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BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Investigation pursuant to Senate Bill 380 to determine the feasibility of minimizing or eliminating the use of the Aliso Canyon natural gas storage facility located in the County of Los Angeles while still maintaining energy and electric reliability for the region	Investigation 17-02-002

ADMINISTRATIVE LAW JUDGE'S RULING ENTERING INTO THE RECORD DIRECTION TO MAINTAIN ALISO CANYON STORAGE CAPACITY AT OR BELOW THE INTERIM LEVEL OF 34 BILLION CUBIC FEET AND REQUESTING COMMENT

Summary

Public Utilities Code Section 715(d) instructs the Executive Director of the California Public Utilities Commission, in consultation with the State Oil and Gas Supervisor, to direct the operator of the Aliso Canyon natural gas storage facility to maintain a specified range of working gas in the storage field. Public Utilities Code Section 715 expires after January 1, 2021. Following the expiration of Public Utilities Code Section 715, the effective necessary range of working gas at Aliso Canyon natural gas storage facility will be set in this instant proceeding, Investigation 17-02-002.

On July 19, 2017; December 11, 2017; and July 2, 2018, the Commission's Executive Director wrote to Southern California Gas Company regarding the range of working gas allowed at Aliso Canyon natural gas storage facility.

This ruling enters into the record materials regarding the necessary range of working gas at the Aliso Canyon natural gas storage facility for comment by

parties. According to the July 2, 2018 letter from the Commission's Executive Director, SoCalGas must maintain the storage capacity at the interim storage level between zero billion cubic feet and 34 billion cubic feet.

This ruling allows parties to file comments on maintaining the interim storage capacity at Aliso Canyon between zero billion cubic feet to 34 billion cubic feet until a final determination is made in this proceeding. Concurrent opening comments may be filed by close of business September 8, 2020. Concurrent reply comments may be filed by close of business September 15, 2020. Following these comments, the assigned Commissioner will issue a proposed decision adopting an interim range of working gas until further determination in this proceeding.

1. Executive Director Letters and Energy Division Reports

The California Public Utilities Commission (Commission) released a series of five reports identifying the range of working gas necessary at the Aliso Canyon natural gas storage facility (Aliso Canyon) to ensure safety and reliability while preserving just and reasonable rates in California, as mandated under Public Utilities Code Section 715.[1] The first report, published on June 28, 2016, found that 15 billion cubic feet (Bcf) was adequate at the time.[2] The second report, published on January 17, 2017, determined that 29.7 Bcf of

[1] The "715 Reports" can be found here: https://www.cpuc.ca.gov/General.aspx?id=6442457392

[2] Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Summer 2016 Reliability, Jun. 28, 2016, available at https://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. (Attachment 1)

inventory was necessary for Southern California Gas Company (SoCalGas) to maintain safe and reliable service.[3]

Taking into account new conditions, a July 19, 2017 report found that inventory should range between 14.8 Bcf and 23.6 Bcf.[4] The Executive Director's letter to SoCalGas reflected the findings of the report and ordered SoCalGas to maintain a working gas level of between 14.8 Bcf and 23.6 Bcf.[5] The fourth report, issued on December 11, 2017,[6] was accompanied by a letter from the Executive Director to SoCalGas.[7] The Executive Director ordered SoCalGas to maintain the working gas inventory at Aliso Canyon between zero Bcf and 24.6 Bcf.[8] The letter also explained that the Executive Director order will be

[3] Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, Jan. 17, 2017, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/AlisoGas1-9-715.pdf. (Attachment 2)

[4] Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, Jul. 19, 2017, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/ReportReliability.pdf. (Attachment 3)

[5] California Public Utilities Commission letter to Southern California Gas Company, Jul. 19, 2017, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/7-19-17_CPUCLtrtoR.Schweckere.Reliability.pdf. (Attachment 4)

[6] Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, Dec. 11, 2017, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/715_Supplement_2017-12-11_FINAL.pdf. (Attachment 5).

[7] California Public Utilities Commission letter to Southern California Gas Company, Dec. 11, 2017, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/12-11-17%20Directive%20to%20maintain%20a%20range%20of%20working_%20gas%20in%20Aliso.pdf. (Attachment 6)

[8] *Id.*

superseded by the determination in this instant proceeding Investigation (I.) 17-02-002.[9]

On July 2, 2018, the fifth report was published with a letter from the Executive Director regarding the working gas inventory.[10] Based on the Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability or Reliability Final Supplemental Report for Summer 2018, published on July 2, 2018 (2018 Report) the Executive Director ordered SoCalGas to maintain the working gas inventory at Aliso Canyon between zero Bcf and 34 Bcf.[11] The 2018 Report explained that the increase of the maximum level from 24.6 to 34 Bcf was necessary due to 1) the need to respond to continuing pipeline outages on the SoCalGas system; 2) consideration of the impact that reductions at the non-Aliso storage fields have on their withdrawal capacity; 3) an examination of whether monthly 1-in-10 peak day demand can be met with forecasted storage inventory levels; and 4) limited injection capacity at the non-Aliso fields, which makes it difficult to inject gas into storage.[12] The July 2, 2018 letter stated that the

[9] *Id.*

[10] Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, Jul. 6, 2018, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/715Report_Summer2018_Final.pdf. (Attachment 7). Although the July 6, 2018 report was released on July 2, 2018, it is accompanied by a July 6, 2018 update that includes comments erroneously omitted.

[11] California Public Utilities Commission letter to Southern California Gas Company, July 2, 2018, p.1, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/7-2-18_Ltr%20To%20Rodger%20Schwecke%20re.%20Aliso%20Canyon%20Gas%20Storage%20Facility.pdf. (Attachment 8)

[12] *Id.*

maximum storage range will be superseded by the determination in this instant proceeding.[13]

2. Phase 2 and Phase 3

This instant proceeding was initiated pursuant to Public Utilities Code Section 714(a) "to determine the feasibility of minimizing or eliminating the use of the Aliso Canyon natural gas storage facility located in the County of Los Angeles while still maintaining energy and electric reliability for the region." Phase 1 of this proceeding closed with the adoption of the final Scenarios Framework in 2019. Phase 2 of this proceeding evaluates economic, production cost, and hydraulic modeling to determine the impact of a closure or curtailment of Aliso Canyon given current rules and infrastructure. Phase 2 modeling is scheduled to be finished this year. Phase 3 of this proceeding will develop scenarios to examine resources and infrastructure, including renewable and low-carbon generation, energy efficiency, electric storage, demand response, and new gas transmission pipelines, that could be implemented to entirely replace Aliso Canyon.[14] Pending the outcomes of Phase 2 and Phase 3, it is important to continue the interim working gas inventory between zero Bcf to 34 Bcf at Aliso Canyon.

The Executive Director's July 2, 2018 letter discussed in depth the 2018 Report evaluations of whether monthly 1-in-10 peak day demand can be met with forecasted storage inventory levels. The Commission's Energy Division has been analyzing scenarios within those exact parameters in Phase 2 of this proceeding.

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[13] *Id.* at 2.

[14] Assigned Commissioner's Phase 3 Scoping memo and Ruling, Dec. 20, 2019, at 3.

On June 20, 2019, the Commission's Energy Division presented on the production cost modeling data development and preliminary hydraulic modeling results. On November 13, 2019, the Commission's Energy Division presented additional information on production cost modeling data development and an update on hydraulic modeling.

Most recently, on July 28, 2020, the Commission's Energy Division conducted a third workshop. The Energy Division and Los Alamos National Laboratory presented production cost modeling results and the 1-in-10 hydraulic modeling results. A fourth workshop will be scheduled for this fall to present results from the 1-in-35 extreme peak demand scenario hydraulic modeling. Complete results from the hydraulic modeling will be available in the fall of 2020, along with the release of Energy Division reports.

Pending the complete results from Phase 2 modeling and a final Phase 2 decision, SoCalGas should maintain the interim working gas inventory between zero Bcf to 34 Bcf at Aliso Canyon to ensure safety and reliability while preserving just and reasonable rates in California. Additionally, information from Phase 3 may also inform the necessary range of working gas inventory. As such, the working gas inventory range may require an update during or after Phase 3.

3. Comments

Concurrent opening comments on maintaining the Aliso Canyon interim storage level between zero billion cubic feet and 34 billion cubic feet during the interim period between January 1, 2021, and the issuance of a final Phase 2 decision may be filed by close of business September 8, 2020.

Concurrent reply comments may be filed by close of business September 15, 2020.

IT IS RULED that:

1. Attachment 1, the report titled Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Summer 2016 Reliability, dated June 28, 2016, is made part of the record.

2. Attachment 2, the report titled Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, dated January 17, 2017, is made part of the record.

3. Attachment 3, the report titled Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, dated July 19, 2017, is made part of the record.

4. Attachment 4, the July 19, 2017 California Public Utilities Commission letter to Southern California Gas Company, is made part of the record.

