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Attachment A

Proposed Scenarios Framework: I.17-02-002

Introduction

In this document, the California Public Utility Commission's (CPUC or Commission) Energy Division proposes a high-level framework for conducting the studies needed to inform the Ordering Instituting Investigation (OII) 17-02-002, which will determine whether use of the Aliso Canyon natural gas storage facility (Aliso) can be minimized or eliminated. The initial models are intended to set a baseline on the need for Aliso for reliability and the cost to the system of various Aliso inventory levels if the gas and electric systems continue to operate close to the planned status quo, which includes all the increases in renewables, conservation, and energy efficiency currently required by California legislation. These baselines will be critical in determining the cost and viability of long-term alternatives to Aliso Canyon.

The proposed framework is not meant to be definitive but to serve as a starting point for discussion at two planned workshops during which parties will have the chance to vet the proposed scenarios and assumptions and to provide additional input. The first such workshop will be held on August 1, 2017. The second workshop has not been scheduled but is expected to take place in October 2017. Parties to the proceeding have the opportunity to make informal comments on this framework in advance of the first workshop. Informal comments are due by July 24, 2017, and should be emailed to the service list of Investigation (I.) 17-02-002 (but not formally filed) and sent to Commission staff at AlisoCanyonOII@cpuc.ca.gov.

Background

A major gas leak was discovered at the Southern California Gas Company's (SoCalGas) Aliso Canyon natural gas storage facility on October 23, 2015. On January 6, 2016, the governor ordered SoCalGas to maximize withdrawals from Aliso to reduce the pressure in the facility. The CPUC subsequently required SoCalGas to leave 15 Billion cubic feet (Bcf) of working gas in the facility that could be withdrawn to maintain reliability. On May 10, 2016, Senate Bill (SB) 380 was approved, which, among other actions, prohibited the injection of gas into the facility until a comprehensive safety review is completed; added Section 715 to the California Public Utilities Code requiring the CPUC to determine the range of gas inventory and injection and withdrawal capacity needed to ensure reliability at just and reasonable rates; and required the CPUC to open a proceeding to determine the feasibility of minimizing or eliminating use of Aliso while still maintaining energy and electric reliability for the region.

On February 9, 2017, the CPUC opened an Order Instituting Investigation pursuant to SB 380. The proceeding is structured to take place in two phases. In Phase 1, the Commission will undertake a comprehensive effort to develop the appropriate analyses and scenarios to evaluate the impact of reducing or eliminating the use of Aliso. The intent of Phase 1 is to involve all interested parties in developing a transparent and vetted list of assumptions, scenarios, and reduction or elimination timelines. Phase 1 will be resolved by the issuance of an Assigned Commissioner's Ruling providing guidance on the scenarios and assumptions that will be evaluated in Phase 2. In Phase 2, the Commission will evaluate the impacts of reducing or eliminating the use of Aliso using the scenarios and models adopted in Phase 1. The results of the models will inform the Commission's decision on the appropriate use of the storage field.

Proposed Studies

Energy Division plans to undertake three studies to inform this investigation: hydraulic modeling, production cost modeling, and economic modeling. The studies are intended to estimate how reducing or eliminating use of Aliso would impact gas and electric reliability, electric costs and reliability, and natural gas commodity costs, respectively. A brief description of each type of model and Energy Division's proposed scenarios and assumptions follows below.

Each model will be run independently of the others (i.e. with its own inputs and outputs un-connected to the others), with one exception. The production cost model will output time series profiles of natural gas usage at the gas-fired power plants. This profile of natural gas usage will be an input to the hydraulic modeling.

Hydraulic Modeling

Hydraulic modeling simulates the impact of hourly changes in gas supply and demand on pressures in the pipeline network. The model includes detailed information about SoCalGas' gas transmission system and can be used to simulate how the system operator would respond to various scenarios. Hydraulic modeling has been used in the three previously published Aliso Summer and Winter Technical Assessments.[1] Energy

[1] Summer 2016 Technical Assessment: https://efiling.energy.ca.gov/getdocument.aspx?tn=211671

Division is in the process of seeking an independent consultant who can run a hydraulic model of the SoCalGas system using either Synergi Gas modeling software or similar software that is compatible with Synergi Gas data using the scenarios and assumptions determined in the upcoming workshops.

