract*	Annual Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
2	*Contract + Growth*	Annual Reservation Charge	$37,060,000	$39,358,000	$41,798,000	$44,389,000	$47,141,000
3	*Assumption*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
4	*Line 2 + 3*	Total Cost of Storage	$37,117,952	$39,415,952	$41,855,952	$44,446,952	$47,198,952
5		**LNG Case**					
6	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
7	*Line (2 / 1) * 6*	Annual Reservation Charge	$0	$0	$0	$0	$0
8	*Line (3 / 1) * 6*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
9	*Line 7 + 8*	Total Cost of Storage	$0	$0	$0	$0	$0
10		**Propane Air**					
11	*Assumption*	Proposed Reservation Quantity (Mcf)	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
12	*Line (2 / 1) * 11*	Annual Reservation Charge	$37,060,000	$39,358,000	$41,798,000	$44,389,000	$47,141,000
13	*Line (3 / 1) * 11*	Injection/Withdrawal Fees[3]	$57,952	$57,952	$57,952	$57,952	$57,952
14	*Line 12 + 13*	Total Cost of Storage	$37,117,952	$39,415,952	$41,855,952	$44,446,952	$47,198,952
15		**New Underground Storage**					
16	*Assumption*	Proposed Reservation Quantity (Mcf)	-	-	-	-	-
17	*Line (2 / 1) * 16*	Annual Reservation Charge	$0	$0	$0	$0	$0
18	*Line (3 / 1) * 16*	Injection/Withdrawal Fees[3]	$0	$0	$0	$0	$0
19	*Line 17 + 18*	Total Cost of Storage	$0	$0	$0	$0	$0

[1] Last annualized year of Keystone contrac
[2] T. Bullard testimony .
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New Mexico Gas
Pro Forma Cost of Keystone Storage

Line No.	Calculation		30
		Status Quo [1]	2046
1	*Contract*	Annual Reservation Quantity (Mcf)	2,700,000
2	*Contract + Growth*	Annual Reservation Charge	$50,064,000
3	*Assumption*	Injection/Withdrawal Fees[3]	$57,952
4	*Line 2 + 3*	Total Cost of Storage	$50,121,952
5		**LNG Case**	
6	*Assumption*	Proposed Reservation Quantity (Mcf)	-
7	*Line (2 / 1) * 6*	Annual Reservation Charge	$0
8	*Line (3 / 1) * 6*	Injection/Withdrawal Fees[3]	$0
9	*Line 7 + 8*	Total Cost of Storage	$0
10		**Propane Air**	
11	*Assumption*	Proposed Reservation Quantity (Mcf)	2,700,000
12	*Line (2 / 1) * 11*	Annual Reservation Charge	$50,064,000
13	*Line (3 / 1) * 11*	Injection/Withdrawal Fees[3]	$57,952
14	*Line 12 + 13*	Total Cost of Storage	$50,121,952
15		**New Underground Storage**	
16	*Assumption*	Proposed Reservation Quantity (Mcf)	-
17	*Line (2 / 1) * 16*	Annual Reservation Charge	$0
18	*Line (3 / 1) * 16*	Injection/Withdrawal Fees[3]	$0
19	*Line 17 + 18*	Total Cost of Storage	$0

[1] Last annualized year of Keystone contrac
[2] T. Bullard testimony .
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New Mexico Gas
Substitution Commodity Cost Alternatives for Underground Storage

Line No.	Calculation	Commodity Costs	30 Year NPV	1	2	3	4	5	6	7	8
				2027	2028	2029	2030	2031	2032	2033	2034
1	*Assumption*	Annual Usage (MMBtu) - LNG Option		1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
2	*Assumption*	Annual Usage (MMBtu) - Propane Option		139,746	139,746	139,746	139,746	139,746	139,746	139,746	139,746
3		*Both options assume a 1.0 Annual Inventory Turn*									
4											
5	*EIA 2020 Price Forecast* [1]	Cost of Natural Gas - Delivered		$6.339	$6.647	$6.972	$7.246	$7.590	$7.784	$8.066	$8.244
6	*EIA 2020 Price Forecast* [1]	Cost of Propane - Delivered		$23.513	$24.710	$25.814	$26.949	$28.291	$29.357	$30.465	$31.452
7											
8	*Assumption*	Underground Storage Adder per MMBtu	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
9	*Assumption*	LNG Adder per MMBtu	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
10											
11	*Line 5 + 8*	Unit Cost of Underground Storage		$6.339	$6.647	$6.972	$7.246	$7.590	$7.784	$8.066	$8.244
12	*Line 6 + 9*	Unit Cost of LNG		$6.339	$6.647	$6.972	$7.246	$7.590	$7.784	$8.066	$8.244
13	*Line 12 - 11*	Difference: LNG Higher / (Lower)		$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
14											
15	*Line 1 * 11*	Annual Cost of Underground Storage	$113,939,823	$6,339,232	$6,646,530	$6,971,719	$7,245,672	$7,589,996	$7,784,093	$8,066,023	$8,243,756
16	*Line 1 * 12*	Annual Cost of LNG	$113,939,823	$6,339,232	$6,646,530	$6,971,719	$7,245,672	$7,589,996	$7,784,093	$8,066,023	$8,243,756
17	*Line 16 - 15*	**Difference: LNG Higher / (Lower)**	**$0**	$0	$0	$0	$0	$0	$0	$0	$0
18											
19	*Line 11*	Unit Cost of Underground Storage		$6.339	$6.647	$6.972	$7.246	$7.590	$7.784	$8.066	$8.244
20	*Line 6*	Unit Cost of Propane (*no adder*)		$23.513	$24.710	$25.814	$26.949	$28.291	$29.357	$30.465	$31.452
21	*Line 20 - 19*	Difference: Propane Higher / (Lower)		$17.174	$18.063	$18.842	$19.704	$20.701	$21.573	$22.399	$23.208
22											
23	*Line 2 * 19*	Annual Cost of Underground Storage	$15,922,683	$885,885	$928,829	$974,273	$1,012,557	$1,060,675	$1,087,799	$1,127,198	$1,152,035
24	*Line 2 * 20*	Annual Cost of Propane	$57,367,071	$3,285,867	$3,453,092	$3,607,400	$3,766,092	$3,953,542	$4,102,576	$4,257,427	$4,395,285
25	*Line 24 - 23*	**Difference: Propane Higher / (Lower)**	**$41,444,388**	$2,399,982	$2,524,263	$2,633,127	$2,753,535	$2,892,867	$3,014,777	$3,130,229	$3,243,250

26

27 [1]Source: U.S. Energy Information Administration

28 Table 3. Energy Prices by Sector and Source

29 https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=ref2022&sourcekey=0

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New Mexico Gas
Substitution Commodity Cost Alternatives for Underground Stc

Line No.	Calculation	Commodity Costs	9	10	11	12	13	14	15	16	17
			2035	2036	2037	2038	2039	2040	2041	2042	2043
1	*Assumption*	Annual Usage (MMBtu) - LNG Option	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
2	*Assumption*	Annual Usage (MMBtu) - Propane Option	139,746	139,746	139,746	139,746	139,746	139,746	139,746	139,746	139,746
3		*Both options assume a 1.0 Annual Inventory Turn*									
4											
5	*EIA 2020 Price Forecast* [1]	Cost of Natural Gas - Delivered	$8.394	$8.576	$8.778	$8.976	$9.177	$9.405	$9.603	$9.773	$9.975
6	*EIA 2020 Price Forecast* [1]	Cost of Propane - Delivered	$32.370	$33.327	$34.351	$35.395	$36.350	$37.588	$38.751	$39.735	$40.925
7											
8	*Assumption*	Underground Storage Adder per MMBtu	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
9	*Assumption*	LNG Adder per MMBtu	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
10											
11	*Line 5 + 8*	Unit Cost of Underground Storage	$8.394	$8.576	$8.778	$8.976	$9.177	$9.405	$9.603	$9.773	$9.975
12	*Line 6 + 9*	Unit Cost of LNG	$8.394	$8.576	$8.778	$8.976	$9.177	$9.405	$9.603	$9.773	$9.975
13	*Line 12 - 11*	Difference: LNG Higher / (Lower)	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
14											
15	*Line 1 * 11*	Annual Cost of Underground Storage	$8,394,195	$8,576,108	$8,777,649	$8,975,824	$9,176,504	$9,405,141	$9,602,743	$9,773,263	$9,975,439
16	*Line 1 * 12*	Annual Cost of LNG	$8,394,195	$8,576,108	$8,777,649	$8,975,824	$9,176,504	$9,405,141	$9,602,743	$9,773,263	$9,975,439
17	*Line 16 - 15*	**Difference: LNG Higher / (Lower)**	$0	$0	$0	$0	$0	$0	$0	$0	$0
18											
19	*Line 11*	Unit Cost of Underground Storage	$8.394	$8.576	$8.778	$8.976	$9.177	$9.405	$9.603	$9.773	$9.975
20	*Line 6*	Unit Cost of Propane (*no adder*)	$32.370	$33.327	$34.351	$35.395	$36.350	$37.588	$38.751	$39.735	$40.925
21	*Line 20 - 19*	Difference: Propane Higher / (Lower)	$23.976	$24.751	$25.574	$26.419	$27.174	$28.183	$29.148	$29.961	$30.950
22											
23	*Line 2 * 19*	Annual Cost of Underground Storage	$1,173,059	$1,198,480	$1,226,645	$1,254,339	$1,282,384	$1,314,335	$1,341,949	$1,365,779	$1,394,032
24	*Line 2 * 20*	Annual Cost of Propane	$4,523,575	$4,657,387	$4,800,452	$4,946,327	$5,079,819	$5,252,753	$5,415,346	$5,552,784	$5,719,139
25	*Line 24 - 23*	**Difference: Propane Higher / (Lower)**	$3,350,516	$3,458,906	$3,573,807	$3,691,988	$3,797,435	$3,938,418	$4,073,397	$4,187,006	$4,325,107

26
27 [1]Source: U.S. Energy Information Administration
28 Table 3. Energy Prices by Sector and Source
29 https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=r

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New Mexico Gas
Substitution Commodity Cost Alternatives for Underground Sto

Line No.	Calculation	Commodity Costs	18	19	20	21	22	23	24	25	26
			2044	2045	2046	2047	2048	2049	2050	2051	2052
1	*Assumption*	Annual Usage (MMBtu) - LNG Option	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
2	*Assumption*	Annual Usage (MMBtu) - Propane Option	139,746	139,746	139,746	139,746	139,746	139,746	139,746	139,746	139,746
3		*Both options assume a 1.0 Annual Inventory Turn*									
4											
5	*EIA 2020 Price Forecast* [1]	Cost of Natural Gas - Delivered	$10.110	$10.308	$10.523	$10.744	$10.981	$11.212	$11.438	$11.438	$11.438
6	*EIA 2020 Price Forecast* [1]	Cost of Propane - Delivered	$42.216	$43.295	$44.474	$45.630	$46.754	$47.800	$48.833	$11.438	$11.438
7											
8	*Assumption*	Underground Storage Adder per MMBtu	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
9	*Assumption*	LNG Adder per MMBtu	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
10											
11	*Line 5 + 8*	Unit Cost of Underground Storage	$10.110	$10.308	$10.523	$10.744	$10.981	$11.212	$11.438	$11.438	$11.438
12	*Line 6 + 9*	Unit Cost of LNG	$10.110	$10.308	$10.523	$10.744	$10.981	$11.212	$11.438	$11.438	$11.438
13	*Line 12 - 11*	Difference: LNG Higher / (Lower)	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
14											
15	*Line 1 * 11*	Annual Cost of Underground Storage	$10,109,999	$10,307,829	$10,523,292	$10,743,744	$10,980,557	$11,211,596	$11,437,503	$11,437,503	$11,437,503
16	*Line 1 * 12*	Annual Cost of LNG	$10,109,999	$10,307,829	$10,523,292	$10,743,744	$10,980,557	$11,211,596	$11,437,503	$11,437,503	$11,437,503
17	*Line 16 - 15*	**Difference: LNG Higher / (Lower)**	$0	$0	$0	$0	$0	$0	$0	$0	$0
18											
19	*Line 11*	Unit Cost of Underground Storage	$10.110	$10.308	$10.523	$10.744	$10.981	$11.212	$11.438	$11.438	$11.438
20	*Line 6*	Unit Cost of Propane (*no adder*)	$42.216	$43.295	$44.474	$45.630	$46.754	$47.800	$48.833	$11.438	$11.438
21	*Line 20 - 19*	Difference: Propane Higher / (Lower)	$32.106	$32.987	$33.951	$34.886	$35.773	$36.588	$37.396	$0.000	$0.000
22											
23	*Line 2 * 19*	Annual Cost of Underground Storage	$1,412,836	$1,440,482	$1,470,592	$1,501,400	$1,534,494	$1,566,780	$1,598,350	$1,598,350	$1,598,350
24	*Line 2 * 20*	Annual Cost of Propane	$5,899,580	$6,050,332	$6,215,122	$6,376,640	$6,533,661	$6,679,878	$6,824,244	$1,598,350	$1,598,350
25	*Line 24 - 23*	**Difference: Propane Higher / (Lower)**	$4,486,744	$4,609,850	$4,744,529	$4,875,240	$4,999,168	$5,113,098	$5,225,894	$0	$0
26											
27	[1]Source: U.S. Energy Information Administration										
28	Table 3. Energy Prices by Sector and Source										
29	https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=r										

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New Mexico Gas
Substitution Commodity Cost Alternatives for Underground Sto

Line No.	Calculation	Commodity Costs	27	28	29	30
			2053	2054	2055	2056
1	*Assumption*	Annual Usage (MMBtu) - LNG Option	1,000,000	1,000,000	1,000,000	1,000,000
2	*Assumption*	Annual Usage (MMBtu) - Propane Option	139,746	139,746	139,746	139,746
3		*Both options assume a 1.0 Annual Inventory Turn*				
4						
5	*EIA 2020 Price Forecast* [1]	Cost of Natural Gas - Delivered	$11.438	$11.438	$11.438	$11.438
6	*EIA 2020 Price Forecast* [1]	Cost of Propane - Delivered	$11.438	$11.438	$11.438	$11.438
7						
8	*Assumption*	Underground Storage Adder per MMBtu	$0.000	$0.000	$0.000	$0.000
9	*Assumption*	LNG Adder per MMBtu	$0.000	$0.000	$0.000	$0.000
10						
11	*Line 5 + 8*	Unit Cost of Underground Storage	$11.438	$11.438	$11.438	$11.438
12	*Line 6 + 9*	Unit Cost of LNG	$11.438	$11.438	$11.438	$11.438
13	*Line 12 - 11*	Difference: LNG Higher / (Lower)	$0.000	$0.000	$0.000	$0.000
14						
15	*Line 1 * 11*	Annual Cost of Underground Storage	$11,437,503	$11,437,503	$11,437,503	$11,437,503
16	*Line 1 * 12*	Annual Cost of LNG	$11,437,503	$11,437,503	$11,437,503	$11,437,503
17	*Line 16 - 15*	**Difference: LNG Higher / (Lower)**	$0	$0	$0	$0
18						
19	*Line 11*	Unit Cost of Underground Storage	$11.438	$11.438	$11.438	$11.438
20	*Line 6*	Unit Cost of Propane (*no adder*)	$11.438	$11.438	$11.438	$11.438
21	*Line 20 - 19*	Difference: Propane Higher / (Lower)	$0.000	$0.000	$0.000	$0.000
22						
23	*Line 2 * 19*	Annual Cost of Underground Storage	$1,598,350	$1,598,350	$1,598,350	$1,598,350
24	*Line 2 * 20*	Annual Cost of Propane	$1,598,350	$1,598,350	$1,598,350	$1,598,350
25	*Line 24 - 23*	**Difference: Propane Higher / (Lower)**	$0	$0	$0	$0

26
27 [1]Source: U.S. Energy Information Administration
28 Table 3. Energy Prices by Sector and Source
29 https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=r

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New Mexico Gas Company
Cost of Capital

Line No.		Ratio	After Tax Rate	After-Tax Weighted Avg Cost
1	L/T Debt	48.00%	3.270%	1.57%
2	Equity	52.00%	9.375%	4.88%
3	Total	100.00%		6.44%

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Handy-Whitman Calculations
The Handy-Whitman Index of Public Utility Construction Costs;
Bulletin No. 195: 1912 to January 1, 2022

LINE	CONSTRUCTION AND EQUIPMENT	FERC	Region	2000 Jan. 1	2000 Jul. 1	2001 Jan. 1	2001 Jul. 1	2002 Jan. 1	2002 Jul. 1	2003 Jan. 1	2003 Jul. 1	2004 Jan. 1	2004 Jul. 1	2005 Jan. 1	2005 Jul. 1	2006 Jan. 1	2006 Jul. 1	20 Jan. 1
1			North Atlantic	376.75		387.25		397.75		404		441.5		460	461	473	476	491
2			South Atlantic	314		321		333.25		335.5		378.75		393	393	405	409	425
3	**Cost Index Numbers**		North Central	359.25		370.5		382.25		390.25		427.75		444	445	460	463	473
4	Storage Plant Gas Holders Excl. of Found	362	South Central	316		324		332		336		371		385	386	394	398	403
5			Plateau	326		336		344		349		383		399	400	407	411	417
6			Pacific	369		378		387		393		429		447	448	464	468	479

LINE	CONSTRUCTION AND EQUIPMENT	FERC	Region	2000	2001	2002	2003	2004	2005	2006	20
8			North Atlantic	376.75	387.25	397.75	404	441.5	463.75	479	439
9			South Atlantic	314	321	333.25	335.5	378.75	396	412	373.28
10	**Annual Index**		North Central	359.25	370.5	382.25	390.25	427.75	448.5	464.75	420
11	Storage Plant Gas Holders Excl. of Found	362	South Central	316	324	332	336	371	387.75	398.25	34
12			Plateau	326	336	344	349	383	401.5	411.5	36
13			Pacific	369	378	387	393	429	451.75	469.75	424

LINE	CONSTRUCTION AND EQUIPMENT	FERC	Region	2000	2001	2002	2003	2004	2005	2006	20
8			North Atlantic	1.71	1.67	1.62	1.60	1.46	1.39	1.35	1.
9			South Atlantic	1.67	1.63	1.57	1.56	1.38	1.32	1.27	1.
10	**Relative Index**		North Central	1.56	1.52	1.47	1.44	1.31	1.25	1.21	1.
11	Storage Plant Gas Holders Excl. of Found	362	South Central	1.53	1.49	1.45	1.43	1.30	1.24	1.21	1.
12			Plateau	1.60	1.55	1.51	1.49	1.36	1.30	1.27	1.
13			Pacific	1.68	1.64	1.60	1.58	1.44	1.37	1.32	1.

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Annual Index, Storage Plant - Gas Holders	Plateau	326	336	344	349	383	401.5	411.5	362.5	365.25	373.75	385.75	393.25	406.5	412.5	420.75

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Handy-Whitman Calculations
The Handy-Whitman Index of Public Utility Construction Costs;
Bulletin No. 195: 1912 to January 1, 2022

LINE	CONSTRUCTION AND EQUIPMENT	FERC	Region	07	2008		2009		2010		2011		2012		2013		2014	
				Jul. 1	Jan. 1	Jul. 1	Jan. 1	Jul. 1	Jan. 1	Jul. 1	Jan. 1	Jul. 1	Jan. 1	Jul. 1	Jan. 1	Jul. 1	Jan. 1	Jul. 1
1			North Atlantic	416	436	452	466	461	470	472	481	481	489	493	501	503	506	515
2			South Atlantic	353.57	361	377	384	379	381	384	384	384	389	392	398	399	397	405
3	**Cost Index Numbers**		North Central	399	412	428	436	431	432	435	445	445	454	457	465	466	468	477
4	Storage Plant Gas Holders Excl. of Found	362	South Central	328	333	349	356	351	359	361	367	367	371	374	379	380	378	387
5			Plateau	341	351	368	374	369	383	385	390	390	403	406	411	413	413	422
6			Pacific	403	414	430	439	435	445	448	459	459	467	471	473	474	476	485
7				07	2008		2009		2010		2011		2012		2013		2014	
8			North Atlantic	.75	451.5		464.5		473.75		483		494		503.25		515	
9			South Atlantic	67781	374.75		380.75		383.25		385.25		392.75		398.25		404.25	
10	**Annual Index**		North Central	.75	426		432.5		436.75		447.25		458.25		466.25		476	
11	Storage Plant Gas Holders Excl. of Found	362	South Central	48	346.75		354.25		362		368		374.5		379.25		386.75	
12			Plateau	2.5	365.25		373.75		385.75		393.25		406.5		412.5		420.75	
13			Pacific	.75	428.25		438.5		450		461		470.5		474.25		484.5	
7				07	2008		2009		2010		2011		2012		2013		2014	
8			North Atlantic	47	1.43		1.39		1.36		1.34		1.31		1.28		1.25	
9			South Atlantic	41	1.40		1.38		1.37		1.36		1.34		1.32		1.30	
10	**Relative Index**		North Central	34	1.32		1.30		1.29		1.26		1.23		1.21		1.18	
11	Storage Plant Gas Holders Excl. of Found	362	South Central	39	1.39		1.36		1.33		1.31		1.29		1.27		1.25	
12			Plateau	44	1.43		1.39		1.35		1.32		1.28		1.26		1.24	
13			Pacific	46	1.45		1.41		1.38		1.34		1.32		1.31		1.28	

		2015	2016	2017	2018	2019	2020	2021
Annual Index, Storage Plant - Gas Holders	Plateau	424	425.75	426.5	442.25	455.75	470	521

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Application for a CCN
Workpaper JJR-WP-1

Handy-Whitman Calculations
The Handy-Whitman Index of Public Utility Construction Costs;
Bulletin No. 195: 1912 to January 1, 2022

LINE	CONSTRUCTION AND EQUIPMENT	FERC	Region	2015 Jan. 1	2015 Jul. 1	2016 Jan. 1	2016 Jul. 1	2017 Jan. 1	2017 Jul. 1	2018 Jan. 1	2018 Jul. 1	2019 Jan. 1	2019 Jul. 1	2020 Jan. 1	2020 Jul. 1	2021 Jan. 1	2021 Jul. 1	20 Jan. 1
1			North Atlantic	524	521	526	527	529	520	535	549	556	563	584	586	605	643	692
2			South Atlantic	410	407	411	412	420	411	421	434	443	450	475	476	486	522	568
3	**Cost Index Numbers**		North Central	482	479	484	485	492	483	493	507	515	522	529	531	547	584.5	532
4	Storage Plant Gas Holders Excl. of Found	362	South Central	395	392	392	393	400	391	397	410	413	420	426	427	440	478	532
5			Plateau	426	423	424	424	431	422	431	445	448	455	465	467	481	519	565
6			Pacific	492	489	496	497	507	498	510	524	536	543	549	551	577	615	669

LINE	CONSTRUCTION AND EQUIPMENT	FERC	Region	2015	2016	2017	2018	2019	2020	2021	20
8			North Atlantic	523	527.25	526	547.25	566.5	590.25	645.75	-
9			South Atlantic	408.75	413.75	415.75	433	454.5	478.25	524.5	-
10	**Annual Index**		North Central	481	486.5	487.75	505.5	522	534.5	562	-
11	Storage Plant Gas Holders Excl. of Found	362	South Central	392.75	394.5	394.75	407.5	419.75	430	482	-
12			Plateau	424	425.75	426.5	442.25	455.75	470	521	-
13			Pacific	491.5	499.25	503.25	523.5	542.75	557	619	-

LINE	CONSTRUCTION AND EQUIPMENT	FERC	Region	2015	2016	2017	2018	2019	2020	2021	20
8			North Atlantic	1.23	1.22	1.23	1.18	1.14	1.09	1.00	-
9			South Atlantic	1.28	1.27	1.26	1.21	1.15	1.10	1.00	-
10	**Relative Index**		North Central	1.17	1.16	1.15	1.11	1.08	1.05	1.00	-
11	Storage Plant Gas Holders Excl. of Found	362	South Central	1.23	1.22	1.22	1.18	1.15	1.12	1.00	-
12			Plateau	1.23	1.22	1.22	1.18	1.14	1.11	1.00	-
13			Pacific	1.26	1.24	1.23	1.18	1.14	1.11	1.00	-

Annual Index, Storage Plant - Gas Holders Plateau

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Handy-Whitman Calculations
The Handy-Whitman Index of Public Utility Construction Costs;
Bulletin No. 195: 1912 to January 1, 2022

LINE	CONSTRUCTION AND EQUIPMENT	FERC	Region	22 Jul. 1	Comments
1			North Atlantic	-	Cost Trends of Gas Utility Construction: North Atlantic Region; G-1
2			South Atlantic	-	Cost Trends of Gas Utility Construction: South Atlantic Region; G-2
3	**Cost Index Numbers**		North Central	-	Cost Trends of Gas Utility Construction: North Central Region; G-3
4	Storage Plant Gas Holders Excl. of Found	362	South Central	-	Cost Trends of Gas Utility Construction: South Central Region; G-4
5			Plateau	-	Cost Trends of Gas Utility Construction: Plateau Region; G-5
6			Pacific	-	Cost Trends of Gas Utility Construction: Pacific Region; G-6
7				22	
8			North Atlantic		Line 1 (After 2000: Weighted .25xJanY1 + .5 JulyY1 + .25JanY2) (2022: Weighted .25xJan1 + .75 July1)
9			South Atlantic		Line 2 (After 2000: Weighted .25xJanY1 + .5 JulyY1 + .25JanY2) (2022: Weighted .25xJan1 + .75 July1)
10	**Annual Index**		North Central		Line 3 (After 2000: Weighted .25xJanY1 + .5 JulyY1 + .25JanY2) (2022: Weighted .25xJan1 + .75 July1)
11	Storage Plant Gas Holders Excl. of Found	362	South Central		Line 4 (After 2000: Weighted .25xJanY1 + .5 JulyY1 + .25JanY2) (2022: Weighted .25xJan1 + .75 July1)
12			Plateau		Line 5 (After 2000: Weighted .25xJanY1 + .5 JulyY1 + .25JanY2) (2022: Weighted .25xJan1 + .75 July1)
13			Pacific		Line 6 (After 2000: Weighted .25xJanY1 + .5 JulyY1 + .25JanY2) (2022: Weighted .25xJan1 + .75 July1)
7				22	
8			North Atlantic		Line 8 2021 / Line 8 year n
9			South Atlantic		Line 9 2021 / Line 9 year n
10	**Relative Index**		North Central		Line 10 2021 / Line 10 year n
11	Storage Plant Gas Holders Excl. of Found	362	South Central		Line 11 2021 / Line 11 year n
12			Plateau		Line 12 2021 / Line 12 year n
13			Pacific		Line 13 2021 / Line 13 year n

Annual Index, Storage Plant - Gas Holders Plateau

Conversion Factors

Propane

Conversion		
91,647.0	BTU	Per Gallon
1,000,000	BTU	Per Dth
10.911	Gallons	Per Dth

Natural Gas

1.037	Therm	Per CCF
1.000	Dth	Per MMBTU
1.037	Dth	Per MCF
10.000	Therm	Per MMBTU
10.370	Therm	Per MCF

LNG

1.030	Dth	Per MMBTU

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GDP-PI Price Index

			Index Year					
Year	Quarter	GDP-PI	2021	2022	2023	2024	2025	2026
2021	Base	-	1.000	1.000	1.000	1.000	1.000	1.000
2022	2	9.0	1.090	1.000	1.000	1.000	1.000	1.000
2023	2	3.0	1.123	1.030	1.000	1.000	1.000	1.000
2024	1	2.5	1.151	1.056	1.025	1.000	1.000	1.000
2025		2.5	1.180	1.082	1.051	1.025	1.000	1.000
2026		2.5	1.209	1.109	1.077	1.051	1.025	1.000
2027		2.5	1.239	1.137	1.104	1.077	1.051	1.025

Source: Blue Chip Financial Forecast, Vol. 41, No. 10, September 30,2022.