5. Attachment 5, the report titled Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, dated December 11, 2017, is made part of the record.

6. Attachment 6, the December 11, 2017 California Public Utilities Commission letter to Southern California Gas Company, is made part of the record.

7. Attachment 7, the report titled Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, dated July 6, 2018, is made part of the record.

8. Attachment 8, the July 2, 2019 California Public Utilities Commission letter to Southern California Gas Company, is made part of the record.

9. Concurrent opening comments on the Aliso Canyon interim working gas inventory may be filed by close of business September 8, 2020.

10. Concurrent reply comments may be filed by close of business September 15, 2020.

Dated August 26, 2020, at San Francisco, California.

/s/ ZHEN ZHANG

Zhen Zhang
Administrative Law Judge

ATTACHMENT 1

California Public Utilities Commission

Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Summer 2016 Reliability

Preliminary Report - Section 715 of the Public Utilities Code

Energy Division

6/28/2016

Table of Contents

Introduction 1

Ongoing Reliability Risk 1

Determinations 5

Production 6

Injection 6

Appendix

Aliso Canyon Risk Assessment Technical Report

Introduction

Public Utilities Code Section 715 requires the California Public Utilities Commission (CPUC) to publish a report identifying:

The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability and at just and reasonable rates in California;

The amount of natural gas production at the facility needed to meet safety and reliability requirements;

The number of wells and associated injection and production capacity required; and

The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation.

The following is the initial report required by California Public Utilities Code Section 715. This report incorporates the Aliso Canyon Risk Assessment Technical Report (attached) and its findings are based on that technical assessment. This initial report addresses the 2016 summer gas season[1]. Currently, additional analysis is underway assessing winter reliability needs and the results of that analysis will be incorporated into a revised report.

The Aliso Canyon Risk Assessment Technical Report was prepared by the staff of the California Independent System Operator (CAISO), the California Energy Commission (CEC), the Los Angeles Department of Water and Power (LADWP), Southern California Gas Company, and the CPUC. A draft of the Technical Assessment was released on April 5, 2016. A joint agency workshop was held to discuss the Technical Assessment, and the report was updated based on public comments.

Ongoing Reliability Risk

The Technical Assessment analyzed four scenarios, each considering different

conditions on particular days that were expected to stress the gas system. The four scenarios are based on both historical (2013-2015) data and on a modeling of the operation of the Southern California Gas System

[1] 2016 Summer Gas Season runs through October 31 of 2016.

using the assumption that the Aliso Canyon facility will be unavailable for use. The results of the analysis indicate that, using all other system resources available, but without access to Aliso Canyon, a loss of capacity and a difference between expected supply and actual demand greater than five percent of the total demand is likely to lead to gas system curtailments (See Technical Assessment , attached p.17).

The scenarios also considered circumstances likely to occur that would reduce the amount of capacity to deliver available supply. These circumstances included planned (maintenance and safety-related) and unplanned system outages. They also considered that multiple outages could occur at the same time. The analysis used historical data to estimate the probability of the event occurring and the impact of these events occurring at the same time.

The curtailments identified will most directly impact Electric Generators who are, as non-core customers, the first to be curtailed. The Scenarios and the resulting risks to Electric Generators are summarized below.

Curtailment Scenarios	Days of Curtailment Risk for Electric Generators
Scenario 1: 150 MMCF supply shortfall between scheduled receipts and actual gas flows (Potential Gas Curtailment: 180MMCF/Day - 84MMCF/8 peak hours)	11 Days (2 summer, 9 non-summer)
Scenario 2: Scenario 1 in addition to a non-Aliso storage outage, reducing 400 MMCFD of system capacity (Potential Gas Curtailment: 480MMCF/Day - 224MMCF/8 peak hours)	2-3 Days (2 summer, 1 non-summer)
Scenario 3: Scenario 1 in addition to a pipeline outage reducing 500 MMCFD of system capacity (Potential Gas Curtailment: 600MMCF/Day – 280MMCF/8 peak hours)	4-11 days (9 summer, 2 non-summer)
Scenario 4: Combination of Scenarios 1,2, and 3 resulting in an overall reduction of 900 MMCFD in system capacity (Potential Gas Curtailment 1100MMCF/Day -513MMCF/8 peak hours)	6-7 days (3 summer, 4 non-summer)

Using information from the above chart, the analysis further determined that by shifting electric generation outside of the area most impacted by the loss of Aliso Canyon; i.e., the LA Basin, some of the impact and resulting risk of electricity outages could be reduced. Specifically, the analysis concluded that by shifting generation it is likely that Scenario 1 would not result in interruptions to summer electric service. However, without Aliso Canyon, despite all other system resources being

utilized, the gas curtailment would have been large enough that interruptions to summer electric service would be likely under Scenario 2; and all but certain under Scenarios 3 and 4.

In each of these scenarios, if enough gas were available for withdrawal from Aliso Canyon, the risks of gas curtailment and associated electricity outages could be reduced, if not eliminated.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Needed Withdraw Capacity (MMcfd)[2]		252	420	1119

In making the determination of how much gas is needed to meet these reliability needs, we must weigh the risks of curtailment against the imperative to operate a safe storage facility and avoid actions that would result in any additional leaks. This interim report concludes that efforts to move generation out of the LA Basin will significantly reduce the likelihood of electricity outages in scenario 1 and will do so without the need for gas withdrawal from Aliso. The analysis also concludes that it is critical for there to be enough withdrawal capacity, 420 MMcfd to meet the needs identified in scenarios 2 and 3 as shown in the Technical Analysis. There is a reasonable likelihood of the events leading to these scenarios occurring, and the consequences of gas curtailments of the magnitude shown above in scenarios 2 and 3 are severe.

Scenario 4 results in a 1, 119 MMcfd gas withdrawal-capacity requirement from Aliso. This is a lower probability scenario reflecting the risk of several coincident events occurring. Until a significant number of wells can be fully inspected and potentially allowed to re-inject (in compliance with SB 380 (Pavley) (2016) the field will not be able to withdraw this quantity of gas. The low likelihood of scenario 4 occurring justifies allowing for a withdraw capacity that may not meet scenario 4 needs.

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[2]For this table of withdrawal capability refer to Table 6, row 11 of the assessment report which refers to the amount of shortfall of gas after accommodating gas curtailments. Therefore this amount of shortfall represents the gas needed to avoid electric load curtailment by scenario. Show conversion from MMcf/8 hours to amount of withdrawal capacity in MMcfd or MMcf/hour. Scenario 2= 84 MMcf/8 hours x 24 hours= 252 MMcfd, Scenario 3 = 140MMcf/8 hours x 24 hours= 420MMcfd, Scenario 4 = 373 MMcf/8 hours x 24 hours=1119MMcfd.

In terms of actual field operations, the withdrawal capacity of the field is determined by how many wells can be used for withdrawal and how much gas is stored in the facility. As the volume of stored gas decreases, the pressure in the field decreases, and this lower pressure results in less withdrawal capacity through any single well. Currently 15 Bcf of gas is stored in the field. SoCalGas cannot inject more gas into the field until it has complied with multiple provisions of SB 380, including a public hearing. The Division of Oil Gas and Geothermal Resources (DOGGR) has, however, authorized the use of wells that have passed "Phase I" mechanical integrity safety tests to withdraw gas if necessary for reliability needs this summer, in accordance with conditions specified in DOGGR's June 15, 2016 letter to SoCalGas, and in compliance with the CPUC's June 2, 2016 Summer Withdrawal Protocol,. If withdrawals occur before new injections are authorized, the volume of the gas in the field will decrease.

As part of its comprehensive safety review, SoCalGas has sealed and isolated from the rest of the field many wells. As of June 20, 2016, of 114 wells in the field, only 4 fully-tested, remediated, and inspected wells were available for gas withdrawal. An additional 17 wells have completed phase 1 tests and can be available for withdrawal if needed for reliability , in compliance with the CPUC's June 2, 2016 Summer Withdrawal Protocol. Of the remaining wells in the field, 5 had been completed all phases of their safety review as determined by DOGGR and approved, but were not yet operational and 23 were still in the process of undergoing comprehensive inspection review .

The analysis indicates that the current combination of gas stored in the fielded and wells available for gas withdrawal leaves SoCalGas with an Aliso Canyon withdraw capacity of approximately 300 MMcfd, which is below the 420 MMcfd capacity needed to meet Scenarios 2 & 3 modeled in the Risk Assessment Technical Report. Consequently, the CPUC has ordered SoCalGas to submit by July 1, a plan to increase capacity to 420 MMcfd [3]

Given the facts that:

The critical element of meeting reliability is not just the volume of gas in the field but also the combination of the volume of gas in the field and the number of wells available for withdrawal;

[3] http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/06-15-16%20Letter%20to%20SoCal%20Gas%20re%20Aliso%20Canyon%20Natural%20Gas%20Storage%20Facility%20comprehensive%20safety%20testing.pdf

The number of wells available is currently limited due to ongoing inspections; and,

No new injections are currently allowed, so the 15 Bcf currently in storage is the maximum amount of the gas available and that amount will likely decrease over the summer months,

this initial report will not identify a maximum volume of gas that is needed to maintain reliability but will focus on the withdrawal capacity needed.