Proposed Scenarios

Near Term, Medium Term, and Long Term

Energy Division proposes modeling the impact of reducing or minimizing the use of Aliso in the near term (2018), medium term (2022), and long term (2027). Since gas usage varies considerably by season, the model would need to be run for both summer and winter in each of the years mentioned above.

Aliso Inventory Level

Energy Division proposes modeling one to three Aliso inventory levels for each year mentioned above: zero (i.e., closure of Aliso), open at the top of the range determined by the most recent California Public Utilities Code Section 715 report (the 715 report),[2] and open at the level determined to be necessary by the hydraulic model.

If the hydraulic model determines that Aliso can be closed with no significant impacts to gas and electric reliability in either summer or winter, then no further modeling would be necessary for that year. If the model determines that Aliso cannot be closed without causing unacceptable reliability impacts, then the system would be modeled including Aliso inventory at the level determined by the 715 report, since that level represents the

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Winter 2016-17 Technical Assessment: https://efiling.energy.ca.gov/getdocument.aspx?tn=212913
Summer 2017 Technical Assessment: http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-11/TN217639_20170519T104800_Aliso_Canyon_Risk_Assessment_Technical_Report_Summer_2017_Asses.pdf

[2] The report required in California Public Utilities Code 715 is known informally as "the 715 report." Two such reports have been published thus far. The first, on June 28, 2016: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/Preliminary%20Report%20-%20Section%20715%20of%20the%20Public%20Utilities%20Code.pdf. The second, on January 17, 2017: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/AlisoGas1-9-715.pdf. The CPUC expects to continue to update the 715 report as new information becomes available. Energy Division proposes using whatever Aliso inventory level has been determined to be sufficient in the most recent 715 report.

CPUC's current best estimate of how much gas is needed in Aliso to maintain reliability. If the inventory levels required by the 715 report are insufficient to maintain reliability, then successive iterations of the model will be run to determine the minimum quantity of gas needed to support gas and electric system reliability.[3]

It is important to note that the results of the hydraulic model and the production cost model discussed below are linked. The total amount of gas needed depends in part on the amount of gas required for gas-fired electric generation. Therefore, the amount of gas-fired electric generation that is determined to be required for electric reliability by the production cost model would be one input to the hydraulic model.

Proposed Inputs

In the three previous technical assessments, a variety of strategies have been used to test how the system would respond to stress. In the Summer 2016 Technical Assessment, four historical days were chosen, and the recorded gas flows were used to model whether gas service could have been maintained on those days without Aliso. Rather than using historical days, the Winter 2016-17 and Summer 2017 Technical Assessments modeled peak days. The Winter 2016-17 Assessment used the 1-in-10 CPUC cold winter day design standard,[4] and the Summer 2017 Assessment used the 1-in-10 peak summer electric load as determined by the Western Electricity Coordinating Council (WECC) Operational Study Subcommittee. Several iterations of the model were run testing reliability at various gas receipt point utilization levels.

Peak Day Forecasts

For this study, Energy Division proposes modeling peak days rather than historical days because energy use patterns are changing rapidly in California. Historic day demand patterns likely will not provide a good basis for modeling 10 years in the future. Energy Division suggests using the Winter Peak Day Demand and the Summer High Sendout Day Demand forecasts[5] in the most recent update to the California Gas Report.

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[3] A flow chart that provides a visual representation of the proposed modeling process is included as Attachment A: Hydraulic Modeling Flow Chart.

[4] This design standard was agreed to in the Triennial Cost Application Proceeding (TCAP). See the Direct Testimony of Bruce Wetzel, p. 10: https://www.socalgas.com/regulatory/documents/a-15-07-014/TCAP%20Phs%202%20-%20Wetzel%20with%20new%20caption.pdf. The forecast has since been lowered in the most recent update to the California Gas Report.

[5] The SoCalGas Winter Peak Day Demand forecast is a composite of 1-in-35 year winter cold day core demand and 1-in-10 year winter cold day noncore demand. The SoCalGas Peak Summer Day Demand forecast is a composite of average daily summer demand for core and non-electric

Currently, these forecasts do not extend beyond 2022. However, the Report states that SoCalGas expects total gas use to decline by 0.6% per year from 2016 to 2035.[6] Energy Division proposes using the 0.6% expected annual rate of decline to forecast peak day demand in 2027.