	History								Consensus Forecasts-Quarterly					
	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	**4Q**	**1Q**	**2Q**	**3Q**	**4Q**	**1Q**
Key Assumptions	2020	2021	2021	2021	2021	2022	2022	2022**	**2022**	**2023**	**2023**	**2023**	**2023**	**2024**
Fed's AFE $ Index	105.1	103.4	102.9	105.0	107.0	108.4	113.7	118.5	**121.4**	**121.5**	**120.4**	**118.8**	**117.6**	**117.0**
Real GDP	3.9	6.3	7.0	2.7	7.0	-1.6	-0.6	1.4	**0.7**	**0.1**	**0.1**	**0.9**	**1.3**	**1.6**
GDP Price Index	2.5	5.2	6.3	6.2	6.8	8.3	9.0	4.9	**4.3**	**3.5**	**3.0**	**2.8**	**2.7**	**2.5**
Consumer Price Index	2.2	4.1	8.2	6.7	7.9	9.2	10.5	5.3	**3.9**	**3.4**	**3.0**	**2.6**	**2.5**	**2.4**
PCE Price Index	1.6	4.5	6.4	5.6	6.2	7.5	7.3	4.5	**3.7**	**3.2**	**2.7**	**2.5**	**2.4**	**2.3**

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Table 3. Energy Prices by Sector and Source
https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=ref2022&sourcekey=0
Sun Oct 09 2022 10:01:34 GMT-0400 (Eastern Daylight Time)
Source: U.S. Energy Information Administration

Line no.	Sector	full name	units	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
1	Residential																
2	Propane	Energy Prices: Residential: Propane: Reference case	2021 $/MMBtu		$21.485	$23.221	$23.000	$23.044	$22.988	$23.074	$23.388	$23.909	$24.402	$24.912	$25.580	$26.018	$26.452
3	Distillate Fuel Oil	Energy Prices: Residential: Distillate Fuel Oil: Reference case	2021 $/MMBtu		$21.710	$22.033	$21.711	$23.109	$23.639	$24.201	$24.844	$25.028	$25.149	$25.113	$25.387	$25.492	$25.554
2	Natural Gas	Energy Prices: Residential: Natural Gas: Reference case	2021 $/MMBtu		$11.696	$12.122	$11.529	$11.062	$10.771	$10.617	$10.537	$10.647	$10.825	$10.905	$11.293	$11.340	$11.504
3	Electricity	Energy Prices: Residential: Electricity: Reference case	2021 $/MMBtu		$38.701	$38.684	$38.433	$37.651	$37.503	$37.489	$37.613	$37.782	$37.946	$38.048	$38.222	$38.356	$38.606
4	Commercial																
3	Propane	Energy Prices: Commercial: Propane: Reference case	2021 $/MMBtu		$18.792	$19.810	$18.258	$18.183	$18.057	$18.190	$18.576	$19.120	$19.492	$19.875	$20.463	$20.742	$21.044
4	Distillate Fuel Oil	Energy Prices: Commercial: Distillate Fuel Oil: Reference case	2021 $/MMBtu		$21.788	$22.116	$20.637	$20.993	$20.443	$19.930	$19.514	$19.705	$19.820	$19.787	$20.375	$20.485	$20.598
5	Residual Fuel Oil	Energy Prices: Commercial: Residual Fuel: Reference case	2021 $/MMBtu		$6.500	$7.545	$7.669	$9.007	$9.545	$10.125	$10.896	$11.102	$11.200	$11.355	$11.535	$11.676	$11.796
4	Natural Gas	Energy Prices: Commercial: Natural Gas: Reference case	2021 $/MMBtu		$8.429	$8.785	$8.503	$8.205	$8.062	$8.042	$8.082	$8.178	$8.332	$8.395	$8.659	$8.673	$8.796
5	Electricity	Energy Prices: Commercial: Electricity: Reference case	2021 $/MMBtu		$33.181	$33.080	$32.241	$31.373	$31.229	$31.142	$31.166	$31.217	$31.272	$31.262	$31.352	$31.330	$31.495
6	Industrial																
5	Propane	Energy Prices: Industrial: Propane: Reference case	2021 $/MMBtu		$13.642	$14.474	$12.691	$12.674	$12.555	$12.705	$13.113	$13.681	$14.057	$14.454	$14.810	$15.103	$15.386
6	Distillate Fuel Oil	Energy Prices: Industrial: Distillate Fuel Oil: Reference case	2021 $/MMBtu		$21.718	$22.040	$20.641	$20.963	$20.404	$19.875	$19.435	$19.630	$19.755	$19.727	$20.012	$20.122	$20.206
7	Residual Fuel Oil	Energy Prices: Industrial: Residual Fuel Oil: Reference case	2021 $/MMBtu		$7.081	$8.281	$8.627	$10.170	$10.904	$11.725	$12.707	$12.934	$13.054	$13.224	$13.426	$13.580	$13.715
6	Natural Gas	Energy Prices: Industrial: Natural Gas: Reference case	2021 $/MMBtu		$5.058	$4.844	$4.539	$4.209	$4.038	$4.015	$4.093	$4.238	$4.358	$4.444	$4.487	$4.511	$4.580
7	Metallurgical Coal	Energy Prices: Industrial: Metallurgical Coal: Reference case	2021 $/MMBtu		$3.920	$3.520	$3.350	$3.188	$3.096	$3.033	$3.006	$3.007	$3.018	$3.046	$3.068	$3.100	$3.125
8	Other Industrial Coal	Energy Prices: Industrial: Other Industrial Coal: Reference case	2021 $/MMBtu		$2.691	$2.678	$2.687	$2.692	$2.690	$2.680	$2.669	$2.669	$2.670	$2.671	$2.675	$2.678	$2.682
7	Coal to Liquids	Energy Prices: Industrial: Coal to Liquids: Reference case	2021 $/MMBtu		$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
8	Electricity	Energy Prices: Industrial: Electricity: Reference case	2021 $/MMBtu		$21.929	$21.734	$20.807	$20.107	$19.872	$19.647	$19.638	$19.724	$19.747	$19.778	$19.793	$19.817	$19.859
9	Transportation																
8	Propane	Energy Prices: Transportation: Propane: Reference case	2021 $/MMBtu		$17.743	$18.353	$16.844	$16.847	$16.747	$16.877	$17.223	$17.694	$17.997	$18.317	$18.938	$19.167	$19.436
9	E85	Energy Prices: Transportation: E85: Reference case	2021 $/MMBtu		$25.695	$25.689	$25.836	$25.612	$25.307	$25.590	$25.920	$26.239	$26.471	$27.161	$27.897	$28.259	$28.425
10	Motor Gasoline	Energy Prices: Transportation: Motor Gasoline: Reference case	2021 $/MMBtu		$25.844	$24.781	$22.175	$22.028	$21.806	$22.036	$22.300	$22.541	$22.710	$23.271	$24.016	$24.260	$24.461
9	Jet Fuel	Energy Prices: Transportation: Jet Fuel: Reference case	2021 $/MMBtu		$14.697	$15.364	$14.342	$15.514	$15.575	$15.722	$16.004	$16.282	$16.451	$16.394	$16.880	$17.064	$17.175
10	Diesel Fuel (distillate fuel	Energy Prices: Transportation: Diesel Fuel: Reference case	2021 $/MMBtu		$23.712	$22.807	$22.000	$22.781	$22.756	$22.731	$22.790	$22.969	$23.104	$23.067	$23.680	$23.777	$23.908
11	Residual Fuel Oil	Energy Prices: Transportation: Residual Fuel Oil: Reference case	2021 $/MMBtu		$12.338	$10.432	$12.856	$13.754	$13.924	$14.097	$14.445	$14.624	$14.726	$14.847	$15.074	$15.182	$15.313
10	Natural Gas	Energy Prices: Transportation: Natural Gas: Reference case	2021 $/MMBtu		$14.644	$14.627	$13.911	$13.368	$12.965	$12.669	$12.455	$12.319	$12.188	$12.030	$12.687	$12.505	$12.504
11	Electricity	Energy Prices: Transportation: Electricity: Reference case	2021 $/MMBtu		$38.968	$39.638	$38.259	$37.180	$37.215	$37.523	$37.629	$37.708	$37.744	$37.577	$37.673	$37.763	$37.869
12	Electric Power																
11	Distillate Fuel Oil	Energy Prices: Electric Power: Distillate Fuel Oil: Reference case	2021 $/MMBtu		$21.715	$22.030	$20.394	$20.868	$20.203	$19.562	$19.092	$19.302	$19.443	$19.454	$19.642	$19.774	$19.814
12	Residual Fuel Oil	Energy Prices: Electric Power: Residual Fuel Oil: Reference case	2021 $/MMBtu		$12.985	$13.338	$12.811	$13.728	$13.927	$14.104	$14.526	$14.690	$14.788	$14.879	$15.160	$15.253	$15.389
13	Natural Gas	Energy Prices: Electric Power: Natural Gas: Reference case	2021 $/MMBtu		$5.149	$4.041	$3.784	$3.484	$3.315	$3.311	$3.400	$3.549	$3.635	$3.712	$3.763	$3.784	$3.839
12	Steam Coal	Energy Prices: Electric Power: Steam Coal: Reference case	2021 $/MMBtu		$2.057	$2.029	$2.012	$2.011	$1.962	$1.929	$1.928	$1.918	$1.925	$1.922	$1.921	$1.910	$1.906
13	Uranium	Energy Prices: Electric Power: Uranium: Reference case	2021 $/MMBtu		$0.717	$0.718	$0.720	$0.721	$0.723	$0.724	$0.726	$0.727	$0.729	$0.731	$0.732	$0.735	$0.737
14	Average Price to All Users																
13	Propane	Energy Prices: Average Price to All Users: Propane: Reference case	2021 $/MMBtu		$19.490	$21.366	$20.184	$20.183	$20.088	$20.183	$20.511	$21.026	$21.444	$21.878	$22.449	$22.789	$23.137
14	E85	Energy Prices: Average Price to All Users: E85: Reference case	2021 $/MMBtu		$25.695	$25.689	$25.836	$25.612	$25.307	$25.590	$25.920	$26.239	$26.471	$27.161	$27.897	$28.259	$28.425
15	Motor Gasoline	Energy Prices: Average Price to All Users: Motor Gasoline: Reference case	2021 $/MMBtu		$25.835	$24.777	$22.200	$22.065	$21.840	$22.060	$22.309	$22.550	$22.719	$23.280	$24.023	$24.267	$24.468
14	Jet Fuel	Energy Prices: Average Price to All Users: Jet Fuel: Reference case	2021 $/MMBtu		$14.697	$15.364	$14.342	$15.514	$15.575	$15.722	$16.004	$16.282	$16.451	$16.394	$16.880	$17.064	$17.175
15	Distillate Fuel Oil	Energy Prices: Average Price to All Users: Distillate Fuel Oil: Reference case	2021 $/MMBtu		$23.240	$22.619	$21.725	$22.458	$22.347	$22.246	$22.234	$22.415	$22.534	$22.494	$23.023	$23.114	$23.227
16	Residual Fuel Oil	Energy Prices: Average Price to All Users: Residual Fuel Oil: Reference case	2021 $/MMBtu		$12.014	$10.459	$12.579	$13.529	$13.738	$13.943	$14.329	$14.505	$14.602	$14.719	$14.945	$15.052	$15.179
15	Natural Gas	Energy Prices: Average Price to All Users: Natural Gas: Reference case	2021 $/MMBtu		$6.715	$6.362	$6.001	$5.663	$5.507	$5.474	$5.530	$5.656	$5.791	$5.882	$6.023	$6.042	$6.126
16	Metallurgical Coal	Energy Prices: Average Price to All Users: Metallurgical Coal: Reference case	2021 $/MMBtu		$3.920	$3.520	$3.350	$3.188	$3.096	$3.033	$3.006	$3.007	$3.018	$3.046	$3.068	$3.100	$3.125
17	Other Coal	Energy Prices: Average Price to All Users: Other Coal: Reference case	2021 $/MMBtu		$2.093	$2.067	$2.052	$2.058	$2.013	$1.983	$1.981	$1.972	$1.980	$1.979	$1.978	$1.969	$1.966
16	Coal to Liquids	Energy Prices: Average Price to All Users: Coal to Liquids: Reference case	2021 $/MMBtu		$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
17	Electricity	Energy Prices: Average Price to All Users: Electricity: Reference case	2021 $/MMBtu		$32.461	$32.267	$31.664	$30.878	$30.708	$30.615	$30.680	$30.793	$30.883	$30.929	$31.034	$31.090	$31.261
18	Non-Renewable Energy Expenditures by Sector																
17	(billion 2021 dollars)																
18	Residential	Energy Expenditures: Non-Renewable Residential: Reference case	billion 2021 $		$274.757	$275.373	$274.574	$270.376	$269.818	$270.294	$271.543	$273.805	$276.318	$278.005	$281.739	$283.546	$286.574
19	Commercial	Energy Expenditures: Non-Renewable Commercial: Reference case	billion 2021 $		$197.940	$201.655	$196.177	$191.187	$189.778	$188.811	$189.434	$190.588	$191.842	$192.416	$194.629	$195.247	$197.127
18	Industrial	Energy Expenditures: Non-Renewable Industrial: Reference case	billion 2021 $		$207.871	$216.866	$207.969	$205.658	$205.000	$206.922	$210.261	$216.456	$221.232	$225.770	$230.393	$234.782	$239.177
19	Transportation	Energy Expenditures: Non-Renewable Transportation: Reference case	billion 2021 $		$608.610	$602.926	$562.806	$570.521	$567.752	$571.395	$574.937	$578.653	$580.724	$587.704	$603.970	$607.325	$611.172
20	Total Non-Renewable Exp	Energy Expenditures: Total Non-Renewable: Reference case	billion 2021 $		$1,289.178	$1,296.820	$1,241.525	$1,237.741	$1,232.348	$1,237.423	$1,246.174	$1,259.502	$1,270.116	$1,283.896	$1,310.732	$1,320.900	$1,334.050
19	Transportation Renewabl	Energy Expenditures: Renewable Transportation: Reference case	billion 2021 $		$0.930	$0.954	$0.895	$0.878	$0.858	$0.844	$0.827	$0.806	$0.785	$0.773	$0.759	$0.737	$0.723
20	Total Expenditures	Energy Expenditures: Reference case	billion 2021 $		$1,290.108	$1,297.775	$1,242.420	$1,238.619	$1,233.206	$1,238.267	$1,247.002	$1,260.308	$1,270.900	$1,284.669	$1,311.491	$1,321.637	$1,334.773
21	Prices in Nominal Dollars																
20	Residential																
21	Propane	Energy Prices: Nominal: Residential: Propane: Reference case	nom $/MMBtu		$21.485	$23.781	$23.974	$24.564	$25.086	$25.797	$26.811	$28.098	$29.375	$30.688	$32.237	$33.518	$34.831

Prepared by: Concentric Energy Advisors, Inc.

New Mexico Gas Company
Application for a CCN
Workpaper JJR-WP-1

Table 3. Energy Prices by Sector and Source
https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=ref2022&sourcekey=0
Sun Oct 09 2022 10:01:34 GMT-0400 (Eastern Daylight Time)
Source: U.S. Energy Information Administration

Line no.	Sector	full name	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
1	Residential																
2	Propane	Energy Prices: Residential: Propane: Reference case	$26.771	$27.013	$27.245	$27.497	$27.744	$27.927	$28.223	$28.481	$28.621	$28.825	$29.073	$29.214	$29.366	$29.491	$29.580
3	Distillate Fuel Oil	Energy Prices: Residential: Distillate Fuel Oil: Reference case	$25.604	$25.683	$25.852	$26.069	$26.196	$26.264	$26.488	$26.585	$26.598	$26.824	$27.082	$27.181	$27.387	$27.416	$27.338
2	Natural Gas	Energy Prices: Residential: Natural Gas: Reference case	$11.546	$11.504	$11.518	$11.568	$11.591	$11.626	$11.646	$11.669	$11.670	$11.677	$11.660	$11.678	$11.690	$11.709	$11.711
3	Electricity	Energy Prices: Residential: Electricity: Reference case	$38.788	$38.626	$38.583	$38.430	$38.274	$38.310	$38.323	$38.229	$38.249	$38.184	$37.969	$38.000	$37.962	$37.890	$37.948
4	Commercial																
3	Propane	Energy Prices: Commercial: Propane: Reference case	$21.209	$21.319	$21.465	$21.653	$21.827	$21.917	$22.190	$22.361	$22.385	$22.553	$22.761	$22.801	$22.902	$22.972	$23.008
4	Distillate Fuel Oil	Energy Prices: Commercial: Distillate Fuel Oil: Reference case	$20.651	$20.745	$20.917	$21.136	$21.267	$21.336	$21.543	$21.647	$21.663	$21.908	$22.184	$22.291	$22.481	$22.527	$22.468
5	Residual Fuel Oil	Energy Prices: Commercial: Residual Fuel: Reference case	$11.807	$11.826	$11.776	$11.754	$11.954	$11.782	$12.307	$12.479	$12.620	$12.993	$13.267	$13.360	$13.507	$13.623	$13.530
4	Natural Gas	Energy Prices: Commercial: Natural Gas: Reference case	$8.823	$8.773	$8.778	$8.818	$8.835	$8.862	$8.876	$8.891	$8.886	$8.889	$8.866	$8.877	$8.884	$8.898	$8.899
5	Electricity	Energy Prices: Commercial: Electricity: Reference case	$31.566	$31.311	$31.178	$30.963	$30.725	$30.726	$30.665	$30.471	$30.415	$30.327	$30.021	$30.001	$29.921	$29.757	$29.779
6	Industrial																
5	Propane	Energy Prices: Industrial: Propane: Reference case	$15.557	$15.673	$15.832	$16.039	$16.228	$16.321	$16.630	$16.814	$16.831	$17.025	$17.259	$17.294	$17.409	$17.487	$17.526
6	Distillate Fuel Oil	Energy Prices: Industrial: Distillate Fuel Oil: Reference case	$20.257	$20.360	$20.541	$20.766	$20.903	$20.978	$21.181	$21.295	$21.317	$21.579	$21.864	$21.976	$22.163	$22.219	$22.172
7	Residual Fuel Oil	Energy Prices: Industrial: Residual Fuel Oil: Reference case	$13.739	$13.775	$13.734	$13.701	$13.938	$13.810	$14.323	$14.503	$14.647	$15.017	$15.269	$15.355	$15.527	$15.604	$15.572
6	Natural Gas	Energy Prices: Industrial: Natural Gas: Reference case	$4.575	$4.556	$4.558	$4.574	$4.583	$4.587	$4.611	$4.617	$4.596	$4.591	$4.546	$4.534	$4.526	$4.523	$4.526
7	Metallurgical Coal	Energy Prices: Industrial: Metallurgical Coal: Reference case	$3.148	$3.173	$3.201	$3.233	$3.259	$3.284	$3.312	$3.337	$3.360	$3.383	$3.410	$3.438	$3.467	$3.494	$3.514
8	Other Industrial Coal	Energy Prices: Industrial: Other Industrial Coal: Reference case	$2.684	$2.680	$2.678	$2.677	$2.684	$2.688	$2.693	$2.699	$2.694	$2.698	$2.704	$2.710	$2.715	$2.718	$2.720
7	Coal to Liquids	Energy Prices: Industrial: Coal to Liquids: Reference case	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
8	Electricity	Energy Prices: Industrial: Electricity: Reference case	$19.875	$19.710	$19.657	$19.516	$19.411	$19.374	$19.334	$19.259	$19.185	$19.081	$18.930	$18.866	$18.805	$18.745	$18.726
9	Transportation																
8	Propane	Energy Prices: Transportation: Propane: Reference case	$19.566	$19.653	$19.776	$19.934	$20.078	$20.147	$20.384	$20.520	$20.528	$20.675	$20.850	$20.872	$20.957	$21.013	$21.040
9	E85	Energy Prices: Transportation: E85: Reference case	$28.903	$29.075	$29.117	$29.251	$29.627	$29.617	$29.850	$30.064	$30.083	$30.376	$30.672	$30.775	$31.039	$31.145	$31.068
10	Motor Gasoline	Energy Prices: Transportation: Motor Gasoline: Reference case	$24.651	$24.743	$24.919	$25.076	$25.351	$25.364	$25.563	$25.725	$25.766	$26.022	$26.268	$26.352	$26.563	$26.645	$26.573
9	Jet Fuel	Energy Prices: Transportation: Jet Fuel: Reference case	$17.344	$17.456	$17.653	$17.910	$18.089	$18.193	$18.381	$18.523	$18.564	$18.855	$19.167	$19.275	$19.485	$19.576	$19.548
10	Diesel Fuel (distillate fuel	Energy Prices: Transportation: Diesel Fuel: Reference case	$23.948	$24.047	$24.229	$24.429	$24.563	$24.652	$24.855	$24.970	$24.982	$25.243	$25.529	$25.632	$25.814	$25.874	$25.823
11	Residual Fuel Oil	Energy Prices: Transportation: Residual Fuel Oil: Reference case	$15.327	$15.361	$15.346	$15.380	$15.569	$15.517	$15.844	$15.975	$16.060	$16.366	$16.583	$16.678	$16.827	$16.881	$16.853
10	Natural Gas	Energy Prices: Transportation: Natural Gas: Reference case	$12.354	$12.179	$12.064	$11.961	$11.870	$11.777	$11.748	$11.704	$11.623	$11.590	$11.533	$11.490	$11.459	$11.430	$11.385
11	Electricity	Energy Prices: Transportation: Electricity: Reference case	$37.825	$37.507	$37.233	$37.014	$36.794	$36.591	$36.426	$36.230	$36.050	$35.795	$35.545	$35.393	$35.216	$35.001	$34.835
12	Electric Power																
11	Distillate Fuel Oil	Energy Prices: Electric Power: Distillate Fuel Oil: Reference case	$19.937	$20.035	$20.221	$20.428	$20.528	$20.596	$20.812	$20.902	$20.938	$21.170	$21.440	$21.543	$21.784	$21.851	$21.798
12	Residual Fuel Oil	Energy Prices: Electric Power: Residual Fuel Oil: Reference case	$15.415	$15.454	$15.436	$15.483	$15.653	$15.636	$15.853	$15.891	$15.835	$15.973	$15.985	$15.802	$16.025	$16.111	$16.149
13	Natural Gas	Energy Prices: Electric Power: Natural Gas: Reference case	$3.810	$3.780	$3.773	$3.776	$3.791	$3.789	$3.821	$3.816	$3.795	$3.785	$3.736	$3.722	$3.717	$3.706	$3.720
12	Steam Coal	Energy Prices: Electric Power: Steam Coal: Reference case	$1.899	$1.886	$1.870	$1.867	$1.866	$1.864	$1.869	$1.865	$1.854	$1.843	$1.837	$1.834	$1.831	$1.826	$1.817
13	Uranium	Energy Prices: Electric Power: Uranium: Reference case	$0.738	$0.740	$0.742	$0.743	$0.745	$0.747	$0.749	$0.751	$0.753	$0.755	$0.758	$0.760	$0.762	$0.764	$0.766
14	Average Price to All Users																
13	Propane	Energy Prices: Average Price to All Users: Propane: Reference case	$23.364	$23.525	$23.697	$23.896	$24.086	$24.201	$24.469	$24.667	$24.730	$24.900	$25.112	$25.182	$25.289	$25.369	$25.413
14	E85	Energy Prices: Average Price to All Users: E85: Reference case	$28.903	$29.075	$29.117	$29.251	$29.627	$29.617	$29.850	$30.064	$30.083	$30.376	$30.672	$30.775	$31.039	$31.145	$31.068
15	Motor Gasoline	Energy Prices: Average Price to All Users: Motor Gasoline: Reference case	$24.657	$24.750	$24.926	$25.083	$25.358	$25.371	$25.571	$25.733	$25.774	$26.030	$26.276	$26.360	$26.571	$26.653	$26.582
14	Jet Fuel	Energy Prices: Average Price to All Users: Jet Fuel: Reference case	$17.344	$17.456	$17.653	$17.910	$18.089	$18.193	$18.381	$18.523	$18.564	$18.855	$19.167	$19.275	$19.485	$19.576	$19.548
15	Distillate Fuel Oil	Energy Prices: Average Price to All Users: Distillate Fuel Oil: Reference case	$23.261	$23.353	$23.519	$23.735	$23.864	$23.935	$24.133	$24.240	$24.253	$24.509	$24.784	$24.890	$25.071	$25.119	$25.067
16	Residual Fuel Oil	Energy Prices: Average Price to All Users: Residual Fuel Oil: Reference case	$15.191	$15.224	$15.204	$15.229	$15.419	$15.358	$15.694	$15.822	$15.904	$16.208	$16.421	$16.507	$16.659	$16.715	$16.686
15	Natural Gas	Energy Prices: Average Price to All Users: Natural Gas: Reference case	$6.124	$6.101	$6.098	$6.106	$6.108	$6.109	$6.123	$6.113	$6.083	$6.069	$6.014	$5.995	$5.984	$5.973	$5.968
16	Metallurgical Coal	Energy Prices: Average Price to All Users: Metallurgical Coal: Reference case	$3.148	$3.173	$3.201	$3.233	$3.259	$3.284	$3.312	$3.337	$3.360	$3.383	$3.410	$3.438	$3.467	$3.494	$3.514
17	Other Coal	Energy Prices: Average Price to All Users: Other Coal: Reference case	$1.963	$1.951	$1.940	$1.939	$1.939	$1.938	$1.945	$1.942	$1.933	$1.924	$1.920	$1.919	$1.917	$1.913	$1.905
16	Coal to Liquids	Energy Prices: Average Price to All Users: Coal to Liquids: Reference case	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
17	Electricity	Energy Prices: Average Price to All Users: Electricity: Reference case	$31.367	$31.181	$31.114	$30.950	$30.788	$30.799	$30.780	$30.659	$30.627	$30.543	$30.323	$30.318	$30.264	$30.174	$30.212
18	Non-Renewable Energy Expenditures by Sector																
17	(billion 2021 dollars)																
18	Residential	Energy Expenditures: Non-Renewable Residential: Reference case	$288.697	$288.898	$290.236	$291.366	$292.371	$294.349	$296.075	$297.197	$298.851	$300.172	$300.724	$302.795	$304.460	$305.916	$307.982
19	Commercial	Energy Expenditures: Non-Renewable Commercial: Reference case	$198.307	$197.982	$198.473	$198.742	$198.944	$200.086	$200.945	$201.327	$202.227	$203.185	$203.167	$204.469	$205.492	$206.208	$207.665
18	Industrial	Energy Expenditures: Non-Renewable Industrial: Reference case	$241.704	$243.648	$246.295	$249.979	$253.259	$255.100	$259.037	$262.698	$265.092	$268.040	$270.748	$272.825	$276.046	$277.769	$278.596
19	Transportation	Energy Expenditures: Non-Renewable Transportation: Reference case	$614.391	$616.354	$620.703	$626.230	$633.009	$635.550	$642.605	$648.443	$651.841	$661.370	$671.180	$677.169	$686.597	$692.322	$694.338
20	Total Non-Renewable Exp	Energy Expenditures: Total Non-Renewable: Reference case	$1,343.099	$1,346.883	$1,355.707	$1,366.318	$1,377.583	$1,385.085	$1,398.662	$1,409.664	$1,418.011	$1,432.766	$1,445.818	$1,457.258	$1,472.595	$1,482.215	$1,488.581
19	Transportation Renewabl	Energy Expenditures: Renewable Transportation: Reference case	$0.696	$0.678	$0.677	$0.676	$0.674	$0.675	$0.682	$0.689	$0.697	$0.710	$0.722	$0.733	$0.748	$0.761	$0.771
20	Total Expenditures	Energy Expenditures: Reference case	$1,343.795	$1,347.560	$1,356.384	$1,366.993	$1,378.257	$1,385.760	$1,399.344	$1,410.352	$1,418.708	$1,433.476	$1,446.541	$1,457.992	$1,473.343	$1,482.976	$1,489.353
21	Prices in Nominal Dollars																
20	Residential																
21	Propane	Energy Prices: Nominal: Residential: Propane: Reference case	$36.038	$37.169	$38.317	$39.527	$40.770	$41.947	$43.354	$44.742	$45.987	$47.376	$48.875	$50.228	$51.642	$53.044	$54.421