Determinations

With the above background and using the Aliso Canyon Risk Assessment Technical Report as a basis, this report makes the following determinations:

The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates in California:

If SoCalGas has sufficient wells available for withdrawal, the present working inventory of 15 Billion cubic feet (Bcf) of natural gas in the Southern California Gas (SoCalGas) Aliso storage facility[4] is adequate for safety and reliability under most circumstances expected through the remainder of the summer gas season, which ends on October 31, 2016. SoCalGas should maintain an adequate number of working wells and working gas to maintain a withdrawal capacity of 420 MMcfd.

The amount of natural gas production at the facility needed to meet safety and reliability requirements:

To meet the needs of all the scenarios analyzed in the Risk Assessment Technical Analysis, SoCalGas would need a withdrawal capacity of 1119 MMcfd. The current volume of 15 Bcf is insufficient to support withdrawal of that rate. In addition, in weighing the risks of curtailment against the need to operate a safe storage facility and avoid actions that would cause additional leaks, this interim report concludes that there should be enough withdrawal capacity at the current inventory level to meet the needs identified in scenarios 1, 2, and 3 in the Technical Analysis. Once a significant

[4] SoCalGas completed a physical inventory of the field indicating that as of February 9, 2016, there was 15.08 Bcf of working gas inventory at Aliso.

number of wells have been fully inspected in compliance with SB 380 (Pavley) (2016), and injections are again authorized, this level should be increased to 1119 MMcfd, in order to provide sufficient withdrawal capability to meet scenario 4.

Production

The number of wells and associated injection and production capacity required:

Per SB 380, wells that have completed all required testing and remediation and have been inspected can be used for withdrawal (production); however, these wells may use only their well tubing for withdrawals. Previously, both the tubing and the casing surrounding the tubing could be used. As a result these wells will operate at significantly lower injection and withdrawal capacity than their historical capacity. There is uncertainty about well withdrawal capacity when withdrawals are made using only the tubing. Capacity estimates range widely from between forty and eighty percent of prior well-withdrawal capacity.

As explained above, wells that have not undergone the full testing, remediation, and inspection process can be used for withdrawal, if necessary, for reliability needs and if approved by DOGGR. On June 15, 2016 DOGGR issued a letter that allowed SoCalGas to withdraw gas to meet reliability needs using wells that have undergone mechanical integrity (temperature and noise) testing; provided that certain conditions were adhered to, and in accordance with the CPUC's. 2016 Summer Withdrawal Protocol

To date, only nine wells have been fully tested, remediated, and inspected and of these nine, only four are operationally available for use. These four wells are now subject to production and injection using tubing only. Applying a conservative forty percent reduction in capacity for the four inspected wells available for use, plus capacity from those inspected but not yet operational wells and those wells still undergoing full safety review, plus the average historic capacity from other wells available to meet reliability needs, it is estimated that 36 wells will be required to withdraw gas at a rate of 420 MMcfd.

Injection

There is a moratorium on injections at Aliso Canyon until (1) all wells are either fully tested, remediated, and pass DOGGR inspection; (2) any wells not meeting the criteria in (1) are 'plugged' thereby isolating them from the remainder of the field; and (3) DOGGR and the CPUC determine that the field is safe for use; and (4) a public meeting in the affected community is held.

The injection capacity available will be dependent on the number of wells tested and remediated. As such, there is no defined amount of injection capacity known beyond a range for the nine tested and remediated wells (only four of which are currently operational). For perspective, with the current four wells that have been tested, remediated, and inspected that are operationally available for use: at 40 percent of their prior capacity they could inject only .016 Bcf/day and at 80 percent capacity of their prior capacity they could inject only .032Bcf/ day. These amounts are too small to provide any significant benefit to the gas or electricity systems in terms of reducing the impacts of potential curtailments or service interruptions.

The availability of sufficient natural gas production using gas storage wells that have satisfactorily completed testing and remediation:

As of June 20, 2016, only nine wells have completed the full range of testing, remediation and inspection required by DOGGR. Only four of those wells are currently available for use and these four by themselves do not provide significant production capacity.

APPENDIX

Aliso Canyon Risk Assessment Technical Report

Prepared by the Staff of the California Public Utilities Commission, California Energy Commission, the California Independent System Operator, the Los Angeles Department of Water and Power, and Southern California Gas Company

April 4, 2016

Table of Contents

EXECUTIVE SUMMARY 3
INTRODUCTION 3
BACKGROUND 4
Operational Role of Aliso Canyon 6
Role of Gas and Electric System Operator 7
Existing Tools to Manage the SoCalGas & SDG&E System 8
Electric and Gas Operations Coordination and Reliability 9
California Independent System Operator (California ISO) 13
Los Angeles Department of Water and Power (LADWP) 16
GAS OPERATIONAL ANALYSIS AND ASSESSMENT 17
Introduction 17
Hydraulic Analyses Summary 17
Hydraulic Software & Modeling 18
Study Parameters & Assumptions 19
Results 21
September 9, 2015 examination 21
December 15, 2015 Examination 25
CURTAILMENT RISK ASSESSMENT 32
Curtailment Risk Summary 33
Analysis Discussion 33
Step one 33
Step two 34

Results 38

ELECTRIC ANALYSIS 40

Case studies 42

California ISO Minimum Generation Requirements 45

California ISO Ability to Shift Electric Supply from Basin/SoCalGas Area 45

LADWP Minimum Generation Requirements 46

LADWP's Ability to Shift Electric Supply from Basin/SoCalGas Area 46

Electric Service Reliability Risk Assessment 47

JOINT CALIFORNIA ISO AND LADWP IMPACT ANALYSIS AND RESULTS 48

Analysis 50

Results 50

MITIGATION MEASURES 51

APPENDIX A: Analysis of Summer Gas Curtailment June 30, 2015 to July 1, 2015 52

EXECUTIVE SUMMARY

This technical report assesses the risks to energy reliability in the Greater Los Angeles area during the coming summer months without the use of the Aliso Canyon Natural Gas Storage Facility. This assessment was developed by the Aliso Canyon Technical Assessment Group, which is comprised of technical experts from several state and local energy entities.

This technical assessment finds that if no gas can be withdrawn from Aliso Canyon during the coming summer months, a significant risk exists of natural gas curtailments during up to 16 days this summer. These curtailments could interrupt service and affect millions of electric customers during as many as 14 summer days. Several factors contribute to this risk including mismatches between scheduled gas on the pipeline system and actual daily gas demand, planned and unplanned outages to non-Aliso storage that reduce supply, and planned and unplanned pipeline outages that reduce delivery capacity. Prolonged periods of high electrical demand also increase the risk of gas curtailments and electrical service interruption. This happens during extreme heat waves when air conditioning use spikes and all natural gas-fired electricity generation is required.

Aliso Canyon currently has a limited supply of 15 billion cubic feet (Bcf) of working gas in storage. Using this gas stored in Aliso Canyon as needed is very important to reduce the risk of gas curtailments and electrical service interruption this summer. Additionally, implementing other actions detailed in the *Draft Aliso Canyon Action Plan to Preserve Gas and Electric Reliability for the Los Angeles Basin* further reduce—but do not eliminate—risks of gas curtailments and electrical service interruptions.

In summary, the report does the following:
The study addresses summer 2016 only. A winter study may be needed in the future.
Aliso Canyon gas injections will not resume until all wells have been inspected; the time frame for completion of that process is uncertain.
The analysis assessed risk if Aliso Canyon was unavailable.
The electric analysis assumes optimal conditions with minimum gas-fired generation in the Los Angeles Basin and fully available transmission capacity and energy supply.
Analysis finds that gas curtailment events could interrupt electric supply from 22 to 32 days. Fourteen of these days are this summer.
Transfer of gas supply to electric resources outside the Los Angeles Basin is minimal.
Gas supply is necessary for electric generators to supply the public with electricity. Commercial and residential customers, hospitals, and refineries are at risk.
A separate action plan discusses mitigation measures.

INTRODUCTION

This technical report is the work of the Aliso Canyon Technical Assessment Group, which used the report to develop the Aliso Canyon Action Plan. The Technical Assessment Group consists of members from the California Public Utilities Commission (CPUC), California Energy Commission (Energy Commission), California Independent System Operator (California ISO), Los Angeles Department of Water and Power (LADWP), and Southern California Gas Company (SoCalGas). The action plan addresses natural gas and

associated electricity reliability impacts due to the SS-25 well leak and subsequent operating status of the Aliso Canyon underground natural gas storage field.