Gas Receipt Point Utilization

In the Technical Assessments, gas receipt point utilization levels ranging from 85% to 100% were modeled. Gas receipt point utilization can be below 100% for a variety of reasons. For example, customers could bring in less gas than they burn, or pipeline maintenance could reduce transmission capacity. Historically, receipt point utilization has ranged between 60%-80% in the winter.[7] However, most of this data predates the tighter gas balancing rules that went into effect in December 2015. Under the new rules, SoCalGas can call a Low Operational Flow Order (OFO) on days of system stress, which allows the utility to levy financial penalties on customers who do not bring in at least 95% of the gas they use. The new rules have greatly reduced gas imbalances. Since the new rules went into effect, the system has never been more than 8% underdelivered on a high sendout day when a Low OFO was called. Given the new balancing rules, Energy Division suggests that 85% receipt point utilization is sufficiently conservative to cover the impacts of underdeliveries and planned and unplanned maintenance, despite being higher than the historical average.

Maximum Tubing-Only Storage Withdrawal from Non-Aliso Fields

Since the California Department of Oil, Gas, and Geothermal Resources (DOGGR) has proposed new regulations requiring the elimination of "single point-of-failure wells," which typically are wells where gas is flowed through both the tubing and the casing, Energy Division finds it prudent to assume that those restrictions will be in place when conducting the hydraulic modeling. Energy Division proposes including the maximum tubing-only flow from the non-Aliso fields, taking into account existing pipeline constraints at Honor Rancho and constraints at La Goleta related to declining local gas production.

Questions

1. Are the proposed modeling dates reasonable, i.e. 2018, 2022, and 2027?

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generation customers and 1-in-10 dry hydro year demand for noncore customers. See 2016 California Gas Report, p. 93: https://www.socalgas.com/regulatory/documents/cgr/2016-cgr.pdf.

[6] 2016 California Gas Report p. 64.

[7] Winter 2016-17 Technical Assessment p. 29.

2. Is the proposed process for determining the minimum Aliso inventory level reasonable?
3. Is the California Gas Report the appropriate source for summer and winter peak day gas demand forecasts?
4. Is it reasonable to estimate 2027 gas demand by reducing the 2022 peak day forecasts by 0.6% per year?
    a. If additional mitigation measures are put in place, would they result in a greater than 0.6% annual decline in gas demand?
    b. If so, what would be an appropriate method for forecasting future gas demand?
5. Should historical gas days also be modeled?
    a. If so, which days?
    b. How should they be adapted for the medium- and long-term scenarios?
6. Is 85% gas receipt point utilization a reasonable assumption?
7. Is it reasonable to assume that SoCalGas will be restricted to tubing-only flow?
8. Are there any other inputs or assumptions that should be considered?
9. Are there any other questions that should be considered?

Production Cost Modeling

Aliso provides natural gas to 17 natural gas-fired power plants. The plants' nameplate capacity ranges from 45 MW to 1,970 MW, with an average of 441 MW.[8]

Minimizing or eliminating the use of Aliso will reduce the rate of gas delivery to these plants. This will affect the plants' ramping ability, ability to start up on short notice, and other operating parameters, which in turn will affect the electric system's costs and reliability.

Given this problem, Energy Division proposes to evaluate the following questions:

- What is the effect of reducing or eliminating Aliso on the total system production cost and reliability of the electric grid?
- If gas flow from Aliso is reduced by varying percentages, how are reliability (measured in total expected Loss of Load Expectation or LOLE) and cost

[8] For a list of power plants served by Aliso, see the Summer 2016 Aliso Canyon Risk Assessment Technical Report, p.11-12: http://www.energy.ca.gov/2016_energypolicy/documents/2016-04-08_joint_agency_workshop/Aliso_Canyon_Risk_Assessment_Technical_Report.pdf

(measured in rise in expected system production cost from dispatching alternative electric generation) impacted?