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Table 3. Energy Prices by Sector and Source
https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=ref2022&sourcekey=0
Sun Oct 09 2022 10:01:34 GMT-0400 (Eastern Daylight Time)
Source: U.S. Energy Information Administration

						CAGR	
Line no.	Sector	full name	2049	2050	Growth (2021-2050)	2027-2050	2022-2027
1	Residential						
2	Propane	Energy Prices: Residential: Propane: Reference case	$29.612	$29.616	1.10%		
3	Distillate Fuel Oil	Energy Prices: Residential: Distillate Fuel Oil: Reference case	$27.323	$27.270	0.80%		
2	Natural Gas	Energy Prices: Residential: Natural Gas: Reference case	$11.743	$11.755	0.00%		
3	Electricity	Energy Prices: Residential: Electricity: Reference case	$37.873	$37.629	-0.10%		
4	Commercial						
3	Propane	Energy Prices: Commercial: Propane: Reference case	$22.989	$22.964	0.70%		
4	Distillate Fuel Oil	Energy Prices: Commercial: Distillate Fuel Oil: Reference case	$22.447	$22.374	0.10%		
5	Residual Fuel Oil	Energy Prices: Commercial: Residual Fuel: Reference case	$13.587	$13.502	2.60%		
4	Natural Gas	Energy Prices: Commercial: Natural Gas: Reference case	$8.927	$8.935	0.20%		
5	Electricity	Energy Prices: Commercial: Electricity: Reference case	$29.683	$29.405	-0.40%		
6	Industrial						
5	Propane	Energy Prices: Industrial: Propane: Reference case	$17.502	$17.475	0.90%		
6	Distillate Fuel Oil	Energy Prices: Industrial: Distillate Fuel Oil: Reference case	$22.152	$22.080	0.10%		
7	Residual Fuel Oil	Energy Prices: Industrial: Residual Fuel Oil: Reference case	$15.601	$15.553	2.80%		
6	Natural Gas	Energy Prices: Industrial: Natural Gas: Reference case	$4.516	$4.512	-0.40%		
7	Metallurgical Coal	Energy Prices: Industrial: Metallurgical Coal: Reference case	$3.536	$3.565	-0.30%		
8	Other Industrial Coal	Energy Prices: Industrial: Other Industrial Coal: Reference case	$2.724	$2.728	0.00%		
7	Coal to Liquids	Energy Prices: Industrial: Coal to Liquids: Reference case	$0.000	$0.000	- -		
8	Electricity	Energy Prices: Industrial: Electricity: Reference case	$18.667	$18.554	-0.60%		
9	Transportation						
8	Propane	Energy Prices: Transportation: Propane: Reference case	$21.020	$20.997	0.60%		
9	E85	Energy Prices: Transportation: E85: Reference case	$31.098	$31.095	0.70%		
10	Motor Gasoline	Energy Prices: Transportation: Motor Gasoline: Reference case	$26.589	$26.584	0.10%		
9	Jet Fuel	Energy Prices: Transportation: Jet Fuel: Reference case	$19.590	$19.532	1.00%		
10	Diesel Fuel (distillate fuel	Energy Prices: Transportation: Diesel Fuel: Reference case	$25.802	$25.741	0.30%		
11	Residual Fuel Oil	Energy Prices: Transportation: Residual Fuel Oil: Reference case	$16.886	$16.848	1.10%		
10	Natural Gas	Energy Prices: Transportation: Natural Gas: Reference case	$11.346	$11.303	-0.90%		
11	Electricity	Energy Prices: Transportation: Electricity: Reference case	$34.656	$34.435	-0.40%		
12	Electric Power						
11	Distillate Fuel Oil	Energy Prices: Electric Power: Distillate Fuel Oil: Reference case	$21.792	$21.737	0.00%		
12	Residual Fuel Oil	Energy Prices: Electric Power: Residual Fuel Oil: Reference case	$16.206	$16.200	0.80%		
13	Natural Gas	Energy Prices: Electric Power: Natural Gas: Reference case	$3.701	$3.692	-1.10%		
12	Steam Coal	Energy Prices: Electric Power: Steam Coal: Reference case	$1.819	$1.816	-0.40%		
13	Uranium	Energy Prices: Electric Power: Uranium: Reference case	$0.768	$0.770	0.20%		
14	Average Price to All Users						
13	Propane	Energy Prices: Average Price to All Users: Propane: Reference case	$25.399	$25.367	0.90%		
14	E85	Energy Prices: Average Price to All Users: E85: Reference case	$31.098	$31.095	0.70%		
15	Motor Gasoline	Energy Prices: Average Price to All Users: Motor Gasoline: Reference case	$26.598	$26.593	0.10%		
14	Jet Fuel	Energy Prices: Average Price to All Users: Jet Fuel: Reference case	$19.590	$19.532	1.00%		
15	Distillate Fuel Oil	Energy Prices: Average Price to All Users: Distillate Fuel Oil: Reference case	$25.042	$24.966	0.20%		
16	Residual Fuel Oil	Energy Prices: Average Price to All Users: Residual Fuel Oil: Reference case	$16.719	$16.679	1.10%		
15	Natural Gas	Energy Prices: Average Price to All Users: Natural Gas: Reference case	$5.957	$5.941	-0.40%		
16	Metallurgical Coal	Energy Prices: Average Price to All Users: Metallurgical Coal: Reference case	$3.536	$3.565	-0.30%		
17	Other Coal	Energy Prices: Average Price to All Users: Other Coal: Reference case	$1.906	$1.904	-0.30%		
16	Coal to Liquids	Energy Prices: Average Price to All Users: Coal to Liquids: Reference case	$0.000	$0.000	- -		
17	Electricity	Energy Prices: Average Price to All Users: Electricity: Reference case	$30.142	$29.924	-0.30%		
18	Non-Renewable Energy Expenditures by Sector						
17	(billion 2021 dollars)						
18	Residential	Energy Expenditures: Non-Renewable Residential: Reference case	$309.462	$310.004	0.40%		
19	Commercial	Energy Expenditures: Non-Renewable Commercial: Reference case	$208.726	$208.916	0.20%		
18	Industrial	Energy Expenditures: Non-Renewable Industrial: Reference case	$280.167	$283.148	1.10%		
19	Transportation	Energy Expenditures: Non-Renewable Transportation: Reference case	$699.030	$703.491	0.50%		
20	Total Non-Renewable Exp	Energy Expenditures: Total Non-Renewable: Reference case	$1,497.385	$1,505.558	0.50%		
19	Transportation Renewabl	Energy Expenditures: Renewable Transportation: Reference case	$0.785	$0.798	-0.50%		
20	Total Expenditures	Energy Expenditures: Reference case	$1,498.169	$1,506.356	0.50%		
21	Prices in Nominal Dollars						
20	Residential						
21	Propane	Energy Prices: Nominal: Residential: Propane: Reference case	$55.729	$57.012	3.40%		

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Table 3. Energy Prices by Sector and Source
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Sun Oct 09 2022 10:01:34 GMT-0400 (Eastern Daylight Time)
Source: U.S. Energy Information Administration

Line no.	Sector	full name	units	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
22	Distillate Fuel Oil	Energy Prices: Nominal: Residential: Distillate Fuel Oil: Reference case	nom $/MMBtu		$21.710	$22.565	$22.631	$24.633	$25.796	$27.057	$28.481	$29.413	$30.275	$30.935	$31.994	$32.840	$33.649
21	Natural Gas	Energy Prices: Nominal: Residential: Natural Gas: Reference case	nom $/MMBtu		$11.696	$12.415	$12.017	$11.792	$11.754	$11.870	$12.080	$12.512	$13.031	$13.433	$14.232	$14.609	$15.148
22	Electricity	Energy Prices: Nominal: Residential: Electricity: Reference case	nom $/MMBtu		$38.701	$39.618	$40.060	$40.134	$40.926	$41.914	$43.119	$44.401	$45.679	$46.869	$48.169	$49.412	$50.834
23	Commercial																
22	Propane	Energy Prices: Nominal: Commercial: Propane: Reference case	nom $/MMBtu		$18.792	$20.288	$19.031	$19.382	$19.705	$20.336	$21.295	$22.470	$23.465	$24.483	$25.788	$26.721	$27.709
23	Distillate Fuel Oil	Energy Prices: Nominal: Commercial: Distillate Fuel Oil: Reference case	nom $/MMBtu		$21.788	$22.650	$21.511	$22.378	$22.309	$22.283	$22.371	$23.157	$23.860	$24.375	$25.678	$26.389	$27.123
24	Residual Fuel Oil	Energy Prices: Nominal: Commercial: Residual Fuel: Reference case	nom $/MMBtu		$6.500	$7.727	$7.994	$9.601	$10.416	$11.320	$12.491	$13.047	$13.482	$13.987	$14.538	$15.042	$15.533
23	Natural Gas	Energy Prices: Nominal: Commercial: Natural Gas: Reference case	nom $/MMBtu		$8.429	$8.997	$8.864	$8.746	$8.798	$8.991	$9.265	$9.611	$10.030	$10.342	$10.913	$11.172	$11.582
24	Electricity	Energy Prices: Nominal: Commercial: Electricity: Reference case	nom $/MMBtu		$33.181	$33.878	$33.607	$33.442	$34.078	$34.817	$35.728	$36.686	$37.645	$38.509	$39.511	$40.361	$41.472
25	Industrial																
24	Propane	Energy Prices: Nominal: Industrial: Propane: Reference case	nom $/MMBtu		$13.642	$14.823	$13.228	$13.510	$13.700	$14.204	$15.033	$16.078	$16.922	$17.806	$18.665	$19.456	$20.260
25	Distillate Fuel Oil	Energy Prices: Nominal: Industrial: Distillate Fuel Oil: Reference case	nom $/MMBtu		$21.718	$22.572	$21.516	$22.345	$22.267	$22.221	$22.280	$23.069	$23.781	$24.300	$25.220	$25.922	$26.606
26	Residual Fuel Oil	Energy Prices: Nominal: Industrial: Residual Fuel Oil: Reference case	nom $/MMBtu		$7.081	$8.480	$8.993	$10.841	$11.899	$13.108	$14.567	$15.200	$15.714	$16.290	$16.920	$17.495	$18.059
25	Natural Gas	Energy Prices: Nominal: Industrial: Natural Gas: Reference case	nom $/MMBtu		$5.058	$4.961	$4.731	$4.487	$4.406	$4.489	$4.692	$4.980	$5.247	$5.474	$5.655	$5.811	$6.031
26	Metallurgical Coal	Energy Prices: Nominal: Industrial: Metallurgical Coal: Reference case	nom $/MMBtu		$3.920	$3.605	$3.491	$3.398	$3.379	$3.391	$3.446	$3.534	$3.633	$3.753	$3.867	$3.994	$4.115
27	Other Industrial Coal	Energy Prices: Nominal: Industrial: Other Industrial Coal: Reference case	nom $/MMBtu		$2.691	$2.743	$2.801	$2.870	$2.936	$2.996	$3.060	$3.137	$3.214	$3.291	$3.371	$3.450	$3.531
26	Coal to Liquids	Energy Prices: Nominal: Industrial: Coal to Liquids: Reference case	nom $/MMBtu		$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
27	Electricity	Energy Prices: Nominal: Industrial: Electricity: Reference case	nom $/MMBtu		$21.929	$22.259	$21.688	$21.433	$21.686	$21.966	$22.513	$23.179	$23.771	$24.363	$24.944	$25.529	$26.150
28	Transportation																
27	Propane	Energy Prices: Nominal: Transportation: Propane: Reference case	nom $/MMBtu		$17.743	$18.796	$17.558	$17.958	$18.275	$18.869	$19.744	$20.794	$21.664	$22.563	$23.866	$24.692	$25.592
28	E85	Energy Prices: Nominal: Transportation: E85: Reference case	nom $/MMBtu		$25.695	$26.309	$26.931	$27.301	$27.616	$28.610	$29.714	$30.836	$31.865	$33.458	$35.158	$36.404	$37.429
29	Motor Gasoline	Energy Prices: Nominal: Transportation: Motor Gasoline: Reference case	nom $/MMBtu		$25.844	$25.380	$23.114	$23.481	$23.796	$24.637	$25.564	$26.490	$27.338	$28.666	$30.266	$31.253	$32.209
28	Jet Fuel	Energy Prices: Nominal: Transportation: Jet Fuel: Reference case	nom $/MMBtu		$14.697	$15.735	$14.949	$16.537	$16.997	$17.578	$18.347	$19.135	$19.804	$20.195	$21.272	$21.982	$22.615
29	Diesel Fuel (distillate fuel	Energy Prices: Nominal: Transportation: Diesel Fuel: Reference case	nom $/MMBtu		$23.712	$23.357	$22.931	$24.284	$24.832	$25.414	$26.126	$26.993	$27.812	$28.415	$29.843	$30.631	$31.481
30	Residual Fuel Oil	Energy Prices: Nominal: Transportation: Residual Fuel Oil: Reference case	nom $/MMBtu		$12.338	$10.683	$13.400	$14.661	$15.195	$15.761	$16.560	$17.187	$17.727	$18.289	$18.997	$19.558	$20.163
29	Natural Gas	Energy Prices: Nominal: Transportation: Natural Gas: Reference case	nom $/MMBtu		$14.644	$14.980	$14.501	$14.250	$14.149	$14.164	$14.278	$14.478	$14.672	$14.819	$15.989	$16.110	$16.465
30	Electricity	Energy Prices: Nominal: Transportation: Electricity: Reference case	nom $/MMBtu		$38.968	$40.595	$39.879	$39.632	$40.611	$41.951	$43.137	$44.315	$45.436	$46.288	$47.477	$48.648	$49.864
31	Electric Power																
30	Distillate Fuel Oil	Energy Prices: Nominal: Electric Power: Distillate Fuel Oil: Reference case	nom $/MMBtu		$21.715	$22.561	$21.257	$22.244	$22.046	$21.871	$21.887	$22.683	$23.406	$23.964	$24.754	$25.473	$26.090
31	Residual Fuel Oil	Energy Prices: Nominal: Electric Power: Residual Fuel Oil: Reference case	nom $/MMBtu		$12.985	$13.660	$13.354	$14.634	$15.198	$15.769	$16.652	$17.264	$17.801	$18.328	$19.105	$19.650	$20.263
32	Natural Gas	Energy Prices: Nominal: Electric Power: Natural Gas: Reference case	nom $/MMBtu		$5.149	$4.139	$3.944	$3.714	$3.617	$3.702	$3.898	$4.170	$4.375	$4.572	$4.742	$4.874	$5.055
31	Steam Coal	Energy Prices: Nominal: Electric Power: Steam Coal: Reference case	nom $/MMBtu		$2.057	$2.078	$2.097	$2.144	$2.141	$2.157	$2.210	$2.254	$2.317	$2.368	$2.421	$2.460	$2.510
32	Uranium	Energy Prices: Nominal: Electric Power: Uranium: Reference case	nom $/MMBtu		$0.717	$0.735	$0.750	$0.768	$0.789	$0.809	$0.832	$0.855	$0.878	$0.901	$0.923	$0.946	$0.970
33	Average Price to All Users																
32	Propane	Energy Prices: Nominal: Average Price to All Users: Propane: Reference case	nom $/MMBtu		$19.490	$21.882	$21.039	$21.514	$21.921	$22.565	$23.513	$24.710	$25.814	$26.949	$28.291	$29.357	$30.465
33	E85	Energy Prices: Nominal: Average Price to All Users: E85: Reference case	nom $/MMBtu		$25.695	$26.309	$26.931	$27.301	$27.616	$28.610	$29.714	$30.836	$31.865	$33.458	$35.158	$36.404	$37.429
34	Motor Gasoline	Energy Prices: Nominal: Average Price to All Users: Motor Gasoline: Reference case	nom $/MMBtu		$25.835	$25.375	$23.140	$23.520	$23.833	$24.664	$25.574	$26.501	$27.349	$28.678	$30.275	$31.262	$32.218
33	Jet Fuel	Energy Prices: Nominal: Average Price to All Users: Jet Fuel: Reference case	nom $/MMBtu		$14.697	$15.735	$14.949	$16.537	$16.997	$17.578	$18.347	$19.135	$19.804	$20.195	$21.272	$21.982	$22.615
34	Distillate Fuel Oil	Energy Prices: Nominal: Average Price to All Users: Distillate Fuel Oil: Reference case	nom $/MMBtu		$23.240	$23.165	$22.645	$23.939	$24.386	$24.872	$25.488	$26.342	$27.126	$27.709	$29.015	$29.776	$30.584
35	Residual Fuel Oil	Energy Prices: Nominal: Average Price to All Users: Residual Fuel Oil: Reference case	nom $/MMBtu		$12.014	$10.711	$13.112	$14.421	$14.991	$15.588	$16.427	$17.046	$17.578	$18.131	$18.835	$19.391	$19.986
34	Natural Gas	Energy Prices: Nominal: Average Price to All Users: Natural Gas: Reference case	nom $/MMBtu		$6.715	$6.515	$6.255	$6.037	$6.010	$6.120	$6.339	$6.647	$6.972	$7.246	$7.590	$7.784	$8.066
35	Metallurgical Coal	Energy Prices: Nominal: Average Price to All Users: Metallurgical Coal: Reference cas	nom $/MMBtu		$3.920	$3.605	$3.491	$3.398	$3.379	$3.391	$3.446	$3.534	$3.633	$3.753	$3.867	$3.994	$4.115
36	Other Coal	Energy Prices: Nominal: Average Price to All Users: Other Coal: Reference case	nom $/MMBtu		$2.093	$2.117	$2.139	$2.193	$2.196	$2.217	$2.271	$2.318	$2.384	$2.437	$2.493	$2.537	$2.589
35	Coal to Liquids	Energy Prices: Nominal: Average Price to All Users: Coal to Liquids: Reference case	nom $/MMBtu		$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
36	Electricity	Energy Prices: Nominal: Average Price to All Users: Electricity: Reference case	nom $/MMBtu		$32.461	$33.046	$33.005	$32.914	$33.511	$34.229	$35.171	$36.188	$37.177	$38.099	$39.111	$40.051	$41.163
37	Non-Renewable Energy Expenditures by Sector																
36	(billion nominal dollars)																
37	Residential	Energy Expenditures: Nominal: Non-Renewable Residential: Reference case	billion nom $		$274.757	$282.021	$286.201	$288.207	$294.442	$302.196	$311.292	$321.774	$332.630	$342.457	$355.061	$365.277	$377.349
38	Commercial	Energy Expenditures: Nominal: Non-Renewable Commercial: Reference case	billion nom $		$197.940	$206.523	$204.484	$203.795	$207.097	$211.095	$217.163	$223.979	$230.939	$237.025	$245.281	$251.526	$259.570
37	Industrial	Energy Expenditures: Nominal: Non-Renewable Industrial: Reference case	billion nom $		$207.871	$222.102	$216.775	$219.220	$223.709	$231.345	$241.038	$254.378	$266.318	$278.111	$290.352	$302.457	$314.938
38	Transportation	Energy Expenditures: Nominal: Non-Renewable Transportation: Reference case	billion nom $		$608.610	$617.482	$586.639	$608.144	$619.566	$638.835	$659.095	$680.030	$699.073	$723.954	$761.152	$782.383	$804.766
39	Total Non-Renewable Exp	Energy Expenditures: Nominal: Total Non-Renewable: Reference case	billion nom $		$1,289.178	$1,328.128	$1,294.100	$1,319.366	$1,344.812	$1,383.470	$1,428.588	$1,480.161	$1,528.960	$1,581.547	$1,651.846	$1,701.643	$1,756.624
38	Transportation Renewabl	Energy Expenditures: Nominal: Renewable Transportation: Reference case	billion nom $		$0.930	$0.977	$0.933	$0.935	$0.936	$0.944	$0.949	$0.947	$0.945	$0.952	$0.956	$0.950	$0.952
39	Total Expenditures	Energy Expenditures: Nominal: Reference case	billion nom $		$1,290.108	$1,329.105	$1,295.033	$1,320.302	$1,345.748	$1,384.414	$1,429.536	$1,481.108	$1,529.905	$1,582.499	$1,652.802	$1,702.593	$1,757.576

Prepared by: Concentric Energy Advisors, Inc.

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Table 3. Energy Prices by Sector and Source
https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2022&cases=ref2022&sourcekey=0
Sun Oct 09 2022 10:01:34 GMT-0400 (Eastern Daylight Time)
Source: U.S. Energy Information Administration

Line no.	Sector	full name	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
22	Distillate Fuel Oil	Energy Prices: Nominal: Residential: Distillate Fuel Oil: Reference case	$34.467	$35.339	$36.358	$37.474	$38.495	$39.450	$40.688	$41.764	$42.736	$44.088	$45.529	$46.732	$48.162	$49.312	$50.295
21	Natural Gas	Energy Prices: Nominal: Residential: Natural Gas: Reference case	$15.542	$15.830	$16.199	$16.629	$17.033	$17.463	$17.889	$18.331	$18.750	$19.192	$19.602	$20.078	$20.558	$21.060	$21.546
22	Electricity	Energy Prices: Nominal: Residential: Electricity: Reference case	$52.215	$53.148	$54.261	$55.243	$56.245	$57.543	$58.869	$60.056	$61.457	$62.760	$63.830	$65.333	$66.759	$68.152	$69.815
23	Commercial																
22	Propane	Energy Prices: Nominal: Commercial: Propane: Reference case	$28.550	$29.335	$30.188	$31.126	$32.076	$32.920	$34.086	$35.129	$35.967	$37.068	$38.264	$39.202	$40.275	$41.319	$42.330
23	Distillate Fuel Oil	Energy Prices: Nominal: Commercial: Distillate Fuel Oil: Reference case	$27.800	$28.544	$29.418	$30.383	$31.253	$32.047	$33.092	$34.006	$34.807	$36.008	$37.294	$38.325	$39.536	$40.518	$41.335
24	Residual Fuel Oil	Energy Prices: Nominal: Commercial: Residual Fuel: Reference case	$15.894	$16.272	$16.561	$16.896	$17.567	$17.696	$18.905	$19.604	$20.278	$21.355	$22.304	$22.970	$23.754	$24.503	$24.892
23	Natural Gas	Energy Prices: Nominal: Commercial: Natural Gas: Reference case	$11.877	$12.072	$12.345	$12.676	$12.983	$13.311	$13.635	$13.968	$14.279	$14.611	$14.905	$15.263	$15.624	$16.005	$16.372
24	Electricity	Energy Prices: Nominal: Commercial: Electricity: Reference case	$42.493	$43.083	$43.848	$44.509	$45.151	$46.152	$47.105	$47.868	$48.870	$49.846	$50.469	$51.580	$52.619	$53.523	$54.786
25	Industrial																
24	Propane	Energy Prices: Nominal: Industrial: Propane: Reference case	$20.942	$21.565	$22.266	$23.056	$23.848	$24.515	$25.546	$26.415	$27.044	$27.982	$29.014	$29.733	$30.616	$31.453	$32.244
25	Distillate Fuel Oil	Energy Prices: Nominal: Industrial: Distillate Fuel Oil: Reference case	$27.269	$28.014	$28.888	$29.851	$30.718	$31.510	$32.537	$33.454	$34.251	$35.466	$36.757	$37.783	$38.976	$39.964	$40.792
26	Residual Fuel Oil	Energy Prices: Nominal: Industrial: Residual Fuel Oil: Reference case	$18.495	$18.954	$19.315	$19.695	$20.482	$20.743	$22.002	$22.783	$23.534	$24.681	$25.669	$26.401	$27.306	$28.067	$28.649
25	Natural Gas	Energy Prices: Nominal: Industrial: Natural Gas: Reference case	$6.159	$6.268	$6.411	$6.575	$6.735	$6.890	$7.082	$7.254	$7.385	$7.546	$7.643	$7.795	$7.959	$8.136	$8.327
26	Metallurgical Coal	Energy Prices: Nominal: Industrial: Metallurgical Coal: Reference case	$4.237	$4.366	$4.502	$4.647	$4.790	$4.933	$5.088	$5.243	$5.398	$5.560	$5.733	$5.911	$6.098	$6.284	$6.465
27	Other Industrial Coal	Energy Prices: Nominal: Industrial: Other Industrial Coal: Reference case	$3.613	$3.688	$3.766	$3.849	$3.944	$4.037	$4.137	$4.239	$4.329	$4.434	$4.545	$4.659	$4.774	$4.888	$5.003
26	Coal to Liquids	Energy Prices: Nominal: Industrial: Coal to Liquids: Reference case	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
27	Electricity	Energy Prices: Nominal: Industrial: Electricity: Reference case	$26.756	$27.120	$27.646	$28.055	$28.525	$29.101	$29.700	$30.255	$30.827	$31.361	$31.824	$32.437	$33.071	$33.716	$34.452
28	Transportation																
27	Propane	Energy Prices: Nominal: Transportation: Propane: Reference case	$26.339	$27.042	$27.812	$28.656	$29.506	$30.261	$31.312	$32.236	$32.985	$33.981	$35.052	$35.885	$36.856	$37.796	$38.709
28	E85	Energy Prices: Nominal: Transportation: E85: Reference case	$38.908	$40.006	$40.949	$42.048	$43.538	$44.485	$45.853	$47.229	$48.337	$49.926	$51.563	$52.912	$54.585	$56.020	$57.158
29	Motor Gasoline	Energy Prices: Nominal: Transportation: Motor Gasoline: Reference case	$33.184	$34.046	$35.046	$36.046	$37.254	$38.098	$39.268	$40.413	$41.400	$42.769	$44.160	$45.308	$46.714	$47.926	$48.889
28	Jet Fuel	Energy Prices: Nominal: Transportation: Jet Fuel: Reference case	$23.348	$24.019	$24.827	$25.746	$26.583	$27.327	$28.235	$29.098	$29.828	$30.991	$32.221	$33.141	$34.266	$35.211	$35.964
29	Diesel Fuel (distillate fuel	Energy Prices: Nominal: Transportation: Diesel Fuel: Reference case	$32.238	$33.088	$34.075	$35.118	$36.097	$37.028	$38.181	$39.227	$40.141	$41.490	$42.918	$44.070	$45.396	$46.538	$47.508
30	Residual Fuel Oil	Energy Prices: Nominal: Transportation: Residual Fuel Oil: Reference case	$20.632	$21.136	$21.582	$22.109	$22.879	$23.307	$24.338	$25.096	$25.805	$26.899	$27.877	$28.674	$29.592	$30.364	$31.005
29	Natural Gas	Energy Prices: Nominal: Transportation: Natural Gas: Reference case	$16.630	$16.758	$16.966	$17.194	$17.443	$17.689	$18.047	$18.387	$18.676	$19.049	$19.389	$19.755	$20.152	$20.560	$20.945
30	Electricity	Energy Prices: Nominal: Transportation: Electricity: Reference case	$50.919	$51.608	$52.364	$53.208	$54.069	$54.961	$55.954	$56.916	$57.925	$58.832	$59.756	$60.852	$61.932	$62.955	$64.088
31	Electric Power																
30	Distillate Fuel Oil	Energy Prices: Nominal: Electric Power: Distillate Fuel Oil: Reference case	$26.838	$27.568	$28.438	$29.365	$30.166	$30.936	$31.969	$32.836	$33.642	$34.795	$36.043	$37.039	$38.309	$39.302	$40.104
31	Residual Fuel Oil	Energy Prices: Nominal: Electric Power: Residual Fuel Oil: Reference case	$20.751	$21.265	$21.709	$22.257	$23.003	$23.486	$24.352	$24.964	$25.444	$26.253	$26.873	$27.168	$28.182	$28.978	$29.711
32	Natural Gas	Energy Prices: Nominal: Electric Power: Natural Gas: Reference case	$5.129	$5.201	$5.306	$5.427	$5.571	$5.691	$5.870	$5.995	$6.097	$6.221	$6.280	$6.400	$6.536	$6.666	$6.844
31	Steam Coal	Energy Prices: Nominal: Electric Power: Steam Coal: Reference case	$2.557	$2.594	$2.630	$2.684	$2.743	$2.800	$2.871	$2.929	$2.979	$3.029	$3.089	$3.154	$3.221	$3.284	$3.344
32	Uranium	Energy Prices: Nominal: Electric Power: Uranium: Reference case	$0.993	$1.018	$1.043	$1.068	$1.095	$1.122	$1.151	$1.180	$1.211	$1.242	$1.274	$1.306	$1.340	$1.374	$1.409
33	Average Price to All Users																
32	Propane	Energy Prices: Nominal: Average Price to All Users: Propane: Reference case	$31.452	$32.370	$33.327	$34.351	$35.395	$36.350	$37.588	$38.751	$39.735	$40.925	$42.216	$43.295	$44.474	$45.630	$46.754
33	E85	Energy Prices: Nominal: Average Price to All Users: E85: Reference case	$38.908	$40.006	$40.949	$42.048	$43.538	$44.485	$45.853	$47.229	$48.337	$49.926	$51.563	$52.912	$54.585	$56.020	$57.158
34	Motor Gasoline	Energy Prices: Nominal: Average Price to All Users: Motor Gasoline: Reference case	$33.193	$34.056	$35.056	$36.056	$37.264	$38.109	$39.279	$40.425	$41.413	$42.782	$44.173	$45.322	$46.729	$47.941	$48.904
33	Jet Fuel	Energy Prices: Nominal: Average Price to All Users: Jet Fuel: Reference case	$23.348	$24.019	$24.827	$25.746	$26.583	$27.327	$28.235	$29.098	$29.828	$30.991	$32.221	$33.141	$34.266	$35.211	$35.964
34	Distillate Fuel Oil	Energy Prices: Nominal: Average Price to All Users: Distillate Fuel Oil: Reference case	$31.313	$32.133	$33.077	$34.120	$35.069	$35.952	$37.071	$38.080	$38.969	$40.282	$41.666	$42.793	$44.089	$45.180	$46.117
35	Residual Fuel Oil	Energy Prices: Nominal: Average Price to All Users: Residual Fuel Oil: Reference case	$20.450	$20.947	$21.382	$21.892	$22.658	$23.068	$24.107	$24.855	$25.554	$26.639	$27.606	$28.381	$29.296	$30.065	$30.699
34	Natural Gas	Energy Prices: Nominal: Average Price to All Users: Natural Gas: Reference case	$8.244	$8.394	$8.576	$8.778	$8.976	$9.177	$9.405	$9.603	$9.773	$9.975	$10.110	$10.308	$10.523	$10.744	$10.981
35	Metallurgical Coal	Energy Prices: Nominal: Average Price to All Users: Metallurgical Coal: Reference cas	$4.237	$4.366	$4.502	$4.647	$4.790	$4.933	$5.088	$5.243	$5.398	$5.560	$5.733	$5.911	$6.098	$6.284	$6.465
36	Other Coal	Energy Prices: Nominal: Average Price to All Users: Other Coal: Reference case	$2.642	$2.685	$2.728	$2.787	$2.850	$2.911	$2.988	$3.051	$3.106	$3.162	$3.229	$3.299	$3.371	$3.440	$3.505
35	Coal to Liquids	Energy Prices: Nominal: Average Price to All Users: Coal to Liquids: Reference case	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
36	Electricity	Energy Prices: Nominal: Average Price to All Users: Electricity: Reference case	$42.225	$42.904	$43.757	$44.491	$45.244	$46.261	$47.281	$48.163	$49.210	$50.200	$50.977	$52.127	$53.223	$54.273	$55.583
37	Non-Renewable Energy Expenditures by Sector																
36	(billion nominal dollars)																
37	Residential	Energy Expenditures: Nominal: Non-Renewable Residential: Reference case	$388.632	$397.516	$408.180	$418.841	$429.649	$442.124	$454.806	$466.882	$480.186	$493.362	$505.555	$520.601	$535.426	$550.243	$566.615
38	Commercial	Energy Expenditures: Nominal: Non-Renewable Commercial: Reference case	$266.954	$272.417	$279.126	$285.694	$292.355	$300.537	$308.675	$316.275	$324.933	$333.954	$341.549	$351.546	$361.379	$370.901	$382.056
37	Industrial	Energy Expenditures: Nominal: Non-Renewable Industrial: Reference case	$325.373	$335.253	$346.381	$359.348	$372.173	$383.171	$397.910	$412.686	$425.943	$440.551	$455.161	$469.072	$485.456	$499.617	$512.552
38	Transportation	Energy Expenditures: Nominal: Non-Renewable Transportation: Reference case	$827.069	$848.086	$872.939	$900.212	$930.228	$954.622	$987.114	$1,018.674	$1,047.361	$1,087.026	$1,128.338	$1,164.267	$1,207.456	$1,245.261	$1,277.422
39	Total Non-Renewable Exp	Energy Expenditures: Nominal: Total Non-Renewable: Reference case	$1,808.028	$1,853.271	$1,906.627	$1,964.095	$2,024.405	$2,080.453	$2,148.504	$2,214.517	$2,278.422	$2,354.893	$2,430.603	$2,505.487	$2,589.718	$2,666.021	$2,738.645
38	Transportation Renewabl	Energy Expenditures: Nominal: Renewable Transportation: Reference case	$0.936	$0.933	$0.953	$0.971	$0.990	$1.014	$1.048	$1.082	$1.120	$1.166	$1.215	$1.261	$1.315	$1.369	$1.419
39	Total Expenditures	Energy Expenditures: Nominal: Reference case	$1,808.965	$1,854.204	$1,907.580	$1,965.066	$2,025.394	$2,081.467	$2,149.552	$2,215.599	$2,279.542	$2,356.059	$2,431.818	$2,506.748	$2,591.033	$2,667.391	$2,740.064