The Technical Assessment Group analyzed reliability for summer 2016. It looked at the SoCalGas system to understand the operational constraints that might exist on the system. Given the uncertainty about operations at the field and recognizing the January order of the CPUC to hold inventory at 15 Bcf to protect energy reliability, the analysis looked at operations assuming no injection and no withdrawal from Aliso Canyon. The analysis examines the criticality of Aliso Canyon to the integrated operations of gas and electric systems. It identifies what gas would be needed from the field to remedy strained operational conditions, assuming protocols and procedures are developed to provide clarity about how the gas currently stored at Aliso Canyon can be used to mitigate identified reliability risk this summer.

The report provides a background discussion describing SoCalGas' system operations, including existing tools to manage its system and the relationship with the San Diego Gas & Electric (SDG&E) gas system that SoCalGas supplies and operates. It discusses electric and gas coordination and reliability and provides background on the electric generation and transmission of the California ISO and LADWP Balancing Authority areas.

The report describes the detailed gas operations simulations conducted by SoCalGas, with oversight by the Technical Assessment Group members. The group assessed four different types of gas day demand profiles and found a number of conditions likely to result in gas curtailments. These operational findings lead directly to some of the mitigation measures recommended.

Having assessed the conditions that could cause natural gas curtailments, the Technical Assessment Group translated those into impacts to electricity generation, for the California ISO and LADWP Balancing Authority areas relative to their respective operational constraints and reliability criteria.

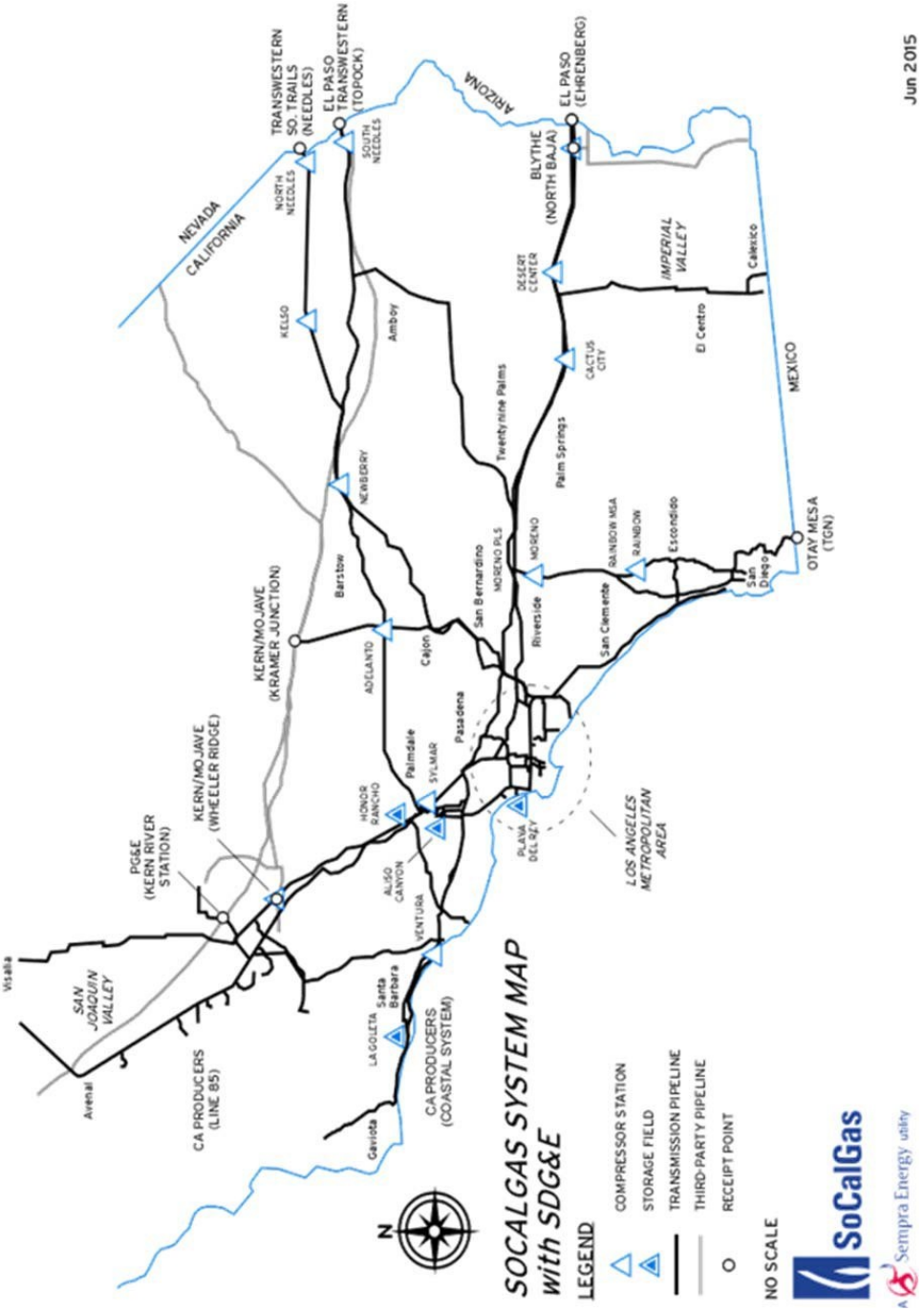
The report includes an appendix that includes more technical detail about the simulation model, supporting data, and assumptions. Inspecting all wells at Aliso Canyon must occur before any wells can be placed back into service. An additional appendix describes details surrounding the June 30 and July 1, 2015 natural gas curtailments, which occurred when Aliso Canyon was fully available, and the actions that the California ISO and LADWP took to avoid electricity service interruptions.

BACKGROUND

The following section discusses the background of gas operations and electric operations.

SoCalGas and SDG&E own and operate an integrated gas transmission system consisting of pipeline and storage facilities. With their network of transmission pipelines and four interconnected storage fields, SoCalGas and SDG&E deliver natural gas to more than five million residential and business customers. A map of the SoCalGas transmission system is included as Figure 1.

FIGURE 1 – SoCalGas' Gas Transmission system



The gas transmission system supports 21 million residents in Southern California. The system extends from the Colorado River to the east of SoCalGas' approximately 20,000 square mile service territory; to the Pacific Coast on the west; from Tulare County in the north; and to the United States/Mexico border in the south (excluding parts of Orange and San Diego counties).

The SoCalGas transmission system was initially designed to receive and redeliver gas from the east, to the load centers in the Los Angeles Basin, Imperial Valley, San Joaquin Valley, north coastal areas, and San Diego County. As SoCalGas and SDG&E accessed new supply sources in Canada and the Rocky Mountain region, the system was modified to concurrently accept deliveries from the north. The system today has the potential capacity to accept up to 3,875 million cubic feet per day (MMcfd) of interstate and local California supplies. However, flowing supplies generally do not exceed 3,000 MMcfd.

SoCalGas and SDG&E's primary supply sources are the southwestern United States, the Rocky Mountain region, Canada, and California's on- and off-shore production. The interstate pipelines that supply the SoCalGas transmission system are El Paso Natural Gas Company (El Paso), North Baja Pipeline (North Baja), Transwestern Pipeline Company (Transwestern), Kern River Gas Transmission Company (Kern River), Mojave Pipeline Company (Mojave), Questar Southern Trails Pipeline Company (Southern Trails), and Gas Transmission Northwest (GTN), via the intrastate system of Pacific Gas and Electric Company (PG&E). The SoCalGas transmission system interconnects with El Paso at the Colorado River near Needles and Blythe, California, with North Baja near Blythe, California, and with Transwestern and Southern Trails near Needles, California. SoCalGas also interconnects with the common Kern/Mojave pipeline at the Wheeler Ridge Compressor Station located in the San Joaquin Valley and at Kramer Junction in the high desert. At Kern River Station in the San Joaquin Valley, SoCalGas maintains a major interconnect with the PG&E intrastate pipeline system, and receives PG&E/GTN deliveries at that location.

SoCalGas operates four storage fields that interconnect with its transmission system. These storage fields – Aliso Canyon, Honor Rancho, La Goleta, and Playa del Rey – are located near the primary load centers of the SoCalGas system. They have a combined inventory capacity of 135.6 Bcf, a combined firm injection capacity of 850 MMcfd, and a combined firm withdrawal capacity of 3,680 MMcfd. Some systems, such as the PG&E gas transmission system, have significant linear pipelines and rely heavily on linepack (storing gas in the pipeline as opposed to within a storage facility) for storage. SoCalGas' system does not have as much linepack as others. It operates using storage and pipeline supplies to meet customer demand. The SoCalGas system cannot function with only pipeline supply or with only storage supply. As a result, storage fields are a much more critical operating asset on the SoCalGas system.