Production Cost Model Analysis Plan

To determine the reliability and cost impacts of reducing or eliminating use of Aliso, Energy Division will use the proprietary Strategic Energy Risk Valuation Model (SERVM) developed by Astrapé Consulting. SERVM simulates least-cost dispatch for a user-defined set of generating resources. It calculates numerous reliability and cost metrics for a given study year in light of expected weather, overall economic growth, and performance of the generating resources. For each of these factors, variability and forecasting uncertainties are also taken into account.

As with all probabilistic models, SERVM attempts to simulate the study year many thousands of times over, with each simulation reflecting a slightly different set of weather, economic, and unit performance conditions. Iteration conditions are selected probabilistically, based on how likely they are to occur. In SERVM, a given future study year is modeled based on historical weather; both load and generation profiles are simulated based on that historical weather. For each of approximately 35 possible weather years (1980 to 2015), multiple points of load forecast error can be simulated, creating a large pool of scenarios.

The results provide hourly grid operations information, including hourly production, a comprehensive distribution of reliability costs, expected unserved energy, and other reliability metrics. Expected values and confidence intervals can then be calculated based on these distributions.

The model allows the user to customize parameters and constraints regarding desired levels of reliability and total system production costs, meaning that a variety of tradeoffs between these two grid properties can be studied. SERVM can also simulate arbitrary operating scenarios with the 17 plants that receive gas deliveries from Aliso, meaning that any level of Aliso inventory can be modeled.

It is important to note that certain plants served by Aliso will be upgraded or retired over the next few years. Upgrades and retirements of plants will affect the demand for natural gas. For example, a more efficient plant would use less gas to serve a given amount of load. Alternately, a more efficient plant may be run more often, thus increasing gas usage overall. These nuances necessitate a multi-year simulation to capture the effects of these changes over time.

Proposed Scenarios

Near Term, Medium Term, and Long Term

As a starting point, Energy Division recommends answering the above questions for the years 2018, 2022, and 2027. These years provide an estimate of the effects of Aliso closure on the short, medium, and long term. Although years beyond 2027 could be forecast, substantial uncertainty exists about the state of the grid in those years, making the outputs of such an analysis less useful.

Aliso Inventory Level

Energy Division proposes beginning the modeling process using the Aliso inventory level determined by the 715 report. If that inventory level is too low to ensure a minimum acceptable level of grid reliability and total system production costs, Energy Division will gradually increase Aliso inventory until an acceptable level is reached. If the level determined by the 715 report is unnecessarily far above minimum acceptable levels of grid reliability and total system production costs, Energy Division will gradually lower inventory until that acceptable level is reached.

Proposed Inputs

To the extent practicable, Energy Division proposes to use model inputs and assumptions already developed as part of the Resource Adequacy (RA) and Integrated Resource Planning (IRP) proceedings[9] so as to ensure consistency across proceedings and to use already validated and publically available inputs. Inputs that are not readily available as part of the RA or IRP proceedings may be developed with the input of parties.

In order to run the SERVM model and validate the results, Energy Division requires the following information.

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[9] RA proceeding (R.14-10-010):
https://apps.cpuc.ca.gov/apex/f?p=401:56:0::NO:RP,57,RIR:P5_PROCEEDING_SELECT:R1410010
IRP proceeding: (R.16-02-007):
https://apps.cpuc.ca.gov/apex/f?p=401:56:0::NO:RP,57,RIR:P5_PROCEEDING_SELECT:R1602007
CPUC modeling datasets and documents: http://www.cpuc.ca.gov/General.aspx?id=6442451973

Geography of the Model
Production cost models are primarily bubble-type models, where geographic granularities inside bubbles are not enforced as they are in the power flow simulations used for transmission planning. Energy Division proposes to model Aliso issues along the same geographic bubbles that were used for the RA and IRP proceedings. A listing of these bubbles can be found on the CPUC website.[10]

Characteristics of Gas Storage Facilities
In addition to Aliso Canyon, the Honor Rancho and Playa del Rey storage facilities also supply natural gas to the 17 gas-fired electric power plants in the Los Angeles basin. Energy Division proposes using the maximum tubing-only flow from these fields, taking into account existing pipeline constraints at Honor Rancho.