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Table 3. Energy Prices by Sector and Source
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						CAGR	
Line no.	Sector	full name	2049	2050	Growth (2021-2050)	2027-2050	2022-2027
22	Distillate Fuel Oil	Energy Prices: Nominal: Residential: Distillate Fuel Oil: Reference case	$51.420	$52.496	3.10%		
21	Natural Gas	Energy Prices: Nominal: Residential: Natural Gas: Reference case	$22.100	$22.628	2.30%		
22	Electricity	Energy Prices: Nominal: Residential: Electricity: Reference case	$71.275	$72.438	2.20%		
23	Commercial						
22	Propane	Energy Prices: Nominal: Commercial: Propane: Reference case	$43.265	$44.207	3.00%		
23	Distillate Fuel Oil	Energy Prices: Nominal: Commercial: Distillate Fuel Oil: Reference case	$42.244	$43.071	2.40%		
24	Residual Fuel Oil	Energy Prices: Nominal: Commercial: Residual Fuel: Reference case	$25.570	$25.993	4.90%		
23	Natural Gas	Energy Prices: Nominal: Commercial: Natural Gas: Reference case	$16.801	$17.201	2.50%		
24	Electricity	Energy Prices: Nominal: Commercial: Electricity: Reference case	$55.862	$56.607	1.90%		
25	Industrial						
24	Propane	Energy Prices: Nominal: Industrial: Propane: Reference case	$32.938	$33.640	3.20%		
25	Distillate Fuel Oil	Energy Prices: Nominal: Industrial: Distillate Fuel Oil: Reference case	$41.689	$42.504	2.30%		
26	Residual Fuel Oil	Energy Prices: Nominal: Industrial: Residual Fuel Oil: Reference case	$29.361	$29.941	5.10%		
25	Natural Gas	Energy Prices: Nominal: Industrial: Natural Gas: Reference case	$8.500	$8.687	1.90%	2.71%	
26	Metallurgical Coal	Energy Prices: Nominal: Industrial: Metallurgical Coal: Reference case	$6.655	$6.863	1.90%		
27	Other Industrial Coal	Energy Prices: Nominal: Industrial: Other Industrial Coal: Reference case	$5.127	$5.252	2.30%		
26	Coal to Liquids	Energy Prices: Nominal: Industrial: Coal to Liquids: Reference case	$0.000	$0.000	- -		
27	Electricity	Energy Prices: Nominal: Industrial: Electricity: Reference case	$35.131	$35.717	1.70%	2.03%	
28	Transportation						
27	Propane	Energy Prices: Nominal: Transportation: Propane: Reference case	$39.559	$40.421	2.90%		
28	E85	Energy Prices: Nominal: Transportation: E85: Reference case	$58.526	$59.860	3.00%		
29	Motor Gasoline	Energy Prices: Nominal: Transportation: Motor Gasoline: Reference case	$50.040	$51.175	2.40%		
28	Jet Fuel	Energy Prices: Nominal: Transportation: Jet Fuel: Reference case	$36.867	$37.599	3.30%		
29	Diesel Fuel (distillate fuel	Energy Prices: Nominal: Transportation: Diesel Fuel: Reference case	$48.558	$49.553	2.60%		
30	Residual Fuel Oil	Energy Prices: Nominal: Transportation: Residual Fuel Oil: Reference case	$31.779	$32.433	3.40%		
29	Natural Gas	Energy Prices: Nominal: Transportation: Natural Gas: Reference case	$21.352	$21.759	1.40%		
30	Electricity	Energy Prices: Nominal: Transportation: Electricity: Reference case	$65.222	$66.290	1.80%		
31	Electric Power						
30	Distillate Fuel Oil	Energy Prices: Nominal: Electric Power: Distillate Fuel Oil: Reference case	$41.011	$41.844	2.30%		
31	Residual Fuel Oil	Energy Prices: Nominal: Electric Power: Residual Fuel Oil: Reference case	$30.499	$31.186	3.10%		
32	Natural Gas	Energy Prices: Nominal: Electric Power: Natural Gas: Reference case	$6.965	$7.107	1.10%		
31	Steam Coal	Energy Prices: Nominal: Electric Power: Steam Coal: Reference case	$3.423	$3.496	1.80%		
32	Uranium	Energy Prices: Nominal: Electric Power: Uranium: Reference case	$1.445	$1.483	2.50%		
33	Average Price to All Users						
32	Propane	Energy Prices: Nominal: Average Price to All Users: Propane: Reference case	$47.800	$48.833	3.20%	3.23%	
33	E85	Energy Prices: Nominal: Average Price to All Users: E85: Reference case	$58.526	$59.860	3.00%		
34	Motor Gasoline	Energy Prices: Nominal: Average Price to All Users: Motor Gasoline: Reference case	$50.056	$51.192	2.40%		
33	Jet Fuel	Energy Prices: Nominal: Average Price to All Users: Jet Fuel: Reference case	$36.867	$37.599	3.30%		
34	Distillate Fuel Oil	Energy Prices: Nominal: Average Price to All Users: Distillate Fuel Oil: Reference case	$47.128	$48.061	2.50%		
35	Residual Fuel Oil	Energy Prices: Nominal: Average Price to All Users: Residual Fuel Oil: Reference case	$31.464	$32.107	3.40%		
34	Natural Gas	Energy Prices: Nominal: Average Price to All Users: Natural Gas: Reference case	$11.212	$11.438	1.90%	2.60%	
35	Metallurgical Coal	Energy Prices: Nominal: Average Price to All Users: Metallurgical Coal: Reference cas	$6.655	$6.863	1.90%		
36	Other Coal	Energy Prices: Nominal: Average Price to All Users: Other Coal: Reference case	$3.588	$3.665	2.00%		
35	Coal to Liquids	Energy Prices: Nominal: Average Price to All Users: Coal to Liquids: Reference case	$0.000	$0.000	- -		
36	Electricity	Energy Prices: Nominal: Average Price to All Users: Electricity: Reference case	$56.727	$57.605	2.00%		
37	Non-Renewable Energy Expenditures by Sector						
36	(billion nominal dollars)						
37	Residential	Energy Expenditures: Nominal: Non-Renewable Residential: Reference case	$582.395	$596.773	2.70%		
38	Commercial	Energy Expenditures: Nominal: Non-Renewable Commercial: Reference case	$392.815	$402.173	2.50%		
37	Industrial	Energy Expenditures: Nominal: Non-Renewable Industrial: Reference case	$527.264	$545.074	3.40%		
38	Transportation	Energy Expenditures: Nominal: Non-Renewable Transportation: Reference case	$1,315.547	$1,354.256	2.80%		
39	Total Non-Renewable Exp	Energy Expenditures: Nominal: Total Non-Renewable: Reference case	$2,818.022	$2,898.277	2.80%		
38	Transportation Renewabl	Energy Expenditures: Nominal: Renewable Transportation: Reference case	$1.477	$1.537	1.70%		
39	Total Expenditures	Energy Expenditures: Nominal: Reference case	$2,819.498	$2,899.813	2.80%		

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

ELECTRONICALLY SUBMITTED AFFIRMATION OF JOHN J. REED

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

In accordance with 1.2.2.10(E) NMAC, John J. Reed, Consultant for New Mexico Gas Company, Inc., upon being duly sworn according to law, under oath, deposes and states under penalty of perjury under the laws of the State of New Mexico: I have read the foregoing Direct Testimony and Exhibits, and they are true and accurate based on my personal knowledge and belief.

SIGNED this 15th day of December 2022.

/s/John J. Reed
John J. Reed
Chairman and CEO
Concentric Energy Advisors, Inc.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	**))))))**	
	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	**))**	
APPLICANT.	**))**	

DIRECT TESTIMONY

OF

MICHAEL A. BARCLAY

December 16, 2022

DIRECT TESTIMONY OF
MICHAEL A. BARCLAY
NMPRC CASE NO. 21-_____-UT

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Michael Arthur Barclay. My business address is 2737 78th Ave SE, Suite 203, Mercer Island, WA 98040.

Q. BY WHOM AND IN WHAT CAPACITY ARE YOU EMPLOYED?

A. I am the Technical Director for The Lisbon Group LLC ("Lisbon").

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE AND STATE WHETHER YOU HAVE PREVIOUSLY TESTIFIED BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION ("NMPRC" OR THE "COMMISSION").

A. I earned a Bachelor of Science in Geology and Geophysics from the University of Wisconsin – Madison and graduated with Honors and Honor within the Major. I earned a Master of Science in Mechanical Engineering from Pennsylvania State University, where I was awarded the President's Fellowship and a University Graduate Fellowship.

Prior to joining Lisbon, I had a varied career working across operations, design, project development, equipment fabrication, and construction of liquefied natural gas ("LNG") facilities. Some of the key roles I have had include:

- Principal Process LNG Consultant for BG Group plc, a multi-national LNG-centric exploration and production company. In this role I provided process technical support and assurance for BG's LNG facilities worldwide.

- Principal Process Engineer for Foster-Wheeler Energy Limited. I led their LNG Core Team and participated in gas processing and LNG projects, primarily in lead, LNG consulting, and risk management and assurance related roles.
- Process Manager CryoFuel Systems, Inc. I led their process group and was responsible for design of LNG processing equipment from concept design through to commissioning and start-up.

As I stated earlier, I am currently the Technical Director of Lisbon. In this position, I am responsible for the quality and content of the work product generated by Lisbon, which focuses on developing front-end engineering, project execution, and facility operations of LNG peak shaving and similar gas processing facilities. I have been with Lisbon for approximately ten years, and during that time I have worked on over 30 LNG projects across six continents.

I have authored multiple publications and presented at industry conferences. I invented technologies resulting in more than ten patents related to LNG liquefaction processes and advanced thermodynamic cycles, floating LNG, LNG heat exchangers, LNG transfer technology, and cryogenic pretreatment and separation.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE NMPRC OR ANY OTHER REGULATORY BODY?

A. No, I have not.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?

A. The purpose of my Direct Testimony is to support New Mexico Gas Company, Inc.'s ("NMGC" or the "Company") proposed LNG Storage Facility (the "LNG Facility") and discuss the work that went into the preliminary front-end engineering design ("pre-FEED") report prepared by Lisbon which was introduced in this matter as NMGC Exhibit TCB-3.

Q. PLEASE DESCRIBE LISBON'S ENGAGEMENT BY NMGC.

A. NMGC engaged Lisbon to provide Owner's Engineer ("OE") services in the development of a proposed LNG peak shaving plant.

Q. WHAT WAS LISBON ASKED TO DO IN THIS CASE?

A. As the OE, Lisbon worked with NMGC to determine the capabilities NMGC will need for an LNG facility and conducted the pre-FEED study. As part of the pre-FEED, Lisbon generated documents such as the Basis of Design, Process Flow Diagrams, key project philosophies, layouts, and siting study. Collectively, the pre-FEED serves as the technical description of the LNG Facility.

Q. PLEASE DESCRIBE YOUR BACKGROUND AND HISTORY IN THE DESIGN CONSTRUCTION AND OPERATION OF LNG FACILITIES SIMILAR TO THE ONE BEING PROPOSED BY NMGC AS PART OF THIS FILING.

A. My background with LNG system design, construction, and operation goes back to 1997 when I began working with liquefaction systems specifically (nitrogen (N2) expander liquefaction / mole sieve pretreatment for a number of projects that included similar process line-up and technology to this project. In the following sections I will break down this experience in more detail.

I have worked with over ten LNG facilities using similar liquefaction and pretreatment technologies as the proposed NMGC LNG Facility during the past 25 years. In the past three years I have conducted work for six LNG peak shaving facilities with similar facilities or processes. This work included a range of activities ranging from pre-FEED assessment of new production train, reliability assessments, fire safety assessments, regen gas heater replacement, boil off gas ("BOG") compressor replacement, booster compression addition design, and pretreatment upgrade projects.

I have been involved in multiple LNG construction activities similar, larger and smaller than the proposed NMGC LNG Facility. I have worked on LNG projects in the Mountain West Region, an LNG production and storage facility near Monticello, Utah in 2007 and in the Southwest Region the installation, construction, commissioning, and start-up of a merchant LNG facility near Seminole, Texas in 2020. Both facilities are approximately seven hours from Rio Rancho, New Mexico. Lisbon continues to be responsible for a 49 Code of Federal Regulations ("CFR") Section 193 compliant operating and maintenance program, remote monitoring, operator training for the facility in Texas and I have spent a number of months at that facility and years working with some of their operators.

My operational experience at similar LNG facilities includes a range of activities from operational program development and new facility start-up through to troubleshooting, conducting operator training, and supporting on-going operations as a technical authority. For example, I recently worked on a Tacoma LNG facility, specifically commissioning and start-up, as well as operational stand-up activities.

Q. PLEASE IDENTIFY THE TEAM AT LISBON WHO ASSISTED YOU IN YOUR EFFORTS TO PREPARE THE PRE-FEED STUDY IN THIS CASE.

A. The following personnel assisted me in preparation of the pre-FEED:

- Josue Zapata, Engineering Consultant, who has 16 years of LNG and natural gas facility design and operations experience. Mr. Zapata has worked on numerous LNG projects in the US and in four countries. He has worked on numerous feasibility, pre-FEED, front end engineering design ("FEED"), detail design, and operation stand-up of LNG peak shaver projects.
- Santanu Mukhopadhyay, Process Engineering Consultant, who has 30 years of LNG, natural gas facility, and hydrocarbon processing design experience. Mr. Mukhopadhyay has held the roles of Engineering Consult, Process Lead, and Principal Process Engineer on multiple LNG peak shaver upgrade projects, peak shaver troubleshooting projects, as well as safety and reliability assessments.
- Scott Schulte, Electrical, Instrumentation and Controls Engineering Consultant, who has 30 years of LNG, natural gas facility, and hydrocarbon processing

design experience. Mr. Schulte has been involved with multiple peak shaving projects related to mole sieve pretreatment, controls integration and communication, equipment modification and replacement, and facility rejuvenation.

- Doug Elkins, Project Engineering, who has 15 years of LNG and natural gas experience. Mr. Elkins has worked on the Shell Elba Island LNG Export Facility, IEC Mid-scale LNG Nigeria, Shell MMLS, and multiple LNG peak shaver upgrade projects
- Greg Garrett, Process Engineering Consultant, who has 30 years of LNG, natural gas facility, and hydrocarbon processing design experience. Mr. Garrett's prior relevant roles including Engineering Consultant and Lead Process Engineer for multiple LNG export facilities, a merchant plant using N2 expander technology in Mexico, and multiple LNG peak shaver upgrade projects. Mr. Garrett has also had LNG facility support role and has been held the technical authority lead role for one of Lisbon's LNG peak shaving plants.
- Wyatt Doop, Senior Operations and Process Engineer, who has eight years of LNG and natural gas facility design, operations and CSU experience. Mr. Doop has had broad experience with LNG, including being an engineering consulting and working in operations stand-up, start-up, and commissioning of LNG peak shaver facilities, operations stand-up, start-up, and commissioning of LNG peak shaver and small-scale LNG marine terminal, and peak shaver fire safety and hazards assessments.

- Jerome Mullins, Electrical Engineering Consultant, who has 43 years of industry experience within power generation, agriculture, pulp and paper, LNG, and natural gas processing. He has supported LNG projects on three continents and been involved with multiple similar LNG projects.

Q. WHAT IS A PRE-FEED STUDY?

A. A pre-FEED study is a preliminary engineering activity conducted to establish the feasibility, make key decisions, and define the cost, schedule, and economic case for a project. One important part of a pre-FEED study is to define the engineering design, capital and operating cost, risks around a project development concept in sufficient detail to make good, well-informed decisions to progress the project.

Site selection is an important part of a pre-FEED study. LNG facilities generally have rigorous siting requirements, and layout development and evaluation of site dispersion and thermal radiation is fundamental to site selection.

Engineering deliverables are progressed in a pre-FEED study to allow the operating and capital costs to be estimated. In this case for NMGC's LNG Facility, the deliverables were progressed to the level of technical definition required to support an Association for the Advancement of Cost Engineering ("AACE") class IV estimate. The pre-FEED study contains extensive base equipment and package costs based on recent study specific vendor responses as well as recent projects with similar features at other peak shaving facilities. As such the project level of definition, understanding of the project, and associated cost components is well advanced for AACE Class 4 (e.g., total preparation effort is greater than the standard AACE range) and approaches AACE class III in many areas. Due to the level of definition and familiar subject matter for the estimator, the accuracy Range is placed close to the low end for AACE class IV and within typical AACE class III range. Lisbon is providing the following level of price accuracy:

Estimate Class:	AACE class IV
Accuracy Range:	-20% / +25%.

Commensurate with the level of detail and accuracy range, the estimate for LNG Facility used techniques typically applicable to both Class 3 and Class 4 estimates. Class 4 estimating methodology typically relies heavily on equipment factoring and / or parametric estimating models based on previous project. As a CAPEX estimate transitions to Class 3 level of accuracy, it increasingly relies on semi-detailed unit costs with assembly (equipment and component) level line items. LG used cost our cost database, study specific enquiry responses, and recent projects completed through detailed design and FEED including those related to STV vaporization, BOG compression, and MS-only pretreatment completed within the past two years.

Q. HOW DOES A PRE-FEED STUDY COMPARE TO A FEED STUDY?

A. A pre-FEED study is less detailed, and less costly than a FEED study and is usually completed before a FEED. A pre-FEED activity is completed to make key decisions (site selection, storage capacity, vaporization capacity, technology selection) and understanding project economics and associated estimates, schedule, and risks. A FEED is a more detailed study and often completed to arrive at a more detailed set of estimates of capital and operating costs, schedule, and execution strategy. Because it is more detailed and project teams are bigger, a FEED is completed on a single concept selected in pre-FEED to control costs since deliverables are developed in more detail.

The FEED is often developed as part of the upfront engineering design to progress the level of engineering definition to support the execution of a lump sum turnkey ("LSTK") contract to be executed. The deliverables are progressed to enable a material take off for mechanical, electrical, instrumentation and controls ("EIC"), and civil/structural disciplines sufficient to support the AACE Class II (+10%/-20%).

The activity includes the preliminary process package along with sufficient mechanical and electrical engineering to enable the LSTK contractor competitive bids. The Engineering, Procurement and Construction Management ("EPCM") model provides value by putting engineering, procurement, and construction suppliers in competition for evaluation of qualifications, schedule and price.

Contract negotiations are anticipated to take place concurrently with engineering to enable execution of LSTK or cost-plus contract at the end of FEED.

Q. HOW DID LISBON GO ABOUT PREPARING THE PRE-FEED?

A. Lisbon mobilized a study team resourced from our Seattle and Houston offices to complete the pre-FEED work. In January of 2022, a four-person Lisbon leadership team, including myself, went to an in-person kick-off meeting in Albuquerque to discuss the project, meet key personnel, and visit the potential sites to collect basis information and collective knowledge.

The pre-FEED was completed using industry standard tools, methods, reference project, and software. The first activity was to define the basis of design, establish the applicable codes and standards, and the environmental conditions relevant to the facility.

To make key decisions and support the capital cost estimating, a number of datasheets and package specifications were developed for the LNG storage tank, liquefaction and refrigeration process, LNG pump, BOG compressors, and pretreatment. Collectively this equipment represents the majority of the project capital expenditures and power consumption. This information, coupled with Lisbon's industry experience and cost estimating database were used to support key decisions and develop capital cost estimates.

A number of industry standard or mandated software programs were used to develop the pre-FEED. This includes Aspen Hysys for process simulation, GTI LNGFire3 for radiation exclusion zone calculations, and Det Norske Veritas ("DNV") Phast V6.7 for dispersion exclusion zone calculations.

Q. TELL US ABOUT LISBON'S INTERACTIONS WITH NMGC.

A. Lisbon and NMGC held weekly project meetings for many months. NMGC provided technical input information including gas composition data, system demand data, and potential site locations. Lisbon then prepared technical options for NMGC to review, discussion, and ultimately decided upon.

Q. WERE MORE THAN ONE SITE LOCATION EVALUATED FOR THE PROJECT?

A. Yes. Analysis was completed to select the site for the LNG Facility between an existing NMGC property and a 160-acre undeveloped parcel, both in Rio Rancho adjacent to existing transmission pipelines and approximately ten miles to the northwest of Albuquerque. The two sites evaluated for the development of the LNG Facility were:

- Quail Ranch: An undeveloped 160-acre site.
- Santa Fe Junction: Co-located at the NMGC owned Santa Fe Junction compressor station property.

Both properties offered good access to relevant transmission pipelines, road infrastructure, required limited site preparation (grading, cut/fill, and scrubbing), and other utilities. The Santa Fe Junction property is significantly smaller than the Quail Ranch property but was considered because it might allow for a reduced cost facility due to synergies with existing operations on the site and reduced property acquisition costs.

Acceptability of the sites were screened by applying federal LNG facility siting dispersion criteria defined in *49 CFR Section 193.2059 Flammable Vapor-Gas Dispersion Protection* and associated sections of National Fire Prevention Association ("NFPA") 59A-2001. The results of this analysis indicated that the Quail Ranch site is expected to be a good fit for the LNG Facility and will be able to comply with stringent siting requirements. The results for the alternative Santa Fe Junction site, although offering synergies with existing NMGC facilities, indicate this site is too small for the LNG Facility.

Q. HOW DOES THE NMGC LNG FACILITY COMPARE WITH OTHERS YOU HAVE BEEN INVOLVED WITH?

A. The NMGC LNG Facility is very similar to other LNG peak shaver plants Lisbon has been involved with. It uses well-proven equipment, technology and capacities that are regularly applied in the industry.

The one billion cubic foot ("Bcf") single containment LNG storage tank is very similar to other LNG storage facilities Lisbon has been involved with. This is because the tank size is a standard size, and is the most frequent tank size in the industry with over 20 LNG storage tanks sized at 1 Bcf. In fact, I am currently involved in projects, and have attended sites within the past year, for four separate LNG storage facilities with 1 Bcf single containment storage tanks. In addition, I have previously worked with many other facilities with storage tanks in this size range, as it has been very popular starting in the 1970's as a good fit for peak shaving operations similar to the one proposed by NMGC. I also note this trend is continuing with three new storage tanks currently in construction that are between 1 and 1.2 Bcf, all of which are single containment LNG storage tanks.