In contrast, SDG&E has no storage fields in its service territory. Almost all of the gas into the SDG&E system comes from SoCalGas via its southern system through the Moreno Compressor Station. While discussed as a separate system, SDG&E's gas transmission system integrates with the SoCalGas system and falls under the responsibility of the SoCalGas System Operator.

Operational Role of Aliso Canyon

Aliso Canyon is the largest of SoCalGas' four storage fields in all regards: largest inventory capacity at
Bcf, largest withdrawal capacity at 1,860 million MMcfd, and largest firm injection capacity at 413 MMcfd (pre-Aliso Canyon Turbine Replacement Project). For summer operations (April through October), the SoCalGas Gas Control department strives to completely fill the storage field in order to provide firm injection services to customers and prepare for the upcoming winter. Aliso Canyon's

withdrawal capabilities are also used during the summer to provide supply during the hourly peak electric generation demands that occur throughout the day, which cannot be met with flowing supplies because of the speed and magnitude that these peaks occur. On average, Aliso Canyon's withdrawal is used approximately 10 days per month during the summerin this way.

For winter operations (November through March), Aliso Canyon provides the needed winter supply and withdrawal services and prepares for the next summer. The large supply of gas that Aliso Canyon provides in the winter to the Los Angeles Basin also allows SoCalGas to maintain service to their customers located outside the basin. In the winter season, when interstate pipeline gas supplies become more expensive and even less available due to well freeze-offs, customers often elect to deliver as little as possible to the SoCalGas system. Absent Aliso Canyon providing supply to the Los Angeles Basin, SoCalGas will have to make a choice to send supplies to theLos Angeles Basin or to other communities.

Without Aliso Canyon, SoCalGas' storage capacities fall to 49.4 Bcf of inventory (a 64 percent loss), 437 MMcfd of firm injection (a 49 percent loss), and 1,820 MMcfd of firm withdrawal (a 51 percent loss). Only SoCalGas' Honor Rancho storage field can provide some of the lost capability to support demand in the Los Angeles Basin. The Playa del Rey storage field is too small to provide that level of support, while the La Goleta storage field is located too far away. The Honor Rancho storage field has significantly less inventory capacity than Aliso Canyon. It frequently supports demand centers in the San Joaquin Valley, the Northern System, and the Coastal System, which limits its effectiveness to support theLos Angeles Basin.

While more specific analysis is required for the upcoming winter, SoCalGas believes if Aliso Canyon were unavailable or not permitted to operate next winter, or if flowing supplies did not materialize because of conditions east of California, SoCalGas would be unable to meet their 1-in-10 year cold day reliability planning criteria and would require noncore (noncore includes electric generators) curtailment. Additionally, without the complete curtailment of all noncore customers, core reliability would be in jeopardy during a 1-in-35 year peak day event.

Role of Gas and Electric System Operator

(SoCalGas, California ISO, and LADWP)

The system operator maintains system reliability and integrity while working to provide reasonably priced service. This is accomplished using a Supervisory Control and Data Acquisition System (SCADA) that provides for real-time remote monitoring and operation of valves, compressor stations, pressure regulation equipment, and gas flow across the gas system for the gas system operator, and electric substations, tansmission ines, generators, circuit breakers, and voltage control equipment for the electric system operator. System operators perform these duties in a 24/7 control room environment.

Responsibilities of the system operator include: adhering to gas pipeline and electric transmission line safety and reliability parameters established by federal, regional, and/or state agencies; analyzing and responding to abnormal or emergency situations on the gas pipeline or electric transmission line systems; and coordinating necessary gas pipeline or electric transmission line outages for maintenance

and/or emergency measures. The electric system operator maintains the instantaneous balance of electric supply with the real-time demand placed upon it. The system operator also serves as a communication coordinator between the various utilities conducting maintenance on their respective systems.

The system operator develops a daily operating plan that includes demand forecasts for their respective gas or electric systems and overall gas or electric facility utilization. These daily plans are based on weather, historical operations, amount of flowing gas or electric supply scheduled onto the system, and demand forecasts from the respective electric utilities, the California ISO, LADWP, and other large electric generators. In doing so, the system operator needs to have contingency plans immediately ready for changes in system conditions resulting from changes in weather patterns and loads, forecast error, and abnormal or emergency operating conditions. This is particularly important for the electric system operator because electricity cannot be stored in bulk, so electric supply and demand must be balanced in real-time. This need for a continually balanced electric transmission system means that a sudden unexpected increase in electric generation is necessary (for example when an electric transmission line relays and is removed from service). This electric generation increase creates a sudden unexpected increase in gas transmission system demand, since the majority of the electric generating stations in California use natural gas as their primary fuel source.

Some hydraulic system analysis and historical statistical studies show that the SoCalGas and SDG&E systems may be able to operate through times of system stress without Aliso Canyon. The SoCal Gas System Operator operates in a real-time environment without knowing how low actual system pressures will get or if the system will recover. Without Aliso Canyon, tit operates without a large tool to mitigate real-time changes. If conditions change during the gas day, the gas system operator must make adjustments in real-time. This is done by moving gas inventories to the load or withdrawing from storage.

These physical tools available to the gas system operator are supplemented by the ability to call high and low operational flow orders (OFOs) and emergency flow orders (EFOs). If physical tools, OFOs, and EFOs are not enough to deal with strained operating conditions, SoCalGas has the ability to curtail service to lower-priority customers, such as electric generators, in order to stabilize the system and protect service to higher-priority customers. These regulatory tools are explained more in detail. On the electric system, service to electric customers will be needed to be curtailed when the electric supply and demand balance cannot be maintained due to lack of generation capacity or transmission line capacity.

Existing Tools to Manage the SoCalGas & SDG&E System

Customers are responsible for scheduling and delivering gas supplies to the SoCalGas and SDG&E system to meet their usage. SoCalGas has few tools besides its storage fields to manage the mismatch between what customers bring onto the system in supplies and their usage. This mismatch can occur for a variety of reasons, including SoCalGas' and SDG&E's current monthly balancing rules, unexpected changes in weather, price arbitrage opportunities, and customer operational changes. With Aliso Canyon temporarily unavailable as a physical tool for the SoCalGas System Operator, SoCalGas must rely on regulatory tools in place to try to manage the system's reliability, integrity and safety. These tools include the low operational flow order ("low OFO"), the high operational flow order ("high OFO"), the

emergency flow order ("EFO"), and SoCalGas Rule 23/SDG&E Gas Rule 14 curtailment procedures. The OFO procedures are orders initiated by SoCalGas under specified circumstances to encourage tighter balancing on the system: more gas onto the system (low OFO) or less gas on the system (high OFO). Tools for more extreme balancing needs are the EFO and finally, if required, actual curtailment of gas to customer facilities using the curtailment rules.

The low OFO and EFO procedures help to minimize supply-related curtailment threats by ensuring that transportation customers do not use any more storage withdrawal than has been physically allocated for the purpose of balancing. It also provides an incentive for customers to bring more pipeline supply into the system. The overuse of withdrawal for transportation balancing can jeopardize system reliability by exhausting SoCalGas' total withdrawal capability. The more closely customers align their supplies with their usage, the less likely that operational issues develop that will necessitate the utility curtailing end-use demand because of inadequate supply.

Electric and Gas Operations Coordination and Reliability

The Aliso Canyon Gas storage facility is integral to the reliable operation of the electric grid and infrastructure. Gas storage acts like a shock absorber for the real-time dynamic variations in electric demand. These facilities also provide additional gas delivery capacity when gas demand exceeds the amount of flowing supply and provides a place to inject unutilized gas when electric demand is less than expected. In both summer and winter, gas storage supports electric reliability when there are significant differences between flowing gas supply and actual gas demand. Such differences are due to either unexpected changes between the amount of gas scheduled the day before and the actual gas demand occurring in real time, or gas procurement commercial practices and incentives that can result in low flowing supply.

California ISO and LADWP Balancing Authorities are responsible for reliability electric service in their territories. Aliso Canyon has long been used by SoCalGas as a critical component of the transmission and distribution system. It provides natural gas service to 17 natural gas fired power plants, large hospitals, oil refineries, and other key parts of California's economy. Figure 2 shows the location of the 17 impacted resources in the Los Angeles Basin.