Utility Capacity Expansion and Plant Retirement Plans
As mentioned above, the production cost analysis will be performed for three future years, 2018, 2022, and 2027. In the time between today and these study years, generating resources used to serve load will change substantially, due to changing load, increasing Renewable Portfolio Standards (RPS) requirements, and other supply and demand aspects of the grid. It is possible that some of the 17 plants currently served by Aliso could be removed from service altogether and/or new ones could be connected to the grid. These new resources may not be dependent on natural gas, or they could be new gas-fired peakers. Therefore it is important to understand the way in which the set of generating resources is likely to evolve over time.

Desired Reliability Levels
The SERVM model requires that the user specify constraints on tolerable reliabilities. Energy Division proposes to use the standard from the Resource Adequacy proceeding as a constraint in the modeling, a maximum of one LOLE (Loss of Load Event) in 10 years. LOLE is defined as the expected number of Loss of Load Events, measuring frequency of outages, but not duration or magnitude. Energy Division welcomes comments on incorporating additional metrics into reliability, such as Loss of Load Hours (which represents the expected total duration of Loss of Load Events but not frequency or magnitude).

Weather Data
Energy Division will use available hourly weather data including the National Oceanic and Atmospheric Administration (NOAA) Integrated Surface Data – Lite (ISD-Lite3505) dataset from multiple weather stations gathered from 1981 to 2015, which includes:

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[10] See last link in footnote above.

- Air temperature
- Dew point temperature
- Wind direction
- Wind speed
- Total cloud cover
- One-hour accumulated liquid precipitation
- Six-hour accumulated liquid precipitation
- Direct and diffuse solar irradiance

This weather data will be used to generate synthetic hourly electricity demand for areas around the weather stations and to generate hourly production profiles for several types of wind or solar generating facilities.

Generating Resources

Information on the 17 generating resources, including ramp rates and heat rate curves, will come from the California Independent System Operator (CAISO) Masterfile, where available. Otherwise, Energy Division will use the Transmission Expansion Planning Policy Committee (TEPPC) 2024 Common Case Dataset.

For information related to forced or scheduled power plant outages, Energy Division will calculate the latest performance indices from the North American Electric Reliability Corporation's (NERC) Generator Availability Data Systems (GADS).

Changes to Operating Characteristics of the 17 Gas-Fired Power Plants

Energy Division already has the normal operating characteristics of these power plants, but any changes to their operating abilities as a result of reducing or eliminating Aliso inventory should be developed. These include changes to ramping ability and start-up characteristics.

Gas Prices

Forecasts of gas prices will come from the California Energy Commission's (CEC) Integrated Energy Policy Report (IEPR), which includes the North American Market Gas-Trade (NAMGas) model report.

SERVM Model Outputs

The SERVM model produces 8,760 hourly profiles of operation for each of the gas-fired power plants. Energy Division will use these profiles to back out gas usage on several gas event days. It will then give these inputs to the hydraulic modeling group to do a gas flow analysis.

The model will produce three scatterplots, one per study year (2018, 2022, and 2027), with each showing reliability on one axis versus production costs on the other. Each point on the plot represents a certain scenario (where each scenario is an Aliso inventory level). Note that because SERVM is a probabilistic model, there will be uncertainty around the results, which will be captured using confidence intervals.

Questions

1. Are the inputs described above appropriate for use in the model as described?
2. Is SERVM an appropriate modeling tool?
3. Is the proposed time horizon appropriate?
4. Are both the LOLE and LOLH appropriate metrics for reliability?
5. What is the best way to simulate the output of the 17 plants with reduced gas flow?
6. What is the best methodology to translate inventory at Aliso, Playa del Rey, and Honor Rancho to withdrawal rates / rate of delivery to the 17 power plants?
7. Are there any other questions that should be considered?

Economic Modeling

In addition to improving reliability, storage is used to reduce the economic impact of fluctuations in natural gas prices. Gas can be purchased and stored in the off-season, when prices are generally lower, for use in the summer and winter, when demand and prices tend to be higher. Storage also helps moderate costs during temporary price spikes, which typically occur during extreme weather events.