Similar to the LNG storage tank, the liquefaction and vaporization systems use very well proven industry standard equipment. The capacity and technology are commonly used, and I am very experienced with them. For instance, I encountered N2 expander liquefaction in the 1990's, early in my career, and I am involved in a current project at a merchant facility that has half of the capacity of the LNG Facility.

Q. PLEASE PROVIDE A BRIEF SUMMARY OF YOUR UNDERSTANDING OF THE HISTORY OF LNG STORAGE FACILITIES IN THE UNITED STATES.

A. The United States has a long history of LNG storage and production starting with a history dating back to the 1940's. 1941 marked the first commercial LNG storage facility (peak shaver). The LNG industry was novel and adequate design and safety practices were not yet developed. Among these early facilities was the East Ohio Gas Company's Cleveland, Ohio facility that was the site of the worst LNG incident in history. This set the foundation for NFPA 59A and modern era safety practices that have resulted in a strong subsequent safety record.

The modern era of LNG storage facilities started in the mid-1960s with multiple plants being constructed and entering service starting in 1965. This included plants in California, Wisconsin, Alabama, New Jersey, New York, Tennessee, Oregon, Connecticut, Massachusetts, and other locations where they were installed to add security of cost-effective gas supply near populated areas. The LNG storage industry continued to expand since then and there are currently more than 100 LNG facilities in the United States, including ~70 units considered peak shaving facilities distributed throughout the country.

Once LNG storage facilities enter service they tend to function as reliable, long-term part of the gas utility's gas infrastructure. To date, I only know of three peak shaving facilities that have been decommissioned. The vast majority of LNG storage facilities remain in service serving the same function as they did when they were constructed. Lisbon regularly works with older facilities to rejuvenate, update, and upgrade them, and I have worked with some of the oldest facilities as well as newest facilities in the US.

LNG peak shaver facilities form a fundamental part of the United States energy infrastructure with direct impact in improving energy reliability and availability. Because natural gas is the largest source of energy used for the generation of electric power, LNG peak shaving facilities are fundamental to reliable electricity supply.

Q ARE LNG STORAGE FACILITIES COMMON IN THE UNITED STATES?

A. Yes. There are 70 active LNG facilities classified as peak shavers by the Pipeline and Hazardous Material Safety Administration ("PHMSA") located in 26 states along with a number of very similar LNG storage facilities classified as baseload or "other", often because they are not operated by the gas utility. Regionally, Dominion Energy in Utah is currently constructing a very similar LNG storage facility, and Southwest Gas Corporation in Arizona recently placed a facility into service in Tucson.

Q. PLEASE DESCRIBE THE PRIMARY PROPOSED OPERATING CHARACTERISTICS AND COMPONENTS OF THE LNG FACILITY DETAILED IN THE PRE-FEED STUDY.

A. As detailed in the pre-FEED, the NMGC LNG Facility provides the following key attributes which make it very functional for safe and reliable use by the Company:

- Store 1 Bcf (~12 million gallons) net natural gas in a single containment LNG storage tank.
- Send-out 195 million standard cubic feet per day ("MMscfd") natural gas to either of the on-network 16 inch or 24 inch transmission pipelines flowing through the eastern edge of the plot. To help achieve high reliability and availability of the vaporization facilities three parallel 65 MMscfd equipment sets (LNG pumps, vaporizers, and heating systems) are installed with interconnects.
- Fill and maintain LNG level in the storage tank, the facility will liquefy 10 MMscfd (net in-tank) of feed gas from either of the two transmission pipelines.

The proposed LNG Facility is planned to be located on a 160-acre site to the west of Albuquerque, New Mexico. The property is undeveloped and is part of a larger master-planned area that is zoned for industrial and commercial use.

This site is proposed for a number of reasons that make it technically suitable and cost-effective including proximity to power lines and gas pipelines, proximity to infrastructure for construction and operations with the eastern edge of the site located roughly 3,000 feet from Paseo Del Norte Boulevard. NE, commuting distance to Albuquerque, reasonable proximity to Interstate 40, the site is undeveloped, and is a sufficiently-sized plot and appropriately zoned site.

The LNG Facility offers three operating modes:

1. HOLDING mode– The facility has LNG in the storage tank but is neither adding to gas inventories or withdrawing through vaporization or liquefaction activities. During this time boil-off gas must be managed and controlled and safety systems are operational.
2. VAPORIZATION mode – The facility is actively vaporizing and sending-out gas. During this time, in addition to HOLDING mode functionality, the LNG pumps and vaporization facility are operational. Reliable performance during this period is critical because it underpins the purpose of the facility.
3. LIQUEFACTION mode – The facility is activity liquefying feed gas from the pipeline to rebuild inventories of stored gas. During this time, in addition to HOLDING mode functionality, the pretreatment and refrigeration systems are operational.

The LNG Facility is being designed to build levels in the storage tank when required throughout the year. This means it is possible to operate liquefaction throughout the year including through the heat of the summer as well as throughout the peak winter heating months. It is also possible to operate LNG unloading facilities during liquefaction to assist in tank level recovery if desired.

Reliability and operational flexibility of the LNG Facility are a key functional requirement that is reflected throughout the pre-FEED design. For example:

- The LNG Facility is being designed to be able to operate, and especially to vaporize and send-out natural gas to NMGC's pipelines, through extreme cold weather events. The minimum design ambient temperature of -20 degrees Fahrenheit is three (3) degrees Fahrenheit colder than the lowest recorded temperature at the site set in 1971.
- The LNG Facility will be able to send-out at full 195 MMscfd capacity when the grid power is not available (e.g., during power outage/blackout conditions) by running the included essential gas generator.
- The LNG pumps and vaporizers are supplied with three equipment line-ups to achieve send-out capability of 195 MMscfd in a 3 x 65 MMscfd arrangement. In the event of problem with an equipment item, it is possible to continue sending out natural gas at up to 130 MMscfd with any combination of LNG pump, vaporizer, and water-glycol heater arrangement for operational flexibility and high reliability.
- The LNG Facility is equipped with LNG trailer loading / unloading facility that allows the LNG storage tank to be topped-up by road tanker if needed and also allows NMGC to supply LNG to support other network activities such as pipeline outage and inspection work. It is possible to unload trailers with the facilities liquefaction system operational.
- The 3 x 65 MMscfd set of vaporization equipment offers a wide range of turn-down capabilities with the LNG pumps supplied with variable speed drives so that send-out of gas can occur over a wide range of volumes.

- The LNG Facility is also designed to allow liquefaction during the winter if it is commercially attractive. The N2 expander refrigeration system and the rest of liquefaction is designed to be started and brought into production within one shift throughout the year.

One important aspect of the LNG Facility to note is that it is a "closed system" and a number of design decisions have been taken to avoid the need to vent or flare un-combusted hydrocarbons from the facility during normal operations. These features include a full spare boil-off gas compressor installed so that when one compressor is down for maintenance or for repair, the other machine can compress all the boil-off and send it to NMGC's distribution network for use. A second feature is the selection of mole sieve pretreatment that is made possible by the available pipeline gas compositions and gas volumes processed at nearby Santa Fe Junction. Impurities that cannot be kept in the LNG like water and CO2 are rejected to a tail gas stream and returned to the pipeline to Santa Fe Junction during liquefaction. A third major decision is selection of an inert N2 refrigerant instead of a hydrocarbon containing refrigerant. This means the losses during system start-up shutdown and compressor seal losses normally do not contain any hydrocarbons. The net effect of these features is that during normal operations the facility is not sending hydrocarbons to vent or a flare and no common vent or flare is required, or provided at the LNG Facility.

Q. PLEASE EXPLAIN THE VALUE OF THESE OPERATING CHARACTERISTICS AND COMPONENTS.

A. The primary characteristics of the LNG Facility that affects operability are the tank size, liquefaction capability, vaporization capability, the ability to prepare the LNG Facility for quick operation resulting in speedy introduction of vaporized gas into the Company's system, the location of the LNG Facility in relation to the Company's load centers.

Q. WERE OTHER ALTERNATIVES TO THESE PRIMARY CHARACTERISTICS CONSIDERED?

A. Yes. Among the alternatives considered were larger or smaller tanks, higher liquefaction rate, higher and lower vaporization rates, and engineering changes throughout the LNG Facility to accommodate these primary specifications.

Q. WHO MADE THE FINAL DECISION ON TANK SIZE, AND LIQUEFACTION AND VAPORIZATION RATES?

A. The Company made the final decision and we consulted with them to help them analyze the alternatives. As they settled on these key decisions to meet their operating plan, we reflected these decisions in the pre-FEED study.

Q. PLEASE EXPLAIN WHAT GOVERNED THE DESIGN OF THE LNG FACILITY.

A. The LNG Facility is subject to 49 CFR Part 193: Liquefied Natural Gas Facilities: Federal Safety Standards, which incorporates NFPA 59a: Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG) – 2001/2006/2013. In 49 CFR Part 193. Any conflicts within 49 CFR Part 193 or any other applicable codes & standards, the requirements in 49 CFR Part 193 shall prevail followed by NFPA 59a, followed by applicable state and local level requirements. 49 CFR Part 193 incorporates NFPA 59a into law by reference and this standard, in turn, is an "umbrella standard" that references and incorporates many American Society of Mechanical Engineers standards, American Petroleum Institute standards, and other NFPA provisions by reference.

Q. IS THE NMGC LNG FACILITY DESIGNED TO OPERATE SAFELY AND RELIABLE WHEN PROPERLY MAINTAINED AND OPERATED?

A. Yes.

Q. WHAT ARE SOME OF THE SAFETY FEATURES INCLUDED IN THE NMGC LNG FACILITY?

A. Safety is a fundamental aspect of the LNG Facility's siting and design. Safety features and requirements are reflected in a number of the pre-FEED documents. Some of the main features are:

Facility siting and exclusion zones: Thermal radiation and dispersion exclusion evaluation in alignment with 49 CFR Part 193.2057 and 49 CFR Part 193.2059 was completed including due consideration of the incorporated sections of NFPA 59a-2001 and additional PHMSA guidance. The LNG Facility design and siting complies with two very important federal regulations intended to limit risk to the community:

i. 49 CFR Part 193.2057 requires LNG facility siting to evaluate thermal radiation to minimize the potential of damaging effects of fire reaching beyond a property boundary.

ii. 49 CFR Part 193.2059 requires LNG facility sites to establish a dispersion exclusion zone to minimize the potential of flammable gas mixtures and associated hazards from reaching beyond a property line that can be built upon.

Based on the analysis completed, both the proposed site and pre-FEED design comply with federal siting requirements that require provisions to minimize the possibility of the damaging effects of fire, or of a flammable mixture of vapors from a design spill, reaching beyond a property line that can be built upon and that would result in a distinct hazard.

Hazard Detection and Safety-Related Control Systems: The LNG Facility is planned to be equipped with a wide array of hazard detection and robust shutdown systems as typical for modern LNG peak shaving facilities. First, the LNG Facility will be provided with high integrity control system(s) that can segregate the facility components and trigger a safe, reliable shutdown of the facility. Additionally, there will be a hazards detection system that can detect a range of hazards and alert operators to those potential problems so that appropriate actions can be taken. The hazard detection system will incorporate fire and gas monitors, which will detect hazardous conditions such as the presence of flammable gas, abnormally high and low temperature, the presence of heat or flame, and the presence of smoke inside buildings.

Fire protection systems: The LNG Facility will be equipped with a set of industry standard fire protection systems to help safeguard the system and minimize the risk of escalation in the event of a fire or other incident. The LNG Facility will be equipped with a firewater system in compliance with NFPA 59a that will be capable of distributing and applying firewater to protect LNG containers, equipment, and other escalation targets from fire exposure and to assist in the control of unignited leaks and spills. A buried firewater ring will be installed around the LNG storage tank impoundment berm and other strategic locations in the plant to provide coverage to all LNG impoundment areas. Fire hydrants and fire monitors will be distributed around the facility in strategic locations, and connected to the firewater ring. In addition to the firewater system, there will be portable wheeled and hand-held fire extinguishers located throughout the facility.

LNG spill containment: Spill containment is the final important part of LNG facility design, and there will be a large earthen berm constructed at the site to contain spills from the LNG storage tank or LNG vaporizers. There will also be a concrete pit capable of collecting LNG release from other plant areas containing LNG, such as the LNG truck loading area. The site's LNG impoundment areas will be in line with guidance and requirements of NFPA 59A, 49 CFR 193 and associated written PHMSA guidance. This is an important aspect of LNG facility design that limits risk to the public.

Q. WHAT DO YOU RECOMMEND THE COMPANY DO TO PROPERLY MAINTAIN AND OPERATE THE LNG FACILITY?

A. There are clear and rigorous federal standards which dictate the minimum requirements related to the operations, maintenance, operator qualification and training, safety, and security of LNG facilities and it is recommended that NMGC follow these requirements. By their nature, these requirements cannot be complied with until the plant is constructed and getting close to operations. Typically, an operator will begin to establish a set of 49 CFR Part 193 compliant operating, maintenance, safety, and security programs during the final year of construction in preparation for commissioning and start-up when the programs go live. Personnel are typically hired during this time and undergo extensive, documented training in compliance with 49 CFR 193 *subpart H Personnel Qualifications and Training.*

Q. PLEASE DISCUSS THE ENVIRONMENTAL IMPACTS OF THE NMGC LNG FACILITY.

A. All industrial developments have some impact on the environment and this answer will focus on facility emissions.

NMGC asked Lisbon to design the LNG Facility to align with best industry practice to allow it to become a useful part of gas infrastructure increasing cost-effective, reliable gas supply to New Mexico while also being a steward to the environment where possible.

The LNG Facility will have the following impacts on the environment:

- The LNG Facility is situated within a 160-acre plot of land in Rio Rancho, New Mexico. This development will be visible during the day and at night with site lighting and navigational lights similar to other energy infrastructure projects.
- The LNG Facility will have a direct fired regeneration gas heater that uses fuel gas and emits some exhaust gasses. This has been specified with low nitrous-oxide and carbon monoxide emission and will be addressed in the air permit.

- The LNG Facility will have three direct-fired Water-Glycol heaters associated with the vaporization that combust fuel gas and emit exhaust gasses. These will be specified with air emission limits and will be addressed in the air permit.
- The LNG Facility has an essential gas generator that is fueled by natural gas and a firewater pump that is fueled by diesel that will be periodically tested in accordance with NFPA 59a and 49 CFR Part 193 requirements. These have emissions to air associated with stationary engines used for emergency purposes.
- The LNG Facility will have heaters and vaporizer heaters which will use natural gas, and thus emit carbon dioxide.
- The LNG Facility adds roads, concrete, and other improved surfaces and modifies stormwater collection and drainage on the site. This will be reflected in site civil design and permitted according to statutory requirements. Measures are taken throughout the LNG Facility initial design to prevent the inadvertent discharge of chemicals, such as glycol used as a heating media in the vaporizers from entering the stormwater management system. Industry standard measures to prevent soil contamination or release to the environment of oils (lubrication for compressors), glycols (heating media), fuels (diesel for firewater pump), and other chemicals present on-site will be taken. Impoundment and secondary impoundment areas affecting surface water drainage will include standard measures to prevent discharge of contaminated stormwater to the environment.
- The LNG Facility, similar to compressor stations or power plants, will emit some noise, particularly when operating in liquefaction mode with all coolers

and compression operational and flow through the pipes. Noise studies will be conducted in subsequent engineering phases, compressors are located in buildings to help with noise attenuation, and noise intensity levels fall within acceptable levels.

One aspect of environmental impact to highlight is the "closed" nature of the LNG Facility with no normal venting of hydrocarbons to the atmosphere. This is possible because of the selection of Mole Sieve pretreatment, BOG compressor redundancy, N2 inerting lines for LNG truck load facility, and other features that have been specified. The LNG Facility does not have a common vent system or a flare and does not normally emit any un-combusted hydrocarbons to the atmosphere. This is not unusual for peak shaving LNG facilities, but it is not a given and is important because it minimizes the environmental impact of this facility. Natural gas enters the facility off the Company's system, and when needed returns to the Company's system with limited venting to the atmosphere.

Finally, the LNG Facility, like all gas processing facilities will have some fugitive emissions to the environment. These are small releases from connection points and fittings, valves and instruments, and items like compressor seals. The design attempts to minimize these through design choices and the facility will be subject to the Protecting Our Infrastructure and Enhancing Safety Act, also known as the PIPES Act, requiring checking for leaks and taking corrective action. Plant features decreasing fugitive emissions include specification of the refrigeration system as N2 expander process eliminating mixed refrigerant leaks to atmosphere (no mixed refrigerant) and specification of the BOG compressor as screw compressors offering significantly lower fugitive emissions with no rod/piston seals.

Q. WHAT SIGNIFICANT DESIGN DECISIONS ABOUT THIS LNG FACILITY ARE YET TO BE DETERMINED?

A. As the project moves into the FEED and construction stages, some engineering and design alterations are inevitable. Typical upcoming design decisions will include selection of equipment types and vendors, tuning capacity around specific commercially available hardware where appropriate, detailed line sizing and insulation thickness as design is refined, and layout refinement based on more detailed survey and additional geotechnical boreholes. This is very normal in a project of this magnitude. The key decisions which include site location, LNG liquefaction technology, storage technology and pre-treatment technology are not anticipated to change.

Q. HAVE YOU DEVELOPED OPERATIONS AND OPERATING SAFETY PLANS FOR THE LNG FACILITY?

A. No. These are detail oriented, facility specific documents that take significant manhours and detailed facility information to develop. They are typically developed during project construction and revised in commissioning, so they are ready in advance of facility start-up and reflect the final design, construction, and fabrication details of the facility (as-built). Lisbon does develop operational programs, operating procedures, maintenance programs, and operating safety plans for LNG facilities and believes the pre-FEED is compatible with industry practices.

Q. IS THAT UNUSUAL?

A. No. Operations and Operating Safety Plans are normally not prepared until later in the design and construction phase of a project as the EPC is retained and engages in the construction of the project.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

ELECTRONICALLY SUBMITTED AFFIRMATION OF MICHAEL A. BARCLAY

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

In accordance with 1.2.2.10(E) NMAC, Michael A. Barclay, Consultant for New Mexico Gas Company, Inc., upon being duly sworn according to law, under oath, deposes and states under penalty of perjury under the laws of the State of New Mexico: I have read the foregoing Direct Testimony and Exhibits, and they are true and accurate based on my personal knowledge and belief.

SIGNED this 15th day of December 2022.

/s/ Michael A. Barclay
Michael A. Barclay
Technical Director
The Lisbon Group LLC

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

DIRECT TESTIMONY AND EXHIBITS

OF

EDWARD JONES

December 16, 2022

DIRECT TESTIMONY OF
EDWARD JONES
NMPRC CASE NO. 22-_____-UT

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Edward Jones, and I am the founder and President of JEI Engineering, Inc. My business address is 5751 Uptain Road, Chattanooga, TN 37411.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I graduated with a Bachelor of Science in Engineering from the University of Tennessee in 1988. I worked in design for application and installation for boilers and heat exchangers including piping and instrumentation until 1990. In 1990 I started working for a company called Marlboro Enterprises that primarily provided design for chemical processing and natural gas processing including liquified natural gas ("LNG") facilities as an instrumentation and mechanical engineer. I later became Director of Engineering, managing a team of approximately 18 Engineers and Designers. In, 2002 I opened my own company, which provides process, mechanical, electrical, and structural design primarily in support of LNG peak shaving facilities. I provide engineering and consulting support to base load LNG import terminals, base load LNG export terminals, peak shaving LNG facilities, satellite LNG facilities, and marine applications for LNG. I have spent close to 30 years working on projects involving LNG in the United States and internationally.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION ("NMPRC" OR THE "COMMISSION") OR ANY REGULATORY BODY?

A. No.

Q. ARE YOU A LICENSED PROFESSIONAL ENGINEER?

A. Yes. I hold professional engineer licenses in 20 states. A complete list of the jurisdictions in which I have a professional engineer license is contained in my curriculum vitae, which is attached as NMGC Exhibit EJ-1.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?

A. The purpose of my Direct Testimony is to provide a third-party engineering review and analysis of New Mexico Gas Company's ("NMGC" or the "Company") proposed LNG storage facility ("LNG Facility").

BACKGROUND OF LNG

Q. PLEASE EXPLAIN WHAT LNG IS.

A. LNG is natural gas that has been liquefied to reduce the specific volume and allow it to be more easily transported or stored. Approximately six hundred (600) standard cubic feet of natural gas occupies one (1) cubic foot in the liquid form. Creating LNG requires a couple of steps. First, the common components of pipeline-quality natural gas must be separated, and components such as water, carbon dioxide, heavy hydrocarbons, and odorants must be removed from the natural gas. The natural gas then must be cooled to approximately negative 260 degrees Fahrenheit, which is 292 degrees below freezing, if it is to be stored at close to atmospheric pressure. LNG is typically stored in a very well insulated storage tank to reduce the heat leak into the LNG and minimize the vaporization of the cold fluid.

Q. PLEASE PROVIDE A BRIEF HISTORY OF LNG.

A. The LNG industry started in the early 1900's when natural gas was liquefied as a means of extracting helium from the natural gas. The first commercial use of LNG in the United States was in the early 1940s. During the late 1960's and early 1970's LNG peak shaving and satellite facilities became popular, and many were built in the United States. There are approximately 110 facilities in operation today. LNG is now transported all over the world, mainly via specially designed cargo ships, and the United States is currently a significant exporter of LNG.

Q. PLEASE DESCRIBE WHAT YOU MEAN BY "LNG PEAK SHAVING."

A. In my Direct Testimony, I will use "peak shaving facilities" and "storage facilities" interchangeably. Peak shaving is the process whereby utilities remove natural gas from a transmission or distribution system and liquify it into LNG and store it in a large storage tank(s) for later use. Most peak shaving facilities liquefy gas during warmer months when there is surplus capacity and relatively lower commodity prices. During the winter or other times of peak demand, when gas supplies can be harder to purchase and gas prices are higher, utilities can vaporize LNG (convert from liquid to gas state) into their transmission or distribution systems to supplement the natural gas supplies.

Q. WHAT PURPOSES DO LNG STORAGE FACILITIES TYPICALLY SERVE?

A. One of the strengths of LNG storage facilities is that they can be built near load centers to quickly and efficiently inject gas supplies when and where needed. The control of these facilities is coordinated by system gas control and the operation can be timed to anticipate and support changes in the system.

LNG storage facilities can serve many roles. Public utilities across the country utilize LNG storage facilities to store gas either for later use in a transmission or distribution gas system, or to provide emergency fuel to operate electric generation facilities. When these facilities are used to provide gas during time of increased demand or interrupted supply, the facilities are commonly referred to as LNG peak shaving plants, as they are not meant to replace base loads, but are designed to supply utilities and their customers with incremental, or peak, loads. Smaller facilities consisting of smaller tank(s) and vaporizer(s) are sometimes placed at locations in the system to address specific area gas needs during times of peak demand. LNG to these facilities is frequently trucked in and replenished from a liquefaction facility.

LNG peak shaving facilities are also utilized to support maintenance on pipelines and to support loads during either planned or unplanned service interruptions. Today, utilities are more sophisticated than ever in the operation of LNG peak shaving facilities and generally design peak shaving facilities to be able to liquify gas at any time of the year after a large usage of the stored LNG, such as a storm or if the economics seem prudent. The amount of liquefaction, storage, and vaporization are all sized based on the specific requirements of the gas system.

Finally, there are also LNG liquefaction exports facilities which are located on the coasts of countries which have an abundance of natural gas and are used to treat and liquefy natural gas and store LNG before exporting it via large container ships.

Q. PLEASE GENERALLY DESCRIBE THE SAFETY HISTORY OF LNG STORAGE FACILITIES.

A. LNG has been widely used in the United States especially for peak shaving and especially since the mid-1960's and is reliable and safe in normal operations. The majority of peak shaving plants are still in operation today, and have operated safely for decades.

Q. ARE LNG STORAGE FACILITIES, SUCH AS THE ONE PROPOSED BY NMGC IN THIS CASE, SAFE AND RELIABLE WHEN PROPERLY DESIGNED, MAINTAINED AND OPERATED?

A. Yes. When these facilities are designed in accordance with the requirements of the codes and standards I previously identified and referenced; engineered and constructed by firms with competent personnel with established experience in the LNG industry, LNG storage facilities like the one proposed by NMGC are safe and reliable.

Q. WHAT IS THE BASIS FOR THIS OPINION?

A. My opinion is based on my long history of working with LNG facilities, my knowledge of the engineering principles involved in the construction and operation of LNG facilities, and my knowledge of regulations and industry standards.

Q. ARE THERE CURRENTLY ANY PERMANENT LNG STORAGE FACILITIES OPERATING IN LARGE METROPOLITAN AREAS?

A. Yes. Because LNG peak shaving facilities are most needed in areas of high natural gas load, these facilities are commonly needed in or near urban load centers. Modern safety and siting regulations ensure that operating a modern LNG peak shaving facility in an urban area is safe.

<u>GOVERNING REGULATIONS</u>

Q. ARE THERE LAWS THAT GOVERN THE DESIGN, CONSTRUCTION AND OPERATION OF LNG STORAGE FACILITIES?

A. Yes. There are two main regulations governing the construction and operation of LNG storage facilities; 49 CFR §193 and NFPA 59A (which is incorporated into 49 CFR §193 by reference).

Q. PLEASE DESCRIBE THE REQUIREMENTS OF 49 CFR § 193.

A. 49 CFR Section193 is the Federal Safety Standard for the siting, design, installation or construction, operation, maintenance and security of LNG facilities in the US. This code governs the construction and operation of LNG facilities and is enforced by both State and Federal authorities. 49 CFR §193 references and adopts many other codes, standards, and models/evaluation methods, such as: (1) NFPA 59A, (2) American Petroleum Institute Standard 620, and (3) Gas Technology Institute models/evaluation methods 04/0032, 04/0049 and 96/0396.5. Compliance with all of the codes and standards referenced in 49 CFR Section 193 is mandatory when constructing and operating an LNG facility.

There is some overlap between 49 CFR Section 193 and NFPA 59A in that both require safe siting, design, construction and operation of LNG facilities. NFPA 59A is described later in my Direct Testimony. Corrosion control, safe operating and maintenance, personal protective measures and record keeping requirements are specified in 49 CFR Section 193.

Q. PLEASE DESCRIBE NFPA 59A.

A. Pursuant to 49 CFR Section 193, all LNG storage facilities constructed after March 31, 2000 must comply with the referenced requirements of NFPA 59A.

NFPA 59A is a standard that has been developed over the past 50 years, with the first official edition issued in 1967. The standard is based on lessons learned from LNG facilities' operations, technical developments such as engineering modeling, and best practices developed by the LNG industry. NFPA 59A focuses chiefly on assuring personnel competence, and defining requirements on plant siting, equipment safety and plant safety systems. These include emergency shutdown systems, gas and fire detection and mitigation systems, and spill prevention and containment. Some of the other provisions and requirements of NFPA 59A are:

- both passive and active systems requirements to minimize the potential for LNG or vapor leaks and their associated hazards;
- siting requirements for LNG storage tanks, piping and process equipment; and
- requirements that the LNG plant designers, fabricators, operators and maintenance personnel be competent as shown by training and experience.

NFPA 59A also gives special attention to corrosion control, the handling of LNG and other refrigerants, and the selection of equipment including: piping and supports, valves, relief devices, vaporizers, pumps, compressors and storage tanks.

In addition to specifying safe and reliable equipment, NFPA 59A requires documentation and record keeping to assure that the proper materials, welding, procedures and methods are used for the handling of LNG and its vapors including methods for purging, transferring LNG, filling tanks and tank trucks. Additionally, NFPA 59A specifies reliability requirements such as electrical equipment, instrumentation, and hazard prevention. NFPA 59A also details the training requirements of operating and maintenance personnel and the development of procedures used by these personnel.

In summary, NFPA 59A is the national and international guidebook for safe and reliable construction, operation and maintenance of LNG facilities.

Q. WHO ENFORCES THESE REGULATIONS?

A. The regulations and requirements are enforced generally by the United States Pipeline and Hazardous Materials Safety Administration ("PHMSA"). In some jurisdictions, state regulators and PHMSA agree that the state regulator can take primary responsibility for enforcing these regulations.