Figure 2 Electric Generation Plants Served by Aliso Canyon

Table 1 – Power Plants Served by Aliso Canyon

Power Plants Served by Aliso Withdrawal		
#	Electric Generation Station	Capacity (Megawatts - MW)
1	LADWP Haynes Generation Station	1724
2	LADWP Scattergood Generation Station	803
3	LADWP Valley Generation Station	573
4	LADWP Harbor Generation Station	466
5	SCE Alamitos Toll	1970

6	SCE Huntington Beach Generating Station	452
7	SCE Redondo Beach	1343
8	SCE Barre Peaker	45
9	SCE Center Peaker	45
10	El Segundo Energy Center, LLC	526
11	Long Beach Generation, LLC	260
12	City of Glendale	288
13	City of Burbank	139
14	City of Pasadena	203
15	City of Anaheim - Canyon Power	200
16	City of Vernon - Malburg	138
17	Southern California Public Power Authority – Magnolia	328

Under the North American Electric Reliability Corporation (NERC) definition, a Balancing Authority and Transmission Operator has the responsibility of maintaining reliability by continuously balancing supply and demand and ensuring that the transmission is operated in a stable manner that prevents cascading outages from affecting the interconnection.[1] LADWP and California ISO are responsible for bulk electric system reliability and operational control of the electric generating resources served by Aliso Canyon.

All[2] of the generating resources in Table 1 above use gas as their only fuel source. Generating resources served by the Aliso Canyon gas storage facility represent almost 70 percent of the local capacity resources identified in California ISO's 2016 Local Capacity requirements for the Los Angeles Basin and nearly 75 percent of the local capacity available to the LADWP Balancing Authority. The other 25

[1] LADWP and California ISO are both a Balancing Authority and Transmission Operator and two of the 38 Balancing Authority Areas in the Western Electric Coordination Council (WECC) interconnection.

[2] (Distillate) capable For LADWP has limited alternate fuel capability at its Harbor and Valley Generation stations. The unit's capacity is limited and my only use alternate fuel for Blackstart emergencies largely to South Coast Air Quality Management District permit restrictions and operational constraints.

percent of available capacity being energy limited hydro pumped storage or small, run-of-the-river, aqueduct power plants. As a result, availability of these resources are critical to maintaining local reliability for both single and multiple contingency events as required by NERC transmission operations standards. If these resources are limited or curtailed due to gas limitations, it may be necessary to interrupt electric load in the local capacity area to avoid cascading blackouts and maintain system reliability as required by NERC Reliability Standards.

Under the NERC requirements the Balancing Authorities need to stand ready to respond to a sudden real-time loss of a transmission or generation element. Electric capacity reserved on gas fired generating resources is used to compensate for these sudden losses by instantaneously responding and recovering from the loss within minutes. The lost energy is replaced by the most efficient resources available to meet the current and future energy demand. An electric generator is also used to maintain stable voltages throughout the transmission grid by increasing or decreasing the power output, which will raise or lower voltage levels. During hot summer days when the electric demand is high, transmission lines are heavily loaded with flowing energy. As the load on transmission lines increases, voltage support provided by the generators is required in order to avoid a voltage collapse leading to transmission line relay tripping and ultimate loss of electric customer load.

Another critical role of maintaining electric generation is to manage the thermal loading on transmission lines. That happens when the output of the electric generators is increased and decreased at either end of a transmission line to transfer the energy source and keeps the flows of the line from exceeding the lines thermal capabilities. When an electric transmission line approaches its thermal limits, generation output near the receiving end is increased while the generation output near the sending end is decreased. This reduces the flowing energy on the line to keep it from a thermal overload and maintaining the balance of generation to electric demand.

Gas-fired generation resources served by Aliso Canyon provide contingency, operating reserves, and regulation reserve capacity to regulate system frequency around 60 Hertz. Based on 2015, these resources provided an average of 130 MW of reserves over the year and up to 244 MW of reserves during the summer months for California ISO. For the LADWP Balancing Authority, reserve capacity requirement can be in excess of 700MW. A large portion of this reserve capacity is located in the local area. To the extent there are gas limitations to these resources, they cannot be relied upon for reserves. These levels will have to be maintained by other resources in the California ISO and LADWP systems. These alternative resources may or may not be available, given prevailing operating conditions. Both LADWP and the California ISO maintain a portion of their system operating reserve by relying on resources in the SoCalGas region. Since gas curtailments issued by SoCalGas may impact resources beyond the immediate resources served by Aliso Canyon the gas curtailments could impact California ISO and LADWP's ability to maintain prudent system operating reserves.

The ability for LADWP and California ISO to shift electric supply from the resources affected by Aliso Canyon to other resources in Southern California or outside the SoCalGas system is limited based on timing and system conditions. The first limitation arises due to the need to maintain a minimum amount of local generation to ensure local reliability. The second limitation is due to limited ability to import

energy into the area as a result of transmission constraints or supply availability. The ability to shift supply in the in the day-ahead market is greater and significantly decreases as real-time approaches.

California Independent System Operator (California ISO)

The California ISO is the bulk electric system operator for 30 million customers in northern and southern California and a small part of Nevada. As a system operator, the California ISO ensures bulk electric system stability and electric supply necessary to meet customer demand on a minute- by- minute basis 24 hours a day seven days a week. The California ISO's Southern California service area includes Southern California Edison's (SCE) 14 million electric customers, most of whom are in the Los Angeles Basin (excluding LADWP customers), (SDG&E) 1.4 million customers, and several municipal utilities in the region. The California ISO's portion of the Southern California load is served by a diverse mix of electric generation including wind, solar, combined heat and power, hydro, gas-fired resources, and energy provided over high voltage transmission lines. All these resources are optimized based on location, availability, and effectiveness to maintain transmission grid stability, voltage support, thermal loading on transmission lines, and provide the most efficient power solution to meet demand.

California's electric system has 26,000 miles of bulk electric transmission lines ranging from 60 kilovolts (kV) to 500KV and hundreds of electric generation sources that work in concert to continuously maintain system reliability and balance supply and demand. In 2012, the San Onofre Nuclear Generating Station representing 2,246 MW was retired. Solar resources have compensated for much of the energy loss during the daytime hours. However, the use of the gasfired generation has increased during the shoulder hours and to maintain local reliability.

Customer demand is dynamic and varies based on weather conditions and patterns. During hot summer periods, electric demand use is high during the daytime and evening hours, mainly due to air conditioning load. With the increased penetration of variable resources such as wind and solar, supply has also become variable. To balance supply and demand during the volatile periods, flexible gas-fired generation is used to fill the energy needs when variable resources are not fully used or unavailable. During the winter, electric demand is lower overall but increases sharply as evening when lighting load increases and solar production decreases.

Figure 3, which shows the California ISO system generation resources needed to meet the 24-hour customer demand for September 9, 2015, illustrates a typical daily late summer load pattern. The graph also illustrates the resource mix including renewable generation, predominately solar during this time of the year, gas-fired (thermal) generation, and imported generation from outside the California ISO Balancing Authority. The energy delivered from gas-fired resources has the flexibility to follow the load pattern by increasing and decreasing based on the availability of other resources types.

Figure 3: September 9, 2015 electric load profile.

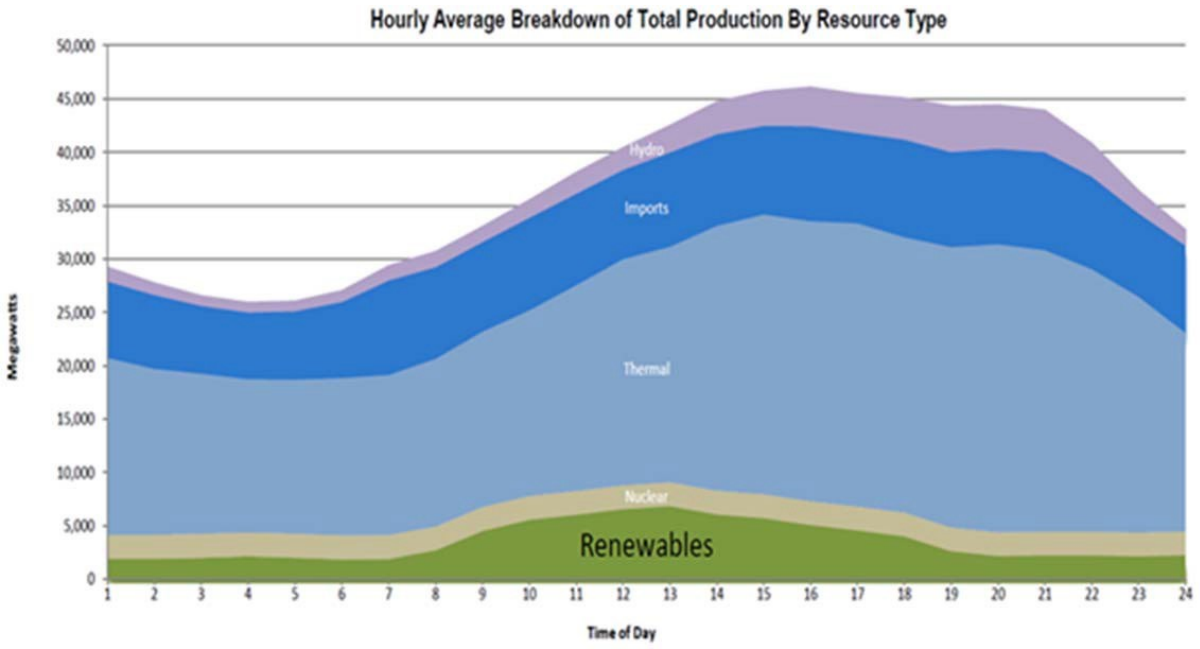


Figure 4, which shows the California ISO system generation needed for December 15, 2015, illustrates a typical winter load pattern. As in the summer graph, the same resource types make up the energy needed to serve the 24-hour customer demand. In the winter, the renewable energy is typically high due to the higher production of wind energy and the imports tend to be more plentiful based on temperature patterns throughout the west. Gas-fired (thermal) generation continues to be necessary to fulfill the remaining energy needs that are not available from the other resource types.