Loss of storage impacts core and noncore customers differently. SoCalGas purchases both gas and storage rights for core customers while noncore customers buy their own gas and have the option to pay for storage rights. Since gas is a pass-through cost for core customers — meaning the price paid by the utility is passed on to residential and small business consumers — loss of storage could increase core customers' exposure to market volatility. Noncore customers have been unable to purchase new storage rights in the primary storage market since restrictions on the use of Aliso were put in place. If Aliso is permanently closed, their ability to purchase storage would likely be severely reduced compared to historic norms, leaving them more exposed to market volatility. The economic model is intended to forecast the likely impact a reduction in storage would have on natural gas commodity prices for both core and noncore customers at the SoCalGas border and the SoCalGas city-gate. Energy Division is seeking an independent consultant who can run the economic model using the scenarios and assumptions determined in the upcoming workshops.

A specific model has not yet been chosen for the economic modeling. However, Energy Division has specified that the analysis must dynamically model market and consumer reaction to supply and pricing of the natural gas market in California, taking into consideration the composition of California's electricity market and its dependence on renewable energy sources as well as practices in spot market purchases and long-term contracted purchases. In addition, the analysis should consider any undue burdens or impacts to user group segments. These user group segments may include, but are not limited to, low-income households and particular high-use industries

Proposed Scenarios

Near Term, Medium Term, and Long Term

Energy Division proposes modeling the economic impact of reducing or minimizing the use of Aliso in the near term (2018), medium term (2022), and long term (2027). Since gas prices and usage vary considerably by season, the model would need to be run for both summer and winter in each of the years mentioned above.

Aliso Inventory Level

The economic model should be run for at least two, and up to three, Aliso inventory levels for each of the years mentioned above: closed, open at the level determined by the 715 report, and, if necessary, open at the level determined in the hydraulic modeling phase.

Proposed Inputs

Forecasted Gas Price Ranges: Low, Mid, and High

For each scenario, a range of forecasted natural gas prices should be modeled: low, mid, and high.

Questions

1. Are the proposed modeling dates reasonable?
2. Are the proposed Aliso inventory levels appropriate?
3. Is it reasonable to model low, mid, and high forecasts of natural gas prices?
4. Is there an existing gas price forecast dataset that would be appropriate to use in this model?
5. Are there any other inputs or assumptions that should be considered?
6. Are there any other questions that should be considered?

Attachment A: Hydraulic Modeling Flow Chart

Model Year: 2018

Scenario 1A

Reliable Electric Dispatch as Determined by Production Cost Model

Aliso Closed ⟶ Yes, reliable: stop

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No, not reliable; go to Scenario 1B

Scenario 1B

Reliable Electric Dispatch as Determined by Production Cost Model

Aliso Open at Top of Range Defined in 715 Report ⟶ Yes, reliable: stop

↓

No, not reliable; go to Scenario 1C

Scenario 1C

Reliable Electric Dispatch as Determined by Production Cost Model

Aliso Open

Given defined assumptions about gas and electric demand, iterate to find the minimum Aliso inventory, withdrawal, and injection capacity necessary to support gas demand and reliable electric dispatch.

Model Year: 2022

Scenario 2A

Reliable Electric Dispatch as Determined by Production Cost Model

Aliso Closed ⟶ Yes, reliable: stop

↓

No, not reliable; go to Scenario 2B

Scenario 2B

Reliable Electric Dispatch as Determined by Production Cost Model

Aliso Open at Top of Range Defined in 715 Report ⟶ Yes, reliable: stop

↓

No, not reliable; go to Scenario 2C

Scenario 2C
Reliable Electric Dispatch as Determined by Production Cost Model
Aliso Open

Given defined assumptions about gas and electric demand, iterate to find the minimum Aliso inventory, withdrawal and injection capacity necessary to support gas demand and reliable electric dispatch.

Model Year: 2027

Scenario 3A
Reliable Electric Dispatch as Determined by Production Cost Model
Aliso Closed ⟶ Yes, reliable: stop

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No, not reliable; go to Scenario 3B

Scenario 3B
Reliable Electric Dispatch as Determined by Production Cost Model
Aliso Open at Top of Range Defined in 715 Report ⟶ Yes, reliable: stop

↓

No, not reliable; go to Scenario 3C

Scenario 3C
Reliable Electric Dispatch as Determined by Production Cost Model
Aliso Open

Given defined assumptions about gas and electric demand, iterate to find the minimum Aliso inventory, withdrawal and injection capacity necessary to support gas demand and reliable electric dispatch.

[End of Attachment]