Q. HAVE THESE REGULATIONS MADE LNG FACILITIES SAFER?

A. Yes. The regulations have addressed accidents that occurred in the past, and have made LNG facilities in the United States safer.

Q. HAVE THERE BEEN ANY ACCIDENTS AT LNG FACILITIES?

A. While there are LNG facilities operating safely around the world, over the years there have been several major incidents in the history of the industry.

The first one occurred in Cleveland, Ohio in 1944 which occurred after installing a larger fourth LNG storage tank on the site. The steel used to construct the failed LNG storage tank contained 3.5% nickel which experienced a brittle failure and resulted in a serious leak which carried over into the adjacent plant utility area and entered the storm sewer system. A vapor cloud formed and covered the entire plant area and adjacent street system and ignited. The US Bureau of Mines investigated the incident and concluded that the liquefying and storing of LNG was sound “if proper precautions were observed”.

Today's regulations require that LNG storage tanks be constructed of suitable steel such as austenitic stainless steel, aluminum, invar, or 9% nickel content steel. Additionally, today’s tanks have dikes around them to prevent any such leakage from spilling into sewers or offsite.

In 1979 there was a failure in an electrical seal on a high-pressure LNG pump at the Cove Point LNG facility that allowed vapors into an electrical equipment building approximately 200 feet away. A spark in the building caused an explosion. As a result of this incident there were major design code changes, including additions to National Fire Protection Association standard 59A ("NFPA 59A"). There have been no other incidents of this type recorded.

In 2004 a hydrocarbon refrigerant leak occurred at an LNG export facility in Algeria. The leak resulted in a fire in a boiler, which caused additional ignitions in the plant. In the NMGC LNG Facility, there will be gas detectors at the inlet air supply to the equipment. If a combustible gas is detected at the inlet air to the equipment, it will automatically shutdown.

In 2014, there was an accident at the Plymouth LNG Peak Shaving Plant in Plymouth, Washington. This accident occurred in the system that prepares natural gas for liquefaction, and specifically in the equipment and piping that is used to remove excess water vapor from natural gas before it is liquified. The accident occurred because the LNG facility was taken off-line for several months, and the liquefaction system was not appropriately purged before it was placed back into service. This allowed air to mix with natural gas in a mixture that allowed for ignition. Had the system been purged as required, the accident would not have occurred.

Finally, on June 8, 2022, there was an accident at the Freeport LNG export terminal in Houston, Texas. The cause of the accident is still under investigation, but we know that there was an explosion at a pipe rack near an LNG storage tank. Preliminary information indicates that a pipe containing LNG may have been over-pressurized, leading to the failure of the pipe. As I noted, however, the final determination of this accident has not yet been determined.

Q. WHAT CONCLUSIONS DO YOU DRAW FROM THESE INCIDENTS AND THEIR RELATIONSHIP TO THE PROPOSED NMGC FACILITY?

A. First and foremost, while there have been accidents within the industry, there are numerous LNG facilities safely operating throughout the US and the world. The industry has learned from these accidents and improved operating procedures and construction practices. The regulations and industry practices are meant to avoid these accidents. Additionally, technological advances and other improvements over the years, including significant regulatory oversight, mitigate the likelihood of recurrence of the incidents described above. There have not been any accidents that impacted public safety in the United States in decades.

Second, the recent accidents appear to be caused by operator errors, which can be mitigated through robust training. NMGC is committed to taking significant efforts to mitigate operator mistakes.

Third, I have reviewed the preliminary front end engineering and design ("pre-FEED") study prepared by Lisbon Engineering. The pre-FEED calls for a final design that is state of the art. The LNG Facility will be designed to avoid a repeat of the prior incidents. The likelihood of any significant incident at this facility is mitigated through these efforts, as well as the Company's commitment to training, which I discuss later in my Direct Testimony.

ENGINEERING DESIGN OPINIONS

Q. WOULD YOU PLEASE BRIEFLY DESCRIBE WHAT A PRE-FEED STUDY IS IN RELATION TO A PROJECT LIKE THE ONE NMGC IS PROPOSING?

A. Yes. A pre-FEED study is the first stage of designing and engineering a large-scale construction project. Pre-FEED studies confirm the technical feasibility of the proposed project, establish the key design criteria necessary for the project, and provide an initial cost estimate for the project.

Q. HAVE YOU REVIEWED THE PRE-FEED STUDY OF THE LNG FACILITY CREATED BY LISBON ENGINEERING?

A. Yes.

Q. DID YOU OBSERVE WHETHER THE PRE-FEED STUDY CALLS FOR A CLOSED SYSTEM, AND WHAT IS THE SIGNIFICANCE OF THIS?

A. Yes. To the greatest extent possible I would call this a closed system. This is important because it minimizes any environmental impact of the Company's LNG Facility. Natural gas enters the LNG Facility off the Company's system, and when needed returns to the Company's system with only emergency venting to the atmosphere.

Q. DO YOU HAVE AN OPINION AS TO WHETHER THE PROPOSED LNG FACILITY WILL BE SAFE AND RELIABLE?

A. Yes. While the pre-FEED is preliminary, it serves as a foundation for the overall design of the plant. The Company, working with Lisbon, have thought through many of the key aspects of a safe and reliable LNG facility. I understand that the Company will hire an engineering, procurement and construction ("EPC") contractor with significant experience in final design and construction of LNG facilities. These facts, combined with regulatory requirements and industry standards, indicate that the LNG Facility will be safe and reliable.

Q. WHAT IS THE BASIS FOR THIS OPINION?

A. My opinion is based on my long history of working with LNG facilities, my knowledge of the engineering principles involved in the construction and operation of LNG facilities, my knowledge of regulations and industry standards, and my review of the materials in this case.

Q. FROM AN ENGINEERING PERSPECTIVE, WHAT OCCURS AFTER THE PRE-FEED STUDY?

A. Once a pre-FEED study is completed, generally an EPC contractors (each an "EPC" contractor) are identified. Each of the EPCs often conduct a final front end engineering and design ("FEED") proposal. NMGC will then ultimately select a single EPC contractor, to prepare the final design and engineering of the project, and construct the facility. The

Company, assisted by Lisbon, will select the best design. The plant will then be constructed to specifications of the final design.

Q. IS IT NORMAL FOR A COMPANY PURSUING A PROJECT LIKE THE LNG FACILITY TO HAVE A PRE-FEED STUDY AT THIS STAGE?

A. Yes. Pre-FEED studies are a critical step in the process of constructing an LNG storage facility. As I noted, the next step is a FEED study and final design preparation, and those are more expensive and time-consuming undertakings. Without prior regulatory approval, I would not recommend a client undertake a full FEED study and design preparation for a project this size.

Q. NMGC WITNESS TOM C. BULLARD STATES THAT LISBON ENGINEERING WILL NOT WORK AS THE EPC ON THIS PROJECT IF IT IS APPROVED, AND INSTEAD WILL ACT AS AN OWNER'S ENGINEER. IS THIS A PRUDENT PROPOSAL BY NMGC?

A. Yes. Construction of LNG facilities is very complex, and involves many systems and equipment that are unique to the LNG industry. A company undertaking the construction of an LNG storage facility would be prudent to ensure it has an independent expert reviewing all of the EPC's proposed designs and equipment selections. An owner's engineer often brings value to projects by ensuring the facility is constructed to the owner's operating requirements, and can help minimize cost overruns.

RECOMMENDATIONS FOR OPERATING THE LNG FACILITY

Q. HAVE YOU BEEN ABLE TO REVIEW THE FINAL OPERATIONS AND OPERATIONS SAFETY PLANS FOR THE FACILITY?

A. No.

Q. WHY NOT?

A. They have not been finalized at this time.

Q. IS THAT UNUSUAL?

A. No. Safety and facility operations plans are normally not prepared until later in the final design and construction phase of a project as the EPC is retained and engaged in the design and construction of the project.

Q. DO YOU WORK WITH COMPANIES WHO ARE ACTIVELY OPERATING LNG FACILITIES?

A. Yes, I regularly work with clients who operate LNG storage facilities.

Q. BASED ON YOUR EXPERIENCE WITH OPERATING LNG STORAGE FACILITIES, DO YOU HAVE ANY RECOMMENDATIONS REGARDING THE OPERATION OF THE PROPOSED LNG FACILITY?

A. Yes. First and foremost, I recommend that the operating procedures be written and compiled before the construction of the facility is complete. This ensures that the construction of the facility matches the operating procedures.

Second, I recommend that NMGC conduct significant training of key personnel in the operation of LNG facilities before the facility goes into service. There are various training courses and professionals who conduct intensive training for LNG facility personnel.

Third, I recommend that the LNG Facility be staffed at all times, i.e. on a 24/7 basis, and that an engineer be on site any time the plant is either liquifying or vaporizing. This is an industry best practice, and helps ensure the plant can be quickly engaged when called upon and that any issues that arise at the facility can be dealt with expediently.

Q. HAVE YOU DISCUSSED YOUR OPERATIONAL RECOMMENDATIONS WITH NMGC?

A. Yes. I understand that if the NMPRC approves NMGC's request in this case, the Company will adopt all of my recommendations.

SAFETY OF THE LNG FACILITY

Q. IN YOUR OPINION, ARE THE SAFETY FEATURES FOR THE LNG FACILITY SUFFICIENT TO SAFELY OPERATE THE LNG FACILITY?

A. Yes, in my expert opinion, from what has been included in the Pre-FEED study, the LNG Facility is on track to be designed to allow NMGC to safely operate the facility. The LNG Facility is designed using proven technologies, based of decades of LNG operations world-wide, and will be state-of-the-art. All aspects of the LNG Facility will meet or exceed the requirements of 49 CFR Setion193 and NFPA 59A. NMGC will also ensure operator training and procedure management which will result in safe and reliable operation.

Q. PLEASE DESCRIBE THE SAFETY DESIGN CONSIDERATIONS, AS YOU SEE THEM, ASSOCIATED WITH THE CONSTRUCTION AND OPERATION OF THE LNG FACILITY.

A. I would like to start by describing the properties of LNG:

- LNG does not ignite in itself. LNG must first vaporize into natural gas in order to ignite, and then only if mixed in the right proportions with air. The flammable limits are fairly narrow for natural gas, approximately between 5.0% and 15.0% in air. This means that there is a very low likelihood of a fire or an explosion in an open area. In fact, LNG vapors are known to deflagrate (burn away) rather than detonate when leaked into an open-air environment. Natural gas also has a very high ignition temperature as compared to many other fuels.
- Furthermore, it is industry standard for LNG storage facilities to be designed in such a manner as to minimize the potential for a combustible mixture of air to exist in any normal plant operations and special precautions are taken to avoid any such mixtures to exist within an enclosed space.

In relation to the LNG Facility, it will satisfy safety requirements as follows:

1) NMGC's proposed buffer zone meets the requirements of 49 CFR §193. In the event of an accident, the thermal radiation (i.e. the radiant heat emitted by an object/event) from a fire due to an LNG spill within the plant would typically not reach a level of 1,600 BTU/hr/ft^2 beyond the LNG Facility property line in the event of a 10 minute spill from the largest flow from a single line that could be leaked into an impounding area. The Pre-FEED confirms that the LNG Facility will meet all regulations for catastrophic spills.
2) The property will have an earthen berm constructed around the LNG Facility which is designed to help contain LNG in the event of a leak.
3) For the design spill scenario, the gas concentration from an LNG spill would not reach 50% of the flammable limit at the property line. For NMGC's proposed LNG Facility, the Vapor Dispersion Plan shows that the concentration of half the lower flammable limit is well within the property line for the design spill criteria. The lower flammable limit is the minimum amount of gas in air concentration that would sustain combustion.
4) The LNG Facility will have valves that will automatically close in the event of an accident or in the event of a loss of control, loss of air supply, loss of electric supply or loss of any mission critical nitrogen supply.
5) NMGC plans to have all gas, temperature and flame detectors continuously monitoring the critical operations of the plant, and these automatic functions can operate in an instant to bring the LNG Facility into safe mode without operator intervention.
6) The LNG Facility will contain numerous interlocks to lessen the potential for an operator error resulting in a hazardous condition.

7) The LNG Facility will contain shutdown systems that are also fail safe in nature and have redundancies in functionality.
8) Prior to operation, the LNG Facility will have a full Hazard Identification Study and Hazard and Operability Study review of the facility design, construction, and operation to ensure that risks are at an acceptable level consistent with good industry practice and code requirements.

Q. ARE YOU FAMILIAR WITH NMGC'S PROPOSED SITE FOR THE LNG FACILITY?

A. I have seen maps and aerial photographs of the proposed site for the LNG Facility. I understand that the location is within the boundaries of the City of Rio Rancho, and is close to the western boundaries of the City of Albuquerque.

Q. SHOULD THE COMMISSION OR THE PEOPLE OF NEW MEXICO BE CONCERNED THAT THE LNG FACILITY WILL BE LOCATED WITHIN AND NEAR LARGE METROPOLITAN AREAS?

A. No. As I mentioned earlier, it is normal for LNG storage facilities to be located in metropolitan areas, as this is where the largest demand for natural gas is normally found. NMGC has complied with all siting requirements for LNG storage facilities, and as such I do not have any concerns. Additionally, I note that the LNG Facility will be located on a large tract of land within a planned industrial park, which at the current time is largely undeveloped, which also mitigates risk to the general public.

Q. THE PROPOSED SITE IS LOCATED NEAR DOUBLE EAGLE II, AN EXISTING AIRPORT FACILITY WHERE PRIVATE PLANES TAKEOFF AND LAND. DOES THAT FACT CAUSE ANY SAFETY CONCERNS FOR THE PUBLIC?

A. No. Government regulators actually anticipated that LNG storage facilities may be located near airports, and have enacted regulations for just this possibility. NMGC is complying with all requirements for LNG facilities located near an airport. As such, the public should not be concerned about the proximity to an airport.

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Q. IN SUMMARY, DO YOU HAVE ANY SAFETY CONCERNS RELATING TO THE DESIGN OF NMGC'S PROPOSED LNG FACILITY OR ITS PROPOSED LOCATION?

A. No. The design appears to be using the best practices learned during the history of the mature LNG industry. Some of the specific features about the design include:

1) The inclusion of the vaporizers within the LNG storage tank dike area. This is a best practice that has become popular in recent years. It includes all of the vaporizing hardware that carries LNG within the dike area. That means the tank, the pumps, the vaporizers and the associated piping are all within the dike area. This affords full containment of all LNG process piping and equipment during storage and vaporization.
2) The buffer zone for this LNG Storge Facility is very large.
3) In the event of any credible event, the exposure to the outside world would be limited to levels provided for in NFPA 59A.

TRAINING

Q. WHAT TYPE OF TRAINING IS REQUIRED TO OPERATE AN LNG STORAGE FACILITY?

A. LNG technicians are required to be trained and tested on their understanding of the characteristics of LNG, the hazards associated with LNG, the operations of the LNG storage facility, LNG transfer procedures, and the LNG facility's emergency procedures. Additionally, specific training is required on fire prevention procedures and first aid.

LNG storage facility operators are required to have written training plans, maintain training records, and to have each LNG technician given refresher training every two years.

Further, it is common for LNG plant operators to maintain a close liaison with the local first responders to assure that in the event of any accident, rapid managing of the event is efficient and effective.

Q. WHAT STEPS MUST NMGC TAKE TO ENSURE ITS PERSONNEL RECEIVE THE PROPER TRAINING TO OPERATE THE LNG FACILITY?

A. NMGC personnel should attend national seminars/webinars and classes on LNG, such as LNG Fundamentals, LNG Peak Shaving Operations, LNG Plant Reliability, LNG Plant Safety, LNG Plant Operator Training, LNG and Gas Thermodynamics, and other related natural gas and LNG courses. LNG firefighting training experience can be obtained by enrolling in the live LNG firefighting training courses given at the Texas A&M Fire Fighting Facility.

The LNG Facility will have a robust training and quality assurance program. Personnel will be tested to assure that the training is not only presented but properly understood by the learners.

CONCLUSION

Q. DO YOU HAVE ANY CONCERNS REGARDING THE PROPOSED LNG FACILITY?

A. No. The LNG Facility will be a state-of-the-art facility with the latest safety features and operationally should be able to provide years of service to NMGC's customers.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

- Consulting
- Design
- Procurement
- Construction Management

JEI ENGINEERING, INC.

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Chattanooga, TN 37411
Phone: (423) 553-1150 Fax: (423) 553-1110
Email: edward.jones@jeiengineering.com

RESUME

Name: Edward H. Jones, PE

Title: President

Work History:

9/2002-Present **JEI Engineering, Inc.** – Chattanooga, TN

Extensive process and plant experience in LNG facilities including storage, liquefaction, vaporization, compression, heat exchangers, pumps, plant operations, process control, operator training, plant troubleshooting and maintenance. Work includes projects for 30 years of process feasibility, development, and planning; project development and implementation; commissioning and start-up; and operation support and procedures. Extensive use of computer models allows optimizing of systems, equipment, and systems for each application.

Projects range from Base Load Export and Import Terminals, Peak Shaving Plants, Satellite Facilities for distribution systems, and Commercial Fuel Facilities.

Prepare procedures for removal of LNG and long-term layup for LNG satellite facility.

2022

Prepare Firewater upgrade detail specification and design for LNG facility.

2022

Provide siting, FEED, and detail process design for LNG testing facility.

2021 - 2022

Preparing FEED for BOG compressor replacement for LNG facility including sizing of unit, establishing operational parameters, specifications, and PID development.

2021 - 2022

Provide Owner's Review for Rate Case analysis of upgrades to a Peaking Facility for PUC review including justification for facility, cost of facility, and analysis of other options.

2021 – 2022

Provide virtual training on LNG pump operation and process application for Mid-East LNG company.

2021

Provide piping design, stress analysis, specifications for a pre-treatment piping replacement project. Provided additional support to inerting and purging of the system both out of service for piping changes and for inerting, gas-in, and return to service.

2021

Provide support to project and facility analysis, construction developments, owner's agent for construction reviews, constructability reviews, and Owner's Support for project reviews in multi-discipline EPC projects.

2017 - 2022

Experience in preparing and teaching courses on plant design, development and operations in both the corporate and plant environments. Programs provided have been both instructional and illustrative of concepts and further developed based on interactive feedback from class participation.

2021 – 2022

Lead design team for analysis on Condenser Tube erosion and development of FEA for evaluating requirements and suitability for tube inserts for large power generation facility.

2021

Develop specification and conceptual design for Boil Off Compression upgrade for Fuel Loading LNG Facility. Work included specification for compressor, exchangers, piping system and developing budget estimates for equipment and installation.

2021

Provide ongoing plant Engineering and Operations support for a Base Load Export Terminal including support for projects, optimizing plant operations, troubleshooting operating issues, and writing operating procedures.

2017 - 2021

Provide lead on LNG Plant air compressor system replacement project including confirming plant loads, specification for compressors, receiver, and dryer system. Provided specification for piping and controls.

2020 – 2021

Provide consulting to support installation of a satellite LNG facility consisting of three LNG storage tanks and approximately one mile of natural gas piping to a facility user. Work included sizing and validation of major equipment, pump sizing and validation, stress analysis for above ground piping system including forces and moments on supports including wind and seismic loads as well as operational loads.

2020

Provide study and recommendations for a Boil Off Gas compression system to maximize the use of BOG for fuel gas. Provide control narrative and design for load sharing between systems and compression. Provide optimization of plant fuel gas compressors for utilization of Flash Gas and BOG into fuel gas system. Provide process simulations using HYSYS for flooded screw BOG compressors and compressor curves for Fuel Gas and Flash Gas compressors to validate design. Lead team preparing 3-D modeling for system including pipe routing, structural steel, and preliminary pressure drop and stress analysis of system.

2019 - 2020

Provide a fire protection study and recommendations for a Peak Shaving LNG facility in accordance with NFPA 59A and local codes.

2019 - 2020

Provide a review, analysis, and procedure for removing a satellite LNG facility from service including review of the existing system, analysis of the existing equipment, develop a plan for de-inventory the facility, warm up the equipment, secure the facility, and to cool down the facility and return into service.

2019

Provide an in-depth analysis of an LNG export facility BOG, Flash Gas, and Fuel Gas systems and provide recommendations for optimizing the systems to maximize utilization for fuel gas and to minimize compression demands for the system.

2019

Provide facility support design for installation of an enclosed ground flare including piping, foundations, site, and permitting support.

2019

Provide Process design for cryogenic flare gas analyzer including instrumentation and equipment specifications, piping and foundation layouts, and HAZOP support for design of system including sampling, layout of system, interface with plant control system.

2018 - 2020

Provide control philosophy and narrative for operation of flooded screw compressors in BOG service including loading, unloading, temperature and pressure control.

2018 – 2019

Provide relief sizing and design review of satellite LNG facilities including pressure drop calculations, process simulations, and establishing operating point for system.

2018 – 2019

Provide facility design and review of equipment provided by vendors for LNG pump testing facility including process support for HAZOP. Provide update of facility documentation including PIDs and PFDs. Provide update of fire protection plan, Hazardous Area Classification plan and Site plan for facility.

2018 - 2019

Develop Ship loading LNG and vapor handling procedures, provide operator training on procedures, and provide support for Ship Loading activities and coordination. Coordinate and plan Surge Testing for Ship Loading including development of criteria, valve alignment development, and review of results.

2018

Provide guidance for PSM revalidation at a LNG equipment test facility including facility review, fire protection study update, and review of procedures. Provided recommendations for facility enhancements for greater reliability and safety.

2017 -2018

Review instrumentation and controls for LNG facility to identify reliability and safety including identifying failure modes, identifying ways to improve reliability, and developing matrices for indicating reliability improvements.

2017 - 2018

Develop procedures and criteria for cooldown of LNG lines for Export facility including inerting, gas in, cool down, and LNG inventory. Provide Operations support for activities during execution.

2017

Develop Modes of Operation for facility including modes for handling vapor from ship loading and unloading, plant operations, and holding. Developed plan for LNG circulation, cooling, and minimizing valve line-up changes and maximizing operational efficiencies. Provide Operator Training for Modes.

2015 – 2017

Provide design review and optimization of LNG terminal header feed through for a series of LNG pumps. Review included type of connections, monitoring of flow, detection of leakage, and certification to AHJ.

2016

Manage a LNG Storage Tank Inspection including planning the activities and scheduling the work, participating in the Safety Review of all activities, coordination of Confined Space Entry, reviewing inspection reports, development of isolation plan and operations procedures for taking the tank from LNG to air for entry, and development of plans and operations procedures for returning the tank to service, coordination of cooldown and inventory with minimum LNG heel for return to service.

2016

Provide Process Modeling for compression system optimization including analysis of heat and mass balance, process operations, and impact on existing facility.

2016

Provide Lead Process Support to modifications and tie-ins for a Base Load LNG Export Terminal Conversion Project. Duties include estimates of consumables, utilities, schedule, and manpower for the Outages. Duties also include site support of activities during the outage, optimizing the outage, and scheduling operations based activities for the outage.

2015-2016

Provide Lead Process Design for Regeneration Gas Booster Compressor project. Duties included specification of the unit, coordination with vendor during packaging, review of performance and FAT test approval prior to shipment. Engineering also included process specifications, operating procedures, Interlock Descriptions, Operator Training, and directing a team of Engineers for Process, Instrumentation, and Electrical for the project..

2015-2017

Provide design review of LNG pump installation including review of pump operational requirements, suction and discharge designs, operating modes, and reliability of the system. Provide recommendations for optimization of system for better performance and reliability.

2015

Develop and provide training for operation and maintenance of a natural gas fueled backup power generation facility.

2014-2015

Provide operating procedures and training for facility update and outage including power management at a large natural gas processing facility.

2015-2016

Provide design and recommendations for flare header, flare system, and relief calculations for Natural Gas Treating and Compression Facility.

2014-2015

Provide process design on a Gas Treating and Compression Facility to increase the capacity of the facility. Also, provided flare, vent and relief system design for the project.

2014-2015

Provide process design and lead on detail design for Peak Shaving Pre-Treatment Upgrade including equipment specifications, piping layouts, electrical, instrumentation, structural, and foundation design. Lead HAZOP for project and prepare procedures and coordinate startup for facility.

2014-2015

Provide HAZ storage tank facility structural and process reviews along with certification of equipment.

2014-2015

Provide static and dynamic stress analysis for LNG pump manifold system. Provide optimization of supports and minimization of loads at support points in system.

2014-2015

Provide operating procedures, outage procedures, outage coordination and outage plan recommendations for major expansion for Base Load LNG Facility.

2014-2015

Provide lead for FEED design for 12 MW CHP facility in Southeast including basis of design, PIDs, Electrical Single Line Diagrams, plant layouts, and process simulations.

2014-2015

Provide support, review, and consulting for Cold Box repair for Peak Shaving LNG Facility.

2013

Prepare process and mechanical design for Peak Shaving vaporization upgrade project upgrading the existing facility including shell and tube vaporization, LNG pumps, Liquefaction modifications including Cold Box replacement, provided FEED for pre-treatment replacement. Provided operating procedures, operator training, led HAZOP for facility, and verified control system prior to placing into service. Provided NFPA 59A fire protection study update for modified facility.

2012-2013

Prepare outage isolations, tie-in plans, LOTO plans, outage procedures for Base Load LNG Facility.

2013

Prepare process and mechanical design for Peak Shaving vaporization upgrade project. Process includes equipment specifications, PFDs, P&IDs, and site layouts. Provided operator training and operating procedures for facility. Provided Commissioning Services and start-up of facility.

2011-2013

Provide ongoing support to a peak shaving facility including optimizing liquefaction and resolving issues with cold box. Provide on-site assistance with start-up of system. Support is ongoing.

2011-2012

Prepare "Basis of Design" for Peak Shaving vaporization upgrade project. Project included siting, electrical loads, flow conditions, and outlet station metering.

2011

Prepare and Present an LNG Operational Overview Course for LNG China. Course included primary focus on liquefaction systems and trucking.

2011

Prepare Maintenance Procedures for LNG Peak Shaving Facility. Project consisted of providing maintenance plan, procedures for all components of facility, and preparing and placing in a form for implementation into the work order control system.

2011

Prepare piping bid package for several construction projects in LNG facilities while acting as Owner's Engineer. Projects included cryogenic and non-cryogenic piping. Perform analysis on system movement, growth, and stresses. Provide design for pipe supports including one-way, guides, spring, and rigid supports.

2010-2011

Prepare piping design analysis including stress, temperature, cyclic, wind, and seismic for a natural gas pre-treatment facility.

2010-2011

Prepare procedures for maintenance of Peak Shaving LNG facility including detailed activities, scheduling, and criteria for performance.

2010-2011

Provide contract support services for evaluating of LNG import facilities, review of operational issues, reliability issues, and process performance.

2008-2012

Provide Consulting Services for Process Design review, Lead a facility PSM validation and state facility re-certification for a LNG testing facility. Services included validation of relief system and specifications for elevated flare stack and for process vent condenser.

2009 - 2010

Design upgrade for Feed Pre-Treatment System for two peak shaving facilities including process and mechanical. Lead a PSM review of modifications, Supervise design of instrumentation and electrical components. Provide start up services for units including performance testing of liquefaction system.

2009 – 2010

Provide review of import terminal equipment and operating procedures, provide operator training exams and establish criteria for operator qualifications. Review operational requirements and develop plan for implementation of training and testing for the facility.

2009 - 2010

Provide Engineering for Pressure Vessel design for Horizontal and Vertical Vessels to ASME Code requirements including seismic and wind forces for locations in Tennessee, Texas, California, and North Carolina, as well as various Reviews of ASME and API vessels.

2007-2011

Provide consulting services as Owner's representative on vaporization modifications at two peak shaving LNG facilities. Review specifications, design, equipment, and operating procedures and provide reports to owner regarding all items.

2009

Provide Design services for import terminal facility modification. Modifications included upgrades to provide better controllability for Thermal Fluid for Shell and Tube Vaporizers, optimizing LNG circulation and control, and providing control enhancements for Fired thermal heaters. Provide construction support and inspections for installation of the components.