Figure 4: December 15, 2015 electric load profile

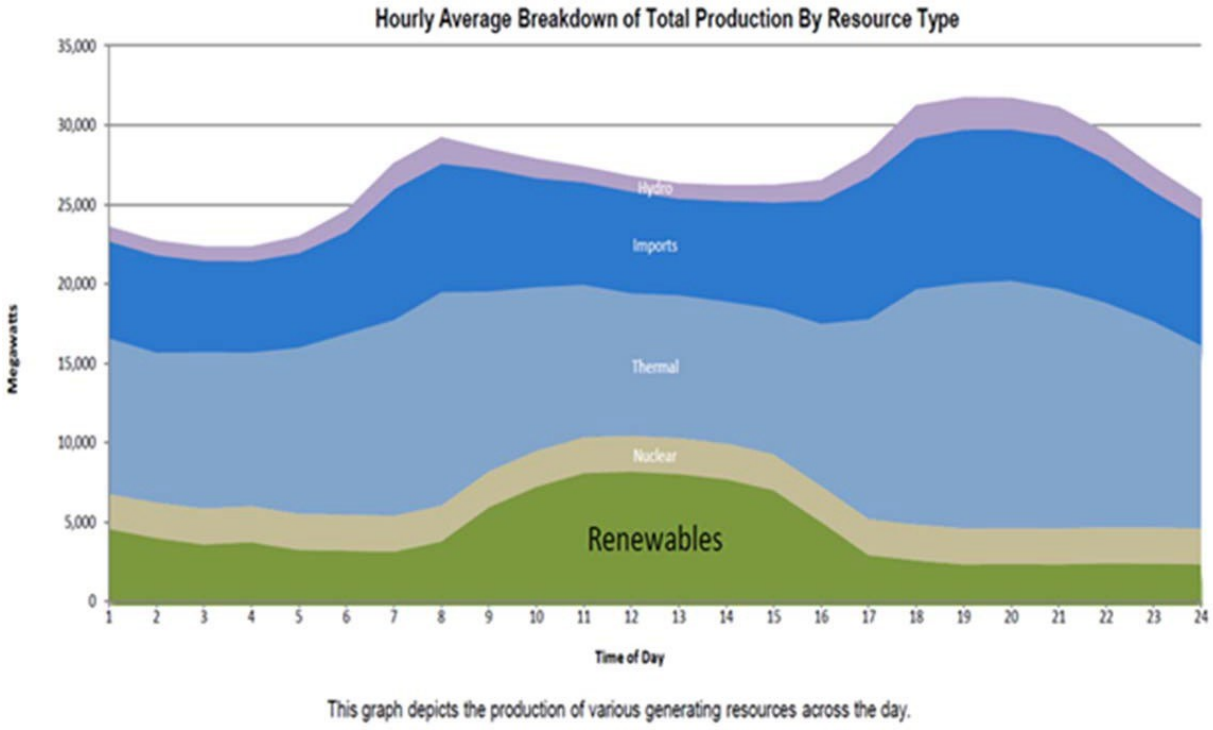
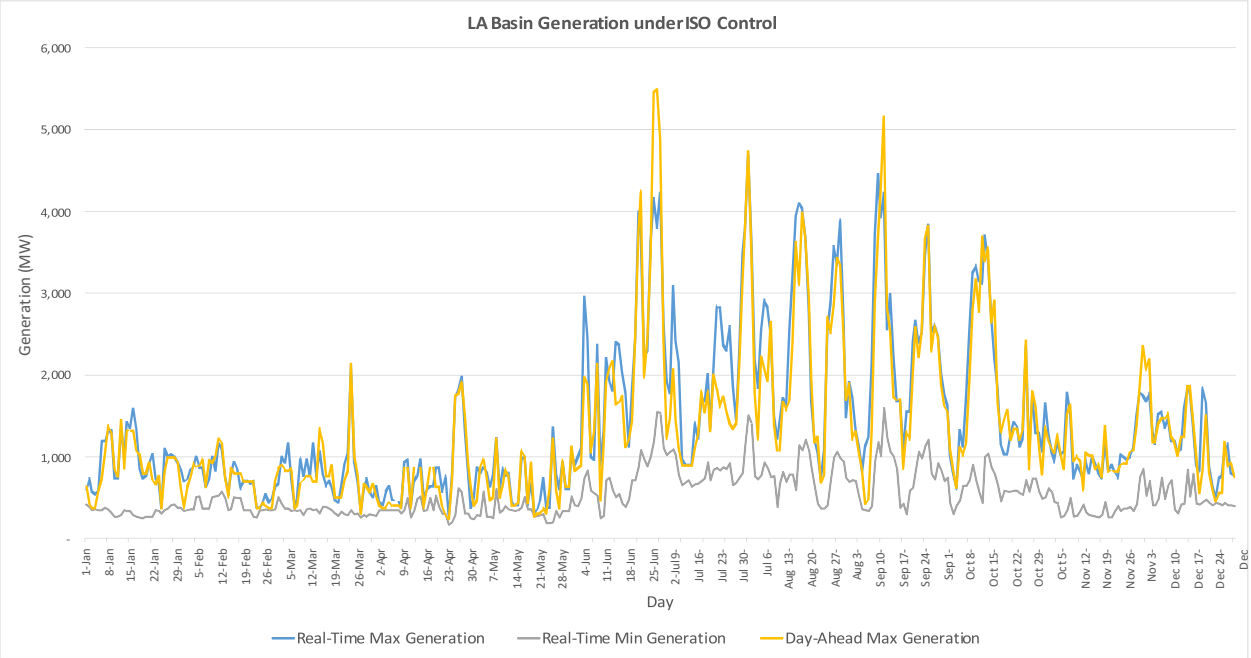


Figure 5 illustrates how the pattern of use of gas-fired generation in the Los Angeles Basin under California ISO control changes over the year. In May, the need for generation increases significantly and at times approaches the full capacity resources of 5,500 MW at times. This pattern continues as high loads could occur into October. One notable day was June 30, 2015. On June 30, the actual expected demand for gas exceeded SoCalGas' ability to deliver even with Aliso Canyon in operation due to high demand from generating resources and a major gas transmission pipeline outage. The California ISO had to reduce generation dispatch by about 1,500 MW from what was planned day-ahead across the peak hours. Appendix A has a more detailed explanation of this actual gas curtailment event.

Figure 5: Los Angeles Basin resource utilization under California ISO control



Los Angeles Department of Water and Power (LADWP)

LADWP, which provides electricity to 1.4 million customers, must meet specific supply reliability metrics. These metrics require LADWP to maintain transmission line loading within limits and provide voltage support for its system. Without this voltage support, LADWP is unable to accept into its system imported generation. Gas-fired generation plays a key role in meeting these metrics with specific generation minimums required which vary based on system load and conditions. LADWP owns some 40 percent of the ga-fired generation capacity in theLos Angeles Basin.i. This local, in-basin generation represents about 24 percent of LADWP's total electrical generation to meet its load; it imports the rest of the electricity it needs using electric transmission lines it owns.

LADWP forecasts its daily gas-fired generation requirement to meet its load and reliability requirements and schedules the necessary gas to meet this generation requirement. This forecast is based on expected system demand, weather, and system conditions. LADWP's gas consumption during the 2015 summer averaged 0.141 Bcf with a maximum usage of 0.336 Bcf. However, loss of a generation resource or transmission circuit, an unexpected reduction in variable generation (primarily wind and solar) and/or weather forecasting error may significantly increase the need for gas-fired generation. These events often happen without little advance warning.

At peak, approximately 72 percent of the available import capability is committed to importing LADWP, Burbank, and Glendale resources from external wind, solar, geothermal, coal, and nuclear resources owned by the Balancing Authority members. The remaining 28 percent of LADWP's electric transmission capacity is not used and is available to import more electricity from outside its system. This import

capability can only be utilized if energy is available for purchase. Thus, LADWP has limited capability to shift load from gas-fired generation. It has some additional generation capacity it can utilize from its Castaic hydroelectric pumped storage facility. LADWP has some import capability from the California ISO that can replace a portion of its own gas-fired generation but the quantity would depend on whether the California ISO has excess energy available and the ability to transmit it to the tie with LADWP. The shorter the notice that LADWP has before it has to reduce its gas demand, the fewer the options that it has.