2009

Provide lead for project team for development of LNG facility plant modifications to provide improved operability and maintainability. Project consisted of development of P&IDs, Piping drawings, Instrumentation drawings, specifications, data sheets, and all Engineering activities. Provide operating procedures for modifications to process.

2009

Provide review and development of operating procedures for LNG import terminal. Activities included review of contractor procedures, development of new procedures, review and development of commissioning schedule, owner's representative to commissioning.

2008

Provide fire protection design and installation to peak shaving LNG facilities on two separate projects. Project included selection, design and installation of system. System included fire, temperature, and smoke detectors, control panel, PLC controller, and touch screen HMI.

2008

Provide ongoing support to operations, maintenance, and code compliance to facilities primarily in the LNG industry. Provide review of operating procedures modifications and provide PSM revalidation lead for review of proposed modifications. Provide process modeling and simulations for new facilities and modifications. Provide consulting services for facilities in the LNG industry.

2008

Provide commissioning support and third party review to expansion of LNG import facility. Duties include review of operability of facility, review and modifications of operating procedures, and interface of both new and existing facilities. Identify and coordinate operational trends and logs, and provide input and modifications to existing operating procedures for complete plant integration.

2008

Lead revalidation of LNG Pump testing facility PSM and review of plant modifications. Reviews included liquid storage, test area, plant piping, and instrumentation system.

2008

Provide Process and Mechanical design for LNG Vaporizer replacement project. Provided project management services and interface with client, vendors, construction, and Engineering. Reviewed and approved operator training, maintenance procedures, and project manuals.

2006-2007

Provide Process Lead and Procedures for warm up, dry-out, and cool down of LNG process piping and vessels for modifications and maintenance at LNG Import Facility. Responsibilities included process lead for plant warm up and cool down including developing requirements for consumables needed, defining systems, and defining parameters for procedures and operations activities. Provided definition and procedures to isolation and purging of systems prior to cool down. Provided operational support for activities during activities. Evaluated site vapor compression system for use during the outage. Prepared analysis comparing fluids for use during cool down of the facility.

2006-2007

Provide conceptual design, budget definition, process basis and detail design for Natural Gas Meter Station Modification including piping arrangement, specifications, and material lists for purchasing.

2007

Provide Design for Pump Suction pot for LNG application. Design included loads, forces and moments on supports and nozzles.

2007

Provide Design of API-650 stainless steel storage tank including nozzle reinforcements, anchorage, and supports.

2006-2007

Provide Balance of Plant Engineering for completion of a 450 MW turbine generation facility. Duties included Gray Water treatment facility, validate and update electrical design, fuel gas supply, fuel oil supply, chemical treatment, treating of existing site corrosion. Lead disciplines including mechanical, process, electrical and structural responsibilities.

2005-2006

Provide Engineering for Pressure Vessel design for Cryogenic Service, Distillation Tower (process design by others), and various ASME and API vessels. Service is ongoing.
2005-2006

Provide facility Engineering Services for LNG Import facility. Responsibilities included providing mechanical design for plant process, interdisciplinary interface, plant support systems and construction management of plant projects.
2006

Provide study for upgrade of send-out capacity including vaporizers, pumps, instrumentation, piping systems, electrical systems, instrumentations, and utilities for a Peak Shaving facility.
2006

Provide Process design for LNG Pump testing facility upgrade including defining testing parameters, limits of equipment, and equipment specifications. Provided Lead for revalidation of PSM and HAZOP for the modifications.
2006

Provide Engineering Study to determine efficiency of Cold Box in Mixed refrigerant liquefaction process. Review original design heat transfer conditions and review operational components including refrigerant composition, feed gas composition, and compressor operating parameters.
2005

Provide Fire Protection Modifications at a LNG facility including Engineering, Procurement, and Construction. Work was performed in accordance with NFPA 59A and CFR 49 Part 193 requirements.
2005

Provide Lead in a Fire Protection Study for a peak-shaving LNG facility. Work consisted of review of current fire protection plan, flammable gas detectors, flame detectors, water protection, and reaction plan. A review and development of vapor dispersion and thermal radiation zones for the facility using current requirements was provided.
2005

Provide Project Engineering lead to SCR modifications for simple cycle gas turbine generators. Duties included reviewing proposed design, providing project initial budget, initial and final schedule, provided leadership for HAZOP, resolving technical issues during design and installation of equipment and providing site Engineering Review to start-up and performance compliance. Led and coordinated operator training, start-up, and commissioning of system. Recommendations were provided for improving operational performance and reliability of ancillary systems.
2005

Revalidation of LNG testing facility PSM program provided. Duties included formatting the review forms, leading the revalidation review, reviewing established documents, providing recommendations, and providing the documentation to complete the review.
2005

Provide Engineering Support to Base Load LNG facility including providing conceptual, preliminary, and final designs for field projects. Providing scope, budget, and schedule for both capital and O&M projects, and providing and coordinating maintenance and operations support. Projects included pad gas system, vent systems, relief systems, and containment systems. Evaluations provided for Send-Out capacity and equipment performance and limitations. Recommendations provided for future expansions of facility.

2004-2005

Studies were provided for upgrades and expansion of components at LNG facility. Responsibilities for the project included identifying site and areas available, development costs, evaluating options, preparing Engineering estimates and budgets, and providing recommendations. The requirements included process, mechanical, structural, civil, electrical and instrumentation.

2004

Provide Fire Protection System Study to Peak Shaving LNG Facility, provide recommendations and evaluations based on current code requirements and Engineering Practice for protection of LNG facilities.

2004

Provide Piping stress analysis for an electrical peaking facility. Duties included reviewing piping design, providing support locations and support types for supporting of system.

2004

Provide Process Design for control system upgrade at an LNG facility. Responsibilities included producing procedures for testing and proving system, producing start-up check lists, leading HAZOP of system.

2004

Provide process and mechanical design review for overseas base load LNG facility pumping systems. Responsibilities included review of pump arrangements, instrumentation review, system performance review. Provided budget pricing for Engineering, Equipment, and Installation.

2004

Provide Vapor Dispersion and Thermal Radiation Models for LNG peak shaving facility. Models included evaluating several event scenarios and identifying the defining situation for the facility. Recommendations were provided for minimizing offsite consequences.

2003

Provide Project Management for Design, Procurement, and Construction Management for LNG Send-Out Pump Vent System Modifications. Responsibilities included providing design to modify existing pump vent system, adding recycle with flow control, instrumentation configuration, start-up, and operator training. Lead PSM and HAZOP analysis for project. Provided piping stress analysis and design review for cryogenic piping systems.

2003

Provide Process and Project Design for LNG Pump Facility modifications including both capacity and head increases. Responsibilities included developing conceptual through preliminary P&ID, directing structural steel layouts, equipment layouts and site plans for the work

2003-2004

Provide Project Management for LNG Turbine Testing Program. Responsibilities included planning, cost management, and coordinating Construction Engineering, Testing, and Client Activities for a testing program for LNG Turbine Generators. Lead HAZOP and Operator Training for the system prior to start-up.

2003

Provide Design for ASME Vessels including FEA analysis of detail components and ASME designs including modeling, analysis, and recommendations for optimizing vessel design, structural and vessel supports.

2002-2004

Marlboro Enterprises, Inc. – Chattanooga, TN

Provide Mechanical Design for Fuel Gas System and LNG Vaporizer Caustic Injection System. Provide Stress Analysis and Piping Design Review for all new Piping Systems. Provide Process Review for System Modifications and Upgrades. Provide Review of Hazardous Area Classifications. All Activities were in support of the reactivation of the Cove Point LNG Receiving Terminal.

2002-2003

8/1990-9/2002 **Marlboro Enterprises, Inc.** – Chattanooga, TN

Director of Engineering with responsibility for directing all Engineering and Design functions. Director of Process, Electrical, Structural, Civil, Mechanical, and Instrumentation Design Disciplines. Primary service markets are LNG base load import terminals, LNG peak shaving facilities, gas processing plants, gas compressor stations, chemical process plants, and air separation facilities. Work consists of proposals, feasibility studies, conceptual designs, detail plant designs, cost analysis, and equipment evaluation. Work was produced in home satellite and field offices.

Provided process support to ship board re-gasification project. Duties included evaluation of pumps, vaporizers, system characteristics, location of equipment, coordination of work with ship manufacturer, and development of testing program and parameters for system prior to installation. Participated in HAZOP and PSM reviews of the system. Provided process and mechanical support for testing of equipment including development of vapor dispersion and thermal radiation zones, fire protection, and finalizing of final site plan for test.

2001-2002

Provided plant process review and provided recommendations for updating plant piping and instrumentation systems for a Cryogenic Pump Test Facility. Provided design for replacement and upgrading of primary Cryogenic exchanger to provide additional plant capacity. Provided review of plant facility to bring facility in compliance with OSHA 1910 and State CAPP requirements.

2001-2002

Provided design study and test facility upgrade for LNG Testing Facility. Upgrading system chilling capacity, instrumentation, valving, piping and other systems required to provide Hydraulic Turbine Testing. Provided HAZOP of facility modifications, and operator training. Provided start up check lists and instructions for operations during the testing.

2001-2002

Provided siting evaluation and initial layout for LNG testing facility. Provided site containment, vapor dispersion, and radiation models to support design for facility. Optimized the layout to provide minimum offsite impacts for plausible spill scenarios.

2002

Provided performance review for LNG peak shaving facility to address limitations of MRL liquefaction system. Review included analysis of existing system, recommendations for modifications, and operating recommendations. System was ultimately modified to address these issues.

2001

Provided expediting for fabrication, construction coordination, and detail site design for the installation of five 135 MMSCFD submerged combustion LNG vaporizers. Provided detail design for plant pipng system, gasket, and bolting specifications. Provided installation support for repairs and replacement of cryogenic insulation system. Provided start-up coordination and preliminary testing for vaporizers. Provided start-up support for Facility Compressor Units. Provided design for Sodium Hydroxide storage and handling system. All activities were in support of the reactivation of the Elba Island LNG Receiving Terminal.

2001-2002

Project Manager for a 5.8 MMSCFD Landfill Gas Recovery Project in which MEI provided the definitive design, preliminary equipment specifications, and budget summary to the client. MEI developed a gas treatment system which allowed processing of the landfill gas to meet commercial pipeline specifications. Coordinate compressor vendor design with process design.

2000-2001

Responsible for equipment specification, mechanical and instrument design for a 6 MMSCFD Feed Gas Compressor for the Peak Shaving facility in North Carolina.

2000

Responsible for preliminary process and equipment design for a Grass Roots Polyol plant. Responsibilities included providing design specifications, preliminary equipment sizing, developing preliminary project budget, and providing for initial air and water permitting.

1999

Responsible for design, specification, purchase, and installation of a 105 MMSCFD LNG Vaporizer for a Peak Shaving Facility.

1997-1998

Responsible for design and specifications for a 4.5 to 6.0 MMSCFH Regulator and Gate Station which included an expander, heat exchangers, and hot water heaters.

1996-1997

Responsible for Compressor Vendor Review, Stress Analysis and Piping Support Design for a 2.00 MMSCFD Boil-Off Compressor System. Provided commissioning lead and provided operating procedures for facility modifications.

1997

Responsible for providing process technical support for a Helium Recovery Project Feasibility Study for a Facility located near Amarillo, TX.

1996

Responsible for piping, control, instrumentation design, and commissioning for a Vaporizer addition to a peak shaving LNG Facility.

1994-1995

Responsible for piping, instrumentation and control system modifications at the NCNGC Bentonville LNG Facility. Activities were in support of the addition of a 60 MMSCFD submerged combustion Vaporizer.

1993-1994

Project Engineer with responsibility for selection, purchase, installation and start-up of a Bristol/Genesis DCS Control System. System consisted of approximately 650 process I/O Points and 3,200 internal signals. Process control included interfacing with existing tank and vaporization control as well as providing a complete control package for feed and liquefaction in a peak shaving LNG facility. Duties also included coordination of civil, electrical, mechanical and instrument designs including providing design parameters, interfacing disciplines, and coordinating design with field personnel. Provided project control system documentation and project maintenance manual at the end of the project.

1991-1993

Designed and specified storage vessels for an acrylate storage facility. Provided design from conceptual through final designs as well as approving preliminary through final vendor designs.

1991

Designed and managed an isocyanurate storage facility project. Provided conceptual through final designs, equipment purchase recommendations, construction bid packages, and construction management. Coordinated efforts of Civil and Electrical Associates and provided start-up support for initial plant run.

1991

Project Engineer on a control system team that designed a control scheme, specified and purchased instrumentation, and supervised installation and start-up of a chemical plant control system using a Fisher Porter Primary Control System.

1990-1991

Education: 1983-1988 University of Tennessee at Chattanooga, B.S.E. in Mechanical Engineering, Thermal Systems.

Additional Studies in Process Control Systems.

Additional Study in Vibration and Shock in Mechanical Systems.

Additional Study in Process Simulation Techniques including Static, Dynamic and Flare System Analysis.

Professional Memberships: NSPE, ASME, CSI, ASHRAE, ISA, AISC

Licenses: Registered Professional Engineer:

State of Alabama: 20179

State of Arizona: 74733

State of California: M32064

State of Connecticut: PEN.0030483

State of Georgia: 25703

State of Indiana: 19700436

State of Louisiana: 36503

State of Maryland: 25448

Commonwealth of Massachusetts: 43151

State of Nevada: 015183

State of New Hampshire: 14702

State of New Jersey: 24GE05395100

State of New Mexico: 28109

State of North Carolina: 025815

State of Ohio: E-88426

Commonwealth of Pennsylvania: PE057277E

State of South Carolina: 19726

State of Tennessee: 100723

Commonwealth of Virginia: 402034391

State of West Virginia: PE 20955

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.

NEW MEXICO GAS COMPANY, INC.,

APPLICANT.

Case No. 22-_______-UT

ELECTRONICALLY SUBMITTED AFFIRMATION OF EDWARD JONES

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

In accordance with 1.2.2.10(E) NMAC, Edward Jones, Consultant for New Mexico Gas Company, Inc., upon being duly sworn according to law, under oath, deposes and states under penalty of perjury under the laws of the State of New Mexico: I have read the foregoing Direct Testimony and Exhibits, and they are true and accurate based on my personal knowledge and belief.

SIGNED this 15th day of December 2022.

Edward Jones
Founder and President
JEI Engineering, Inc.

EDWARD H. JONES
NEW MEXICO
28109
PROFESSIONAL ENGINEER

12/15/2022

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

DIRECT TESTIMONY AND EXHIBITS

OF

JIMMIE L. BLOTTER

December 16, 2022

Q. PLEASE STATE YOUR NAME, POSITION AND BUSINESS ADDRESS.

A. My name is Jimmie L. Blotter. I am the Vice President, Finance and Vice President, Safety and Business Support of New Mexico Gas Company, Inc. ("NMGC" or the "Company"). My business address is 7120 Wyoming Boulevard NE, Suite 20, Albuquerque, NM 87109.

Q. PLEASE DESCRIBE YOUR RESPONSIBILITIES AS VICE PRESIDENT, FINANCE AND VICE PRESIDENT, SAFETY AND BUSINESS SUPPORT.

A. I am responsible for the financial operations for NMGC. This responsibility includes the accounting, financial reporting, tax compliance, budgeting, financial planning and revenue requirement functions. Additionally, as Vice President of Safety and Business Support, I am responsible for safety, pipeline safety, technical training and business support, which includes fleet, procurement, Metro facilities and Metro collectors.

Q. PLEASE SUMMARIZE YOUR EDUCATION, PROFESSIONAL QUALIFICATIONS, AND EXPERIENCE.

A. Please see NMGC Exhibit JLB-1 for a summary of my education, professional qualifications, and experience.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION?

A. Yes. Please see NMGC Exhibit JLB-1 for a list of the cases in which I have provided testimony before the New Mexico Public Regulation Commission ("NMPRC" or the "Commission").

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. The purpose of my Direct Testimony in this case is to discuss:

- The financial impacts of the NMGC liquefied natural gas ("LNG") storage facility ("LNG Facility");
- The depreciation rate for the LNG Facility;
- NMGC's proposal for allowance for funds used during construction ("AFUDC"); and
- The Company's method of accounting for LNG inventory.

I. FINANCIAL IMPACTS OF THE LNG FACILITY

Q. NMGC WITNESS TOM C. BULLARD TESTIFIES THAT THE COST OF CONSTRUCTING THE LNG FACILITY IS ESTIMATED AT $181 MILLION AND WILL TAKE AT LEAST TWO YEARS TO COMPLETE. IS A PROJECT THAT COSTS APPROXIMATELY $181 MILLION AND WILL TAKE AT LEAST TWO YEARS TO CONSTRUCT A SIGNIFICANT UNDERTAKING FOR THE COMPANY FINANCIALLY?

A. Yes, a project estimated to cost $181 million is significant to the Company financially, especially since construction will take at least two years before the project will be used and useful.

Q. HOW WILL NMGC PAY FOR THE CONSTRUCTION COSTS RELATED TO THE PROPOSED LNG FACILITY?

A. NMGC anticipates paying the construction costs through a combination of equity and debt financing. Any debt issuance related to the LNG Facility will only occur after the Company obtains the necessary approvals from the Commission for a certificate of public convenience and necessity.

Q. HAS NMGC DETERMINED THE AMOUNT OF DEBT IT WILL ISSUE IN RELATION TO THE CONSTRUCTION OF THE LNG FACILITY?

A. Not yet. The Company anticipates that it will ultimately fund construction of the LNG Facility at the same ratio of its regulatory capital structure, which at this time is 52% equity and 48% long-term debt. The amount of the debt issuance will also likely depend on the final bids from engineering and construction firms for the construction of the LNG Facility.

Q. DOES NMGC ANTICIPATE HAVING TO PROVIDE ANY SECURITY FOR DEBT ISSUANCES RELATED TO THE LNG FACILITY?

A. No.

Q. WILL UNDERTAKING THIS PROJECT COMPROMISE NMGC'S FINANCIAL HEALTH?

A. No. NMGC anticipates funding construction of the LNG Facility through both equity from its parent companies and debt issuances at the same ratio as its regulatory capital structure. Funding the construction of the LNG Facility in this way will maintain NMGC's good financial metrics.

Q. WILL NMGC STILL HAVE ALL OF THE FINANCIAL CAPACITY NECESSARY TO RUN ITS DAY-TO-DAY OPERATIONS WHILE THE LNG FACILITY IS UNDER CONSTRUCTION?

A. Yes. NMGC funds most of its day-to-day operations through cash flow and the use of its revolving line of credit. The revolving line of credit currently does not mature until December 2026, which is after the Company anticipates having the LNG Facility in service. Additionally, the revolving line of credit provides NMGC with the option to request an increase in the size of the revolving line of credit to $200 million if needed. Finally, NMGC has the benefit of being part of the Emera Inc. family of companies, which provides NMGC with increased access to financing if necessary.

Q. IS THERE A RISK THAT NMGC'S CREDIT RATING MAY BE NEGATIVELY IMPACTED BY THIS PROJECT?

A. I do not believe so. By planning to fund construction of the LNG Facility through equity injections and debt issuances in line with the Company's regulatory capital structure, there should not be any impact on the Company's credit metrics from this project.

Q. WILL NMGC EXPERIENCE ANY ADDITIONAL OR SPECIAL COSTS BECAUSE OF THE LNG FACILITY ONCE IT IS COMPLETED?

A. As noted by NMGC Witness Bullard, the Company anticipates hiring additional employees. NMGC also anticipates an increase in operations and maintenance ("O&M") costs related to additional use of electricity, property taxes, and equipment maintenance. Overall, an increase in O&M of approximately $3.5 million per year is anticipated, which, as NMGC Witness Daniel P. Yardley testifies, will be split evenly between the Company's Purchase Gas Adjustment Clause and base rates.

II. THE DEPRECIATION RATE FOR THE FACILITY

Q. PLEASE ELABORATE ON HOW THE COMPANY ANTICIPATES DEPRECIATING THE LNG FACILITY ONCE IT IS PLACED IN SERVICE.

A. The Company has not owned an LNG Facility previously, and therefore does not have an established depreciation rate for this type of facility. The Company contacted Dane Watson with Alliance Consulting. Mr. Watson is a nationally recognized expert on depreciation, has testified in New Mexico on depreciation issues, and has experience performing depreciation studies for LNG storage facilities in other states. Mr. Watson advised us that it is reasonable based on his experience to expect that the LNG Facility will have a composite useful life of approximately 30 years or an estimated annual depreciation rate of 3.33%.

Q. WHY HASN'T THE COMPANY PERFORMED A DEPRECIATION STUDY YET FOR THE LNG FACILITY?

A. NMGC will perform or retain an expert to perform a full depreciation study for the LNG Facility once it is constructed and in service. Depreciation studies are very detailed and require analysis of many components to come to a useful life, and these components can change based upon the final design of and equipment selection for the LNG Facility. As NMGC Witness Bullard discusses in his Direct Testimony, final design and equipment selection will be conducted only after the Commission authorizes NMGC to proceed with the LNG Facility.

III. AFUDC

Q. PLEASE DESCRIBE HOW AFUDC IS TYPICALLY ACCOUNTED FOR ON CONSTRUCTION PROJECTS SUCH AS THE LNG FACILITY.

A. For construction projects greater than six months, NMGC typically calculates the AFUDC associated with the project on a monthly basis and capitalizes the AFUDC as part of the construction costs for the project. AFUDC represents the costs of funds used during construction. The Company uses the AFUDC formula prescribed by the Federal Energy Regulatory Commission. The formula takes into account the Company's return on equity and its cost of debt. AFUDC becomes part of the capitalized cost of a project.

Q. WHAT IS THE COMPANY ANTICIPATING FOR AFUDC FOR THE LNG FACILITY.

A. NMGC will record AFUDC only after making payments for the project. NMGC anticipates that these payments will be based on milestones to be negotiated with the ultimate engineering and construction contractor. As such, NMGC cannot accurately predict at this time the amount of AFUDC that will be recorded in connection with the LNG Facility.

IV. PROPOSAL FOR LNG INVENTORY ACCOUNTING

Q. HOW WILL THE INVENTORY OF LNG BE ACCOUNTED FOR ON THE BOOKS AND RECORDS OF NMGC?

A. NMGC will account for LNG stored at the LNG Facility as a separate inventory. NMGC will employ the weighted average cost method of accounting for LNG inventory, which is the same method used by the Company to account for its natural gas inventory stored underground. The price paid by the Company to purchase gas to store as LNG at the LNG Facility will be part of the Company's weighted average cost of LNG inventory.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

EDUCATIONAL AND PROFESSIONAL SUMMARY

Name:	Jimmie L. Blotter	
Address:	7120 Wyoming Blvd NE Albuquerque, NM 87109	
Education:	Bachelor of Business Administration Degree, Accounting Major Idaho State University, Pocatello, ID	
	Licensed as a Certified Public Accountant (CPA), Idaho	
Professional Experience:	New Mexico Gas Company, Inc. Albuquerque, NM	
	Vice President, Safety and Business Support	2022 – Present
	Vice President, Finance	2019 – Present
	PNMR Services Company Albuquerque, NM	
	Assistant Treasurer and Director, Investor Relations	2017 – 2019
	Director, Investor Relations	2014 – 2017
	Manager, Investor Relations	2011 – 2014
	Senior Manager, General Accounting	2009 – 2011
	Eclipse Aviation Corporation Albuquerque, NM	
	Financial Manager, Controller External Reporting	2008 – 2009
	ON Semiconductor, Inc. Pocatello, ID	
	Director, Entity Controller	2008
	AMI Semiconductor, Inc. Pocatello, ID	
	Director, Assistant Controller	2006 – 2007
	Manager, External Reporting and Investor Relations	2003 – 2005
	Senior Financial Analyst	1999 - 2003

Testimony before the New Mexico Public Regulation Commission:

Case No. 19-00310-UT – 2019 Finance Case
Case No. 19-00317-UT – 2019 Case
Case No. 20-00180-UT – 2020 Finance Case
Case No. 21-00095-UT – 2021 Winter Weather Event (Short Term Loan Refinance Compliance)
Case No. 21-00244-UT – 2021 Finance Case
Case No. 21-00267-UT – 2021 Rate Case
Case No. 22-00260-UT – 2022 Finance Case

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

ELECTRONICALLY SUBMITTED AFFIRMATION OF JIMMIE L. BLOTTER

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

In accordance with 1.2.2.10(E) NMAC, Jimmie L. Blotter, Vice President of Finance and Vice President-Safety and Business Support for New Mexico Gas Company, Inc., upon being duly sworn according to law, under oath, deposes and states under penalty of perjury under the laws of the State of New Mexico: I have read the foregoing Direct Testimony and Exhibits, and they are true and accurate based on my personal knowledge and belief.

SIGNED this 15th day of December 2022.

/s/ Jimmie L. Blotter
Jimmie L. Blotter
Vice President of Finance and
Vice President of Safety and Business Support
New Mexico Gas Company, Inc.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'S APPLICATION FOR THE ISSUANACE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUIFIED NATURAL GAS FACILITY	)	**Case No. 22-______-UT**
NEW MEXICO GAS COMPANY, INC.	)	
Applicant	)	

DIRECT TESTIMONY AND EXHIBITS

OF

DANIEL P. YARDLEY

December 16, 2022

DIRECT TESTIMONY OF
DANIEL P. YARDLEY
NMPRC CASE NO. 22-______-UT

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Daniel P. Yardley, and my business address is 2409 Providence Hills Drive, Matthews, North Carolina 28105.

Q. IN WHAT CAPACITY ARE YOU EMPLOYED?

A. I am a Principal of Yardley Associates, a consulting firm specializing in rate and regulatory matters in the natural gas utility industry.

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL WORK EXPERIENCE.

A. I received a Bachelor of Science Degree in Electrical Engineering from the Massachusetts Institute of Technology in 1988. For the last 30 years I have been employed as a consultant to the natural gas industry. During this period, I have directed or participated in numerous consulting assignments on behalf of local distribution companies ("LDCs"). I have extensive experience analyzing and developing LDC and gas pipeline cost allocation studies, rate design studies, and in other tariff matters, including the development of revenue adjustment and cost recovery mechanisms. I have also performed gas supply planning analyses and financial evaluation analyses on behalf of LDCs.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING?

A. I am testifying on behalf of New Mexico Gas Company, Inc. ("NMGC" or the "Company").

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION ("NMPRC" OR THE "COMMISSION") ON BEHALF OF NMGC?

A. Yes. I testified in three prior NMGC base rate proceedings before the Commission in NMPRC Case No. 18-00038-UT, NMPRC Case No. 19-00317-UT and NMPRC Case No. 21-00267-UT (the "2021 Rate Case"). I have also testified on behalf of NMGC in matters pertaining to its Weather Normalization Adjustment Mechanism, and concerning recovery of gas costs incurred by NMGC during the February 2021 extreme weather event. I have also testified on numerous occasions before other state utility commissions, the Federal Energy Regulatory Commission, and the Canada Energy Regulator on a variety of rate and regulatory topics. The subject matters addressed in these proceedings include cost allocation, service design, rate design, revenue decoupling, cost recovery mechanisms and tariff design. A summary of my experience and previous expert testimony in other jurisdictions is provided as NMGC Exhibit DPY-1, which is attached to my direct testimony.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS CASE?

A. NMGC is requesting the Commission to authorize it to construct a liquefied natural gas ("LNG") facility ("LNG Facility") to provide service to customers. The purpose of my Direct Testimony is to provide my opinion concerning the appropriate means of recovering the future costs of the Company's proposed LNG Facility.

Q. PLEASE SUMMARIZE YOUR FINDINGS.

A. The following findings and recommendations are supported through my Direct Testimony:

(1) **NMGC's proposed LNG Facility is designed to provide important benefits to NMGC's customers:** NMGC Witness Tom C. Bullard details the operational benefits that the LNG Facility would provide to the Company's customers. These include the ability to reduce price volatility and to enhance system reliability. Mitigating price volatility primarily benefits NMGC's sales customers while enhancing system reliability benefits all customers.

(2) **The recovery of the costs of the proposed LNG Facility should reflect the dual nature of the planned benefits of the facility:** One-half of the costs of the LNG Facility should be recovered from all customers consistent with the benefits associated with enhancing reliability. In addition, one-half of the costs of the LNG Facility should be recovered from sales customers consistent with the benefits associated with reducing price volatility. The amounts to be recovered from each group should be established in a base rate case.

Q. HOW IS THE REMAINDER OF YOUR DIRECT TESTIMONY ORGANIZED?

A. In Section II I discuss NMGC's existing rate structure. In Section III, I summarize background information associated with the proposed LNG Facility. In Section IV, I set forth recommendations for recovery of the prudently-incurred costs of the LNG Facility from customers. Finally, in Section V, I provide illustrative rate impacts based upon the recommended recovery methodology and anticipated LNG Facility costs.

II. NMGC RATE STRUCTURE

Q. PLEASE DESCRIBE THE COMPANY'S EXISTING RATE TARIFFS.

A. A customer's eligibility for a particular NMGC tariff rate is established first on the basis of sector, i.e., whether a customer is residential, commercial or industrial. All residential customers are served under the Rate 10 Residential Rate. NMGC offers three standard commercial and industrial ("C&I") rates based on customer size. These are (i) the Rate 54 Small Volume General Service Rate for C&I customers with less than 200,000 therms per year, (ii) the Rate 56 Medium Volume General Service Rate for C&I customers whose use is from 200,000 up to 2,000,000 annual therms, and (iii) the Rate 58 Large Volume General Service Rate for C&I customers whose annual use is 2,000,000 therms or greater. Over 99 percent of NMGC customers receive service pursuant to the Rate 10 Residential Rate or one of the three standard general service C&I rates. Other NMGC customers receive service under one of the Company's seven other tariff rates offered to customers with specific end-uses or other qualifying criteria. These are the Rate 30 Irrigation Rate, the Rate 31, Water and Sewage Pumping Rate, the Rate 35 Cogeneration Rate, the Rate 37 Gas Air Conditioning Rate, the Rate 39 Alternate Fuel Vehicle Rate, the Rate 61 Sale for Resale Rate, and the Rate 114 District Energy System Service Rate. Lastly, the Company provides transportation service pursuant to the Rate 70 Transportation Service to competitive gas suppliers that serve many of NMGC's customers. The Rate 70

Transportation Service Rate incorporates the underlying base rate charges for the other NMGC tariff rates that retail customers are otherwise eligible for in addition to other rates and terms that apply to transportation service.

Q. ARE THERE SEPARATE CHARGES FOR GAS SUPPLY?

A. Yes. Sales customers that purchase their gas supply from NMGC pay a volumetric purchase gas adjustment ("PGA") charge for gas supply pursuant to Rate Rider No. 4. The Rate Rider No. 4 Cost of Gas rate recovers the direct costs of purchased gas and upstream pipeline capacity and storage resources necessary to ensure firm delivery to customers throughout the year, and is adjusted monthly to track changes in the delivered cost of gas supply.

Other customers are transportation-only customers. These customers purchase their gas supply from various third-party suppliers that may offer competitive pricing or other terms. Each third-party supplier contracts with NMGC for the transportation and distribution services required to deliver supplies to their customers. The price paid by the end-user to the third-party supplier is negotiated in a competitive marketplace and is not disclosed to NMGC or the Commission. A customer of a third-party supplier may return to sales service at any point in the future, subject to availability of capacity and certain notice requirements.

III. NMGC LNG FACILITY

Q. PLEASE DESCRIBE THE PROPOSED LNG FACILITY.

A. NMGC is proposing to construct a one billion cubic foot ("Bcf") LNG storage facility located in Rio Rancho, New Mexico. The proposed LNG Facility would also encompass liquefaction and vaporization equipment and incorporate the capability to directly load or offload LNG to trailers. The liquefaction equipment would be able to fill the tanks at a rate of approximately 10,000 million cubic feet per day ("Mcf/d"). Three separate vaporizers would be able to vaporize a total of 195,000 Mcf/d, if operating at maximum capability. The LNG Facility would be staffed around-the-clock with trained operators.

Q. WHAT SYSTEM BENEFITS IS THE LNG FACILITY DESIGNED TO PROVIDE TO NMGC'S CUSTOMERS?

A. The anticipated benefits of the LNG Facility are described by NMGC Witness Bullard. These include the ability to mitigate exposure to volatile gas price spikes and to enhance reliability. NMGC's existing access to storage is through a contract with a third-party provider that requires gas supplies to be delivered via interstate pipelines to NMGC's own transmission facilities. The proposed LNG Facility is designed to provide important benefits attributable to the direct integration of the LNG Facility with NMGC's system. These include the ability to meet demands on short notice without being subject to contract storage tariff timing limitations or ratchet reductions on withdrawal amounts. Further, the LNG Facility would be strategically located to enhance reliability and flexibility across the NMGC system.

Q. DOES NMGC HAVE AN OPERATING PLAN FOR USE OF THE PROPOSED LNG FACILITY?

A. NMGC Witness Bullard explains how the addition of on-system storage will enhance NMGC's operations throughout the winter heating season. The operation of the LNG Facility will prioritize the ability to avoid significant supply cost increases and curtailments that may result from volatile market conditions or *force majeure* events. In addition, the Company plans to utilize to meet small amounts of gas supply to level out interruptions or price variations that occur on a smaller scale, including as a result of supply cuts or to meet variations between actual and forecast weather.

Q. BASED UPON NMGC WITNESS BULLARD'S TESTIMONY, DO YOU BELIEVE THERE ARE IMPORTANT DISTINCTIONS BETWEEN THE NATURE OF THE CONTRACT STORAGE PRESENTLY PURCHASED BY NMGC AND THE PROPOSED ON-SYSTEM LNG STORAGE?

A. Yes. The investment in on-system that is fully integrated with NMGC's other investments in transmission and distribution facilities for customers offers incremental reliability and flexibility enhancements to NMGC's system operations that offer benefits to customers above those achieved through the purchase of contract storage from a third party.

Q. HAS THE COMMISSION RECOGNIZED THE POTENTIAL BENEFITS FOR NMGC's CUSTOMERS OF NMGC-OWNED STORAGE FACILITIES SUCH AS THE PROPOSED LNG FACILITY?

A. Yes. In the Commission's June 15, 2021 Final Order in Case No. 21-00095-UT, the Commission noted that greater access to storage, including NMGC-owned or controlled storage could provide important benefits including avoiding extraordinary gas expenses when gas prices rise and avoiding customer curtailments.

Q. BASED ON THE FOREGOING, WHAT DO YOU CONCLUDE REGARDING THE COMPANY'S PLANNED INVESTMENT IN THE LNG FACILITY?

A. The purpose and anticipated operation of the LNG Facility reflects the dual functions of reducing gas price volatility and enhancing system reliability. Reducing gas price volatility benefits sales customers that purchase gas from NMGC through its PGA recovery mechanism. Enhancing system reliability benefits all firm customers of NMGC.

Q. IS IT APPROPRIATE TO REFLECT THE DUAL FUNCTIONS OF THE LNG FACILITY WITHIN THE PLANNED COST RECOVERY PROPOSAL?

A. Yes. Each of the functions of the facility benefit different groups of NMGC customers. Under these circumstances, I believe the dual nature of the LNG Facility should be considered in establishing the recovery of the LNG Facility's costs from customers. Specifically, a portion of the costs of the facility should be recovered from sales customers consistent with the benefits associated with reducing price volatility. In addition, a portion of the costs of the LNG Facility should be recovered from all customers consistent with the benefits associated with enhancing reliability benefits.

IV. RECOMMENDED RATE TREATMENT OF NMGCLNG COSTS

Q. WHEN WILL THE COSTS OF THE LNG FACILITY BE REFLECTED IN CUSTOMER RATES?

A. The costs of the LNG Facility represent base rate costs and thus a base rate case will be necessary in order to reflect the associated costs in rates paid by customers. The Company anticipates including the LNG Facility costs in a base rate case based on the LNG Facility's in-service date, which is projected to occur in 2027.

Q. WHAT METHOD DO YOU RECOMMEND FOR RECOVERING THE LNG FACILITY COSTS FROM CUSTOMERS?

A. The cost of service, or revenue requirement, for the LNG Facility should be separately calculated in a base rate proceeding. Fifty percent of the cost of service should be recovered through base rates from all customers and the other 50 percent should be recovered from sales customers.

Q. WHY ARE YOU RECOMMENDING A 50-50 SPLIT BETWEEN RECOVERY THROUGH BASE RATES AND FROM SALES CUSTOMERS?

A. NMGC anticipates substantial benefits resulting from its investment in the LNG Facility, both in terms of reducing price volatility and in terms of enhancing system reliability. Until the LNG Facility is constructed and operated over the course of several seasons, an objective assessment of the relative benefits in each area cannot be reasonably performed. My professional opinion is that the 50-50 split fairly assigns the costs to the customers that benefit from the integration of the LNG Facility into the NMGC system. Further, my recommendation reflects the Commission's view concerning the potential benefits of pursuing an on-system alternative to NMGC's continued purchase of upstream contract storage.

Q. PLEASE EXPLAIN HOW THE TOTAL COST OF SERVICE FOR THE LNG FACILITY WOULD BE ESTABLISHED.

A. Once the LNG Facility is eligible for recovery under the Commission's test year rules, the Company would support the calculation of the LNG Facility's cost of service in a base rate case. The LNG cost of service calculations presented by the Company would include return, income taxes, property taxes, depreciation expense and operation and maintenance ("O&M") expense directly associated with the LNG Facility. Each of the elements of the cost of service, including the rate of return, would be established by the Commission in the base rate case.

Q. WHAT IS THE NEXT STEP IN THE CALCULATION PROCESS FOR ESTABLISHING THE RATE RECOVERY OF THE LNG COST OF SERVICE?

A. The cost of service for the LNG Facility would be divided in half with one-half recovered through base rates from all customers and the other half recovered only from sales customers.

Q. HOW WOULD THE FIRST COMPONENT OF THE LNG FACILITY COST OF SERVICE RECOVERABLE FROM ALL CUSTOMERS BE REFLECTED IN BASE RATES?

A. Each cost of service element of the base rate component of the LNG Facility cost of service would flow through all of the required revenue schedules in the base rate proceeding and be included in the overall base revenue request. The costs would be allocated among rate classes within the Fully Allocated Cost of Service Study ("FACOS") in order to establish the cost responsibility for each customer class.

Q. WHAT ALLOCATION BASIS DO YOU RECOMMEND BE APPLIED TO ALLOCATE THE COSTS ASSOCIATED WITH THE LNG FACILITY WITHIN THE FACOS?

A. I recommend allocating the base rate component of LNG Facility costs using the peak and average allocation factor. The peak and average allocation factor is the general demand allocation methodology used within the FACOS to allocate other reliability-related costs.

Alternatively, this component could be allocated among customer classes on the basis of class contribution to design peak day.

Q. HOW WOULD THE SECOND COMPONENT OF THE LNG FACILITY COST OF SERVICE RECOVERABLE FROM SALES CUSTOMERS BE REFLECTED IN CUSTOMER RATES?

A. One method of recovering the sales customer portion would be to utilize the existing PGA clause. Under this method, 50 percent of LNG Facility costs would be carved out of base rates and included in the PGA beginning with the same month that base rates become effective in the case that established the recovery amount. One-twelfth of the annual costs would be included as a cost each month and recovered from sales customers through the PGA rate. The level of the monthly LNG Facility cost of service amount recovered through the PGA would remain the same until such time as base rates are changed and a new calculation of the cost of service for the LNG Facility is approved by the Commission. Alternatively, a new base rate element only applicable to sales customers could be established for recovery of the second component of the LNG Facility cost of service.

Q. DO YOU RECOMMEND REVISITING THE 50-50 COST SPLIT BETWEEN BASE RATE RECOVERY AND PGA RATE RECOVERY?

A. Yes. It would be appropriate to conduct an empirical analysis of the actual use of the LNG Facility and the resulting benefits based upon the first five years of actual operating experience. The empirical analysis could consider information concerning the operational performance of the LNG Facility, timing and frequency of upstream pipeline and storage curtailments and *force majeure* situations, seasonal and daily market prices of natural gas supplies and any other pertinent data. Any change to the 50-50 split should be implemented in conjunction with the first NMGC base rate case following the assessment.

V. ILLUSTRATIVE CUSTOMER RATE IMPACTS

Q. IS IT POSSIBLE TO PROVIDE AN ESTIMATE OF THE RATE IMPACT TO RESIDENTIAL AND SMALL COMMERCIAL CUSTOMERS OF THE PROPOSED LNG FACILITY?

A. Yes. An estimate of the rate impact to customers can be derived based upon (i) the projected annual revenue requirements for the LNG Facility, (ii) current rate levels, and (iii) billing units and allocation factors from the 2021 Rate Case. The projected revenue requirements for the LNG Facility for 2028 are $27.8 million. For purposes of estimating the bill impacts, I assume that one-half of this amount would be recovered from sales customers. Based on total sales volumes of approximately 46 million dekatherms, the component recovered from sales customers equates to approximately $0.03 per therm. The other half would be recovered from all customers, which would equate to an incremental cost of approximately $0.02 per therm for residential and small commercial customers.

The anticipated impact is different for sales and transportation customers within each rate class. For residential sales customers, the anticipated rate impact in the first full year of the LNG Facility's operations is $3.13 per month or approximately 3.2% on an average bill using current rates. The corresponding anticipated rate impact for residential transportation customers is $1.37 per month or approximately 4.4% on an average bill. Similarly, the anticipated rate impact for small commercial sales customers is $18.11 per month or 3.6% and for small commercial transportation customers is $7.62 per month or 8.1%.

Q. PLEASE PROVIDE CORRESPONDING BILL IMPACTS BASED UPON TEN-YEAR COST OF SERVICE PROJECTIONS.

A. For the ten-year period 2028-2037, the estimated bill impact for residential sales customers is $1.52 per month or approximately 1.6% on an average bill using current rates. The corresponding anticipated rate impact for residential transportation customers is $1.24 per month or approximately 4.0% on an average bill. Similarly, the anticipated ten-year average rate impact for small commercial sales customers is $8.60 per month or 1.7% and for small commercial transportation customers is $6.91 per month or 7.3%.

Q. IS NMGC REQUESTING THAT THE COMMISSION APPROVE THE FUTURE RATE TREATMENT OF THE PROPOSED LNG FACILITY IN THIS PROCEEDING?

A. No. In this proceeding, NMGC is providing the Commission and all interested stakeholders with the Company's recommended cost recovery plan for informational purposes. The Company will support its recommendation when it seeks recovery of the LNG Facility costs in a future base rate proceeding.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-_______-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

ELECTRONICALLY SUBMITTED AFFIRMATION OF DANIEL P. YARDLEY

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

In accordance with 1.2.2.10(E) NMAC, Daniel P. Yardley, Consultant for New Mexico Gas Company, Inc., upon being duly sworn according to law, under oath, deposes and states under penalty of perjury under the laws of the State of New Mexico: I have read the foregoing Direct Testimony and Exhibits, and they are true and accurate based on my personal knowledge and belief.

SIGNED this 15th day of December 2022.

<u>/s/ Daniel P. Yardley</u>
Daniel P. Yardley
Principal
Yardley Associates

DANIEL P. YARDLEY

Summary of Professional Experience

Mr. Yardley is an independent consultant providing litigation support, strategic planning and policy analysis to natural gas LDC clients. Areas of specialty include cost allocation, rate design, market restructuring, resource planning, and rate and regulatory advisory services. He has presented testimony in over 50 state and federal proceedings on matters pertaining to cost of service, cost allocation, rate design, revenue decoupling and resource planning on behalf of many LDCs. Exemplary communication, writing and quantitative skills have been recognized by clients and also outside stakeholders. Previously, Mr. Yardley earned a Bachelor of Science degree in Electrical Engineering from the Massachusetts Institute of Technology.

Rate and Regulatory Experience

Mr. Yardley has extensive experience in all aspects of gas utility and interstate gas pipeline rate and regulatory requirements. He is intimately familiar with the rate case process and provides additional value from direct experience in multiple jurisdictions, as well as through broad involvement in the many aspects of the ratemaking process. While the primary focus of Mr. Yardley's rate and regulatory projects has been in the areas of cost allocation studies, rate design and cost recovery mechanisms, he has also participated in the analysis of special contracts, negotiated rates, preparation of sales and revenue forecasts, development of revenue requirements, design of new service offerings and tariff design. He is also familiar with the complexities associated with implementation and administration of LDC rates and tariffs including annual adjustment filings, budgeting requirements, revenue accounting, and customer outreach and education. A list of expert testimony is attached.

Recent Cost Allocation and Rate Design Projects

> Prepared cost allocation and rate design studies for South Jersey Gas, filed associated testimony in April 2022 supporting proposed rates.

> Prepared cost allocation and rate design studies for New Jesey Natural Gas, filed associated testimony in March 2021 supporting proposed rates.

> Prepared cost allocation and rate design studies for Nicor Gas, filed associated testimony in January 2021 supporting proposed rates.

> Prepared cost allocation and rate design studies for South Jersey Gas, filed associated testimony in March 2020 supporting proposed rates.

> Prepared cost allocation and rate design studies for New Mexico Gas Company along with proposed infrastructure cost recovery mechanism, filed associated testimony in December 2021.

Revenue Decoupling Projects

> Developed a revenue decoupling mechanism for Nicor Gas.

> Developed the first revenue decoupling mechanism in response to the Massachusetts Department of Public Utilities generic policy statement on behalf of Bay State Gas Company. The proposed mechanism included deviations from the Department's prescribed approach that were needed to meet the Company's goals and objectives. As part of this project, a capital recovery mechanism was developed to provide for recovery of significant non-revenue producing plant investments.

> Worked closely with New Jersey Natural Gas Company and South Jersey Gas Company to jointly develop and propose revenue decoupling mechanisms in December 2005, prior to filings by many other LDCs. Mr. Yardley played a critical role in the project team by facilitating the development of the joint decoupling proposals, developing negotiating positions, and acting as lead negotiator with consumer representatives and with the Staff of the New Jersey Board of Public Utilities that resulted in a successful outcome for the two LDCs. Provide ongoing support to both companies related to implementation of decoupling mechanisms.

Interstate Pipeline Cost Allocation and Rate Design Testimony and Analysis

- Advised the New England Customer Group in rate proceedings of various interstate pipelines following the Federal Energy Regulatory Commission's review of pipeline rates following the implementation of the Federal Tax Cuts and Jobs Act including Tennessee Gas Pipeline, Texas Eastern Transmission and Algonquin Gas Transmission. Analyzed filings, developed settlement positions and represented the customer group in settlement negotiations with interested parties.
- Worked with Public Service Electric & Gas Company and National Grid in Transcontinental Gas Pipe Line Corporation's general rate case proceeding in RP18-1126 to address storage and O&M cost allocation issues.
- Worked with the Iroquois LDC Customer Group to negotiate a resolution of a Section 5 proceeding initiated by FERC that led to favorable rate reductions.
- Advised Tampa Electric, Peoples Gas, Duke Energy and Florida Power & Light regarding Florida Gas Transmission Company's rate case in RP15-101. Worked with the group to address complex facility roll-in and rate design issues and participate in settlement negotiations.

Gas Supply Planning Analyses

- Performed an independent evaluation of a capacity acquisition for a Northeast LDC including cost and non-cost assessment.
- Participated in the design of various upstream portfolio management incentives including capacity and storage management incentives, hedging and gas cost incentive mechanisms.

Contact Information

YARDLEY ASSOCIATES

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Prior Testimony of Daniel P. Yardley

Jurisdiction	Sponsor	Year	Topics	Docket
Federal Energy Regulatory Commission	Northern Distributor Group	1992	Cost of Service and Cost Allocation	RP92-1
	Northern Distributor Group	1995	Cost of Service and Rate Design	RP95-185
	Atlanta Gas Light, et al.	2001	Storage Cost Allocation	RP01-245
	Bay State Gas and Northern Utilities	2002	Rate Design	RP02-13
Florida	Peoples Gas System	2008	Cost Allocation and Rate Design	Docket No. 080318-GU
	Peoples Gas System	2020	Cost Allocation and Rate Design	Docket No. 20200051-GU
Massachusetts	Bay State Gas	1998	Capacity Assignment	D.T.E. 98-32
	Bay State Gas	2001	Contract Approval	D.T.E. 00-99
	Bay State Gas	2006	Declining Use Rate Adjustment	D.T.E. 06-77
	Bay State Gas	2007	Declining Use Rate Adjustment	D.P.U. 07-89
	Bay State Gas	2009	Revenue Decoupling	D.P.U. 09-30
Illinois	Nicor Gas	2017	Cost Allocation and Rate Design	Docket No. 17-00124
	Nicor Gas	2018	Revenue Decoupling, Cost Allocation and Rate Design	Docket No. 18-1775
	Nicor Gas	2020	Transportation Service Cost Recovery	Docket No. 20-0606
	Nicor Gas	2021	Cost Allocation and Rate Design	Docket No. 21-0098
New Hampshire	Northern Utilities	2005	Jurisdictional Gas Cost Allocation	DG05-080
Canada Energy Regulator	Alberta Northeast Gas, Ltd.	2012	TransCanada Pipeline Service Restructuring and Tolls	RH-3-2011
	Alberta Northeast Gas, Ltd.	2013	TransCanada Pipeline Shipper Renewal Rights	RH-1-2013
	Alberta Northeast Gas, Ltd.	2014	TransCanada Pipeline Service Service and Toll Design	RH-1-2014
New Jersey	New Jersey Natural Gas	1999	Rate Unbundling	Docket No. GO99030123
	Elizabethtown Gas, *et al.*	1999	Customer Account Services	Docket No. EX99090676
	Elizabethtown Gas	2002	Cost Allocation and Rate Design	Docket No. GR02040245
	South Jersey Gas Company	2003	Cost Allocation and Rate Design	Docket No. GR03080683
	South Jersey Gas Company	2004	Capacity Charge	Docket No. GR04060400
	New Jersey Natural Gas	2005	Revenue Decoupling	Docket No. GR0512020

**Prior Testimony of
Daniel P. Yardley**

Jurisdiction	Sponsor	Year	Topics	Docket
New Jersey cont.	South Jersey Gas Company	2005	Revenue Decoupling	Docket No. GR0512019
	South Jersey Gas Company	2007	Annual Decoupling Adjustment	Docket No. GR07060354
	New Jersey Natural Gas	2007	Cost Allocation and Rate Design	Docket No. GR07110889
	South Jersey Gas Company	2008	Annual Decoupling Adjustment	Docket No. GR08050367
	Elizabethtown Gas	2009	Revenue Decoupling, Cost Allocation and Rate Design	Docket No. GR09030195
	South Jersey Gas Company	2009	Annual Decoupling Adjustment	Docket No. GR09060340
	South Jersey Gas Company	2009	Cost Allocation and Rate Design	Docket No. GR10010035
	New Jersey Natural Gas	2010	Energy Efficiency Cost Recovery	Docket No. GR10030225
	South Jersey Gas Company	2011	Annual Decoupling Adjustment	Docket No. GR11060337
	New Jersey Natural Gas	2011	Energy Efficiency Cost Recovery	Docket No. GR11070425
	South Jersey Gas Company	2012	Annual Decoupling Adjustment	Docket No. GR12060475
	New Jersey Natural Gas	2012	Energy Efficiency Cost Recovery	Docket No. GR12070640
	New Jersey Natural Gas and South Jersey Gas Company	2013	Revenue Decoupling	Docket No. GR13030185
	South Jersey Gas Company	2013	Annual Decoupling Adjustment	Docket No. GR13050434
	South Jersey Gas Company	2013	Cost Allocation and Rate Design	Docket No. GR13111137
	South Jersey Gas Company	2014	Annual Decoupling Adjustment	Docket No. GR14050510
	New Jersey Natural Gas	2014	Energy Efficiency Cost Recovery	Docket No. GO14121412
	South Jersey Gas Company	2015	Annual Decoupling Adjustment	Docket No. GR15060642
	Elizabethtown Gas	2015	Infrastructure Cost Recovery	Docket No. GR15091090
	New Jersey Natural Gas	2015	Cost Allocation and Rate Design	Docket No. GR15111304
	South Jersey Gas Company	2016	Annual Decoupling Adjustment	Docket No. GR16060483
	Elizabethtown Gas	2016	Cost Allocation and Rate Design	Docket No. GR16090826
	South Jersey Gas Company	2017	Cost Allocation and Rate Design	Docket No. GR17010071
	South Jersey Gas Company	2017	Annual Decoupling Adjustment	Docket No. GR17060586

Prior Testimony of
Daniel P. Yardley

Jurisdiction	Sponsor	Year	Topics	Docket
New Jersey cont.	South Jersey Gas Company	2018	Annual Decoupling Adjustment	Docket No. GR17060586
	New Jersey Natural Gas	2019	Cost Allocation and Rate Design	Docket No. GR19030420
	Elizabethtown Gas	2019	Cost Allocation and Rate Design	Docket No. GR19040486
	South Jersey Gas Company	2019	Annual Decoupling Adjustment	Docket No. GR19050679
	South Jersey Gas Company	2020	Cost Allocation and Rate Design	Docket No. GR20030243
	South Jersey Gas Company	2020	Annual Decoupling Adjustment	Docket No. GR20060383
	New Jersey Natural Gas	2021	Cost Allocation and Rate Design	Docket No. GR21030679
	South Jersey Gas Company	2021	Annual Decoupling Adjustment	Docket No. GR21060881
	Elizabethtown Gas	2021	Cost Allocation and Rate Design	Docket No. GR21121254
	South Jersey Gas Company	2022	Cost Allocation and Rate Design	Docket No. GR22040253
	South Jersey Gas Company	2021	Annual Decoupling Adjustment	Docket No. GR22060364
New Mexico	New Mexico Gas Company	2018	Rate Design, Weather Normalization Adjustment and Infrastructu	Case No. 18-00038-UT
	New Mexico Gas Company	2019	Cost Allocation, Rate Design and Infrastructure Cost Recovery	Case No. 19-00317-UT
	New Mexico Gas Company	2020	Weather Normalization Adjustment	Advice Notice No. 81
	New Mexico Gas Company	2021	Weather Normalization Adjustment	Advice Notice No. 85
	New Mexico Gas Company	2021	2021 Winter Weather Event	Case No. 21-00095-UT
	New Mexico Gas Company	2021	Cost Allocation, Rate Design and Infrastructure Cost Recovery	Case No. 21-00267-UT
	New Mexico Gas Company	2021	2021 Winter Weather Event	Advice Notice No. 91
North Carolina	Piedmont Natural Gas Company	2013	Cost Allocation and Rate Design	Docket No. G-9, Sub. 631
	Piedmont Natural Gas Company	2019	Cost Allocation and Rate Design	Docket No. G-9, Sub. 743
Rhode Island	Providence Gas Company	1996	Cost Allocation and Rate Design	Docket No. 2076
Tennessee	Chattanooga Gas Company	2009	Revenue Decoupling, Cost Allocation and Rate Design	Docket No. 09-00183
	Piedmont Natural Gas Company	2011	Cost Allocation and Rate Design	Docket No. 11-00144
	Chattanooga Gas Company	2018	Cost Allocation and Rate Design	Docket No. 18-00017
Wisconsin	Wisconsin Power and Light	2001	Cost Allocation and Rate Design	Docket No. 6680-UR-111

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF NEW MEXICO GAS COMPANY, INC.'s APPLICATION FOR THE ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT A LIQUEFIED NATURAL GAS FACILITY.	)	**Case No. 22-00309-UT**
NEW MEXICO GAS COMPANY, INC.,	)	
APPLICANT.	)	

CERTIFICATE OF SERVICE

I CERTIFY that on this day I sent, via email a true and correct copy of **New Mexico Gas Company, Inc.'s Application for Issuance of a Certificate of Convenience and Necessity** to the parties listed below:

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DATED on December 16, 2022

Respectfully submitted,

/s/ Rebecca Carter

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