GAS OPERATIONAL ANALYSIS AND ASSESSMENT

Introduction

In order to quantify the potential system impact resulting from the limitations on the use of Aliso Canyon, hydraulic analyses must be performed. A review of the SoCalGas and SDG&E gas transmission system comparing supplies into the system and demand leaving it is insufficient. Such an analysis can provide an indication of a problem if the difference between supply and demand is large, but such a comparison does not take into account the way the system responds to intra-day changes in demand and the resulting impact on system operating pressures. Hydraulic analyses take these changing demand patterns into consideration and use industry-standard flow equations to calculate the resulting pressure changes throughout the pipeline network.

Under the direction and guidance of the Aliso Canyon Reliability Task Force, SoCalGas performed hydraulic analyses of its system for four historical days that the task force selected and assumed no supply was available from the Aliso Canyon storage field. Results and findings were presented to the task force.

Hydraulic Analyses Summary

The hydraulic analyses produced several findings:

Differences between supply and demand turn out to be the key predictor of whether SoCalGas will have to curtail gas service.

Without supply available from Aliso Canyon, a loss of capacity or difference between expected supply and actual demand greater than 5 percent of the total demand is likely to lead to gas system curtailments.

While the electric generating plants (“EGs”) located in the Los Angeles Basin receive supply directly from Aliso Canyon, the loss of Aliso Canyon as a supply source impacts customers system-wide, particularly those located on SoCalGas’ Southern System and on the SDG&E system.

Severe pressure drops in the Los Angeles Basin are also a possibility without supply from Aliso Canyon. It may result in a localized curtailment even with the system otherwise in balance.

The loss of Aliso Canyon jeopardizes system reliability in both the summer (April to October) and winter (November to March) operating seasons, potentially even on days with only moderate overall customer demand.

Hydraulic Software & Modeling

DNV GL's Synergi Gas software application provides advanced hydraulic modeling solutions for pipeline network assets. DNV GL has over 44 years of industry-leading modeling software experience, and Synergi provides modeling of large, complex integrated multi-pressure level systems with full control over gas constraints (gravity, heating value and viscosity), equations of state, friction factor calculations, and heat transfer constants for both steady-state and transient analysis.

The model of the system is constructed from non-linear mathematical equations based on the provided network information. These equations represent network interconnection based on Kirchhoff's first law, which states that the flow into or out of a node in a network must sum to zero in order for mass to be conserved.

The equation solutions provide predictions of pressures, flows, valve positions, pipe diameters, compressor powers and speeds, and storage field utilization factors.

The application solves all equations in terms of nodal pressure, and then computes the resultant facility flows, given that facility flows are expressed as functions of unique constants and upstream and downstream pressures. The iterative process ideally results in a solution where all unknown facilities, unknown pressures, and unknown flows are solved to within the set tolerances.

SoCalGas has created a detailed proprietary model of its gas transmission network, and has used it with Synergi to perform hydraulic calculations for over 30 years. The model includes all transmission and storage assets (pipeline, compressor stations, valve stations, and storage fields) and all associated interconnections, locations for supply to be delivered to the system, and locations of demand on the system. Hourly demand profiles are applied to these points of customer demand, which can be an aggregation of customers (such as a point of supply from the transmission system to a distribution system) or a specific customer facility such as an electric generating plant.

In contrast to demand, supply delivered to the system occurs on a relatively steady basis. Supply and demand are rarely in balance. Any time when supply is less than the demand on the system, the system is said to be "drafting." When supply is greater than demand, the system is said to be "packing" so long as the ability to increase pack still exists. Because natural gas is a compressible medium, a pipeline can be used to store gas supply by operating between its minimum and maximum operating pressures, "packing" gas supply when the demand is low (and operating nearer to the maximum operating pressure) and "drafting" gas supply when the demand increases (and operating towards the minimum operating pressure). The volume of gas that can be stored in a pipeline is often referred to as "linepack."

The SoCalGas and SDG&E system has very little pack and draft capability relative to other pipeline networks, such as the PG&E's system. While SoCalGas and SDG&E can and do use the limited pack and draft capability when they have to quickly meet localized changes in hourly demand, they depend upon their storage fields to replenish lost linepack through withdrawal (taking gas out of the storage field)

during the day or to absorb excess gas supplies through injection (putting gas into the field). Flowing supply coming into the system comes in too slowly to perform this function. It is the flexibility that their storage fields provide to the system that enables SoCalGas and SDG&E to maintain uninterrupted service to their customers.

When SoCalGas' engineers model the gas transmission system, they perform the same actions on the model that SoCalGas' Gas Control Department does on the actual system. Because supplies are fixed and delivered at a relatively constant rate, the engineer will simulate bringing on or cutting back storage supplies, opening or closing valve stations, and firing or turning off compressor station units to meet the changing customer demand throughout the operating day, just as the gas control operators would. In order for a simulation to be successful, the engineer must:

Operate the system between its minimum and maximum operating pressures at all times;

Operate within the capacities of the transmission facilities;

Fully recover system linepack.

Exceeding maximum operating pressures presents safety risks, operating below minimum operating pressures jeopardizes continuous service to the distribution systems and customers, and fully recovering system linepack allows the simulated day to theoretically be repeated as often as necessary. Extreme demand conditions are rarely single-day events and recovering the system linepack is a requirement for the models to be successful. In reality, the system rarely recovers its pack completely in a single day, and system stress is incrementally increased the day after a high demand day.

Study Parameters & Assumptions

The task force identified four days of interest for hydraulic simulation. Each day represented an unusual occurrence in the Electric Generators (EG) market segment:

September 16, 2014: LADWP peak demand day

July 30, 2015: Largest change in EG hourly demand

September 9, 2015: Total peak EG demand day

December 15, 2015: Winter day with high EG demand

While these analyses only examined the impact to EG customers per the charter of the task force, SoCalGas' current curtailment rules would not necessarily limit any curtailment to only this customer class. All noncore customers are potentially interruptible, including businesses such as refineries, hospitals, hotels, and airports.

In order to capture the operational challenges on these days, SoCalGas assumed supplies for the simulation based upon a day-ahead forecast of demand, and then modeled the actual demand on that day. This represents actual customer behavior on the SoCalGas system. Without a requirement to do otherwise, customers and shippers are under no obligation to deliver supply matching their actual usage.

Table 2

Supply and Demand for the Sample Days

Description	9/16/2014 **Peak LADWP**	7/30/2015 **Large EG hourly change**	9/9/2015 **Peak EG**	12/15/2015 **Winter + high EG**
Day- Ahead Demand Forecast (MMcfd)				
Core	730	1026	689	1697
Noncore Non-EG	930	840	875	875
EG	1807	1354	1654	684
TOTAL	**3467**	**3220**	**3218**	**3256**
Assumed Supplies (MMcfd)				
CA Producers	60	60	60	60
Honor Rancho	1000	1000	1000	1000
La Goleta	340	340	340	340
Playa Del Rey	0	0	0	0
Pipeline	2067	1820	1818	1856
TOTAL	**3467**	**3220**	**3218**	**3256**
Actual Demand (MMcfd)	**3480**	**3189**	**3467**	**4023**
Imbalance (MMcfd)	**-13**	**31**	**-249**	**-767**

In all simulations, supply from SoCalGas' Playa del Rey storage field was withheld from the calculation of supply necessary to balance the demand forecast. It was held as an operational reserve to manage unexpected changes in demand because of its performance and proximity in the Los Angeles Basin to several large gas-fired power plants.

In Table 2, assumed supplies were sufficient to meet the day-ahead demand forecast, fully utilizing the withdrawal capacity at the Honor Rancho and La Goleta storage fields, and all transmission and storage facilities were assumed to be operational at full capacity (with the exception of Aliso Canyon). Pipeline supplies could have been somewhat larger than assumed, reducing the need for Honor Rancho and La Goleta supplies, but such an assumption would increase those pipeline supplies beyond that which has been historically delivered under similar conditions. Such a change would have had minimal effect on the simulation results.

In Table 2, the actual demand on two days – September 16, 2014 and July 30, 2015 – was nearly equal to the day-ahead demand forecast, while actual demand was significantly greater than the forecast on the other two days – September 9, 2015 and December 15, 2015.

None of the days that the Technical Assessment Group requested for examination are particularly high demand days in total for the entire system. Days where demand exceeds 3.2 billion cubic feet per day (Bcfd) are common in the winter. Peak summer days often show demand in this range. [3]

Results

Hydraulic analysis showed no operational issues for the September 16, 2014 and July 30, 2015 assessments. System pressures were maintained within maximum and minimum limits at all times. System linepack was fully recovered at the end of the simulated operating day. This was largely because supply and demand were essentially in balance – the day-ahead demand forecast (and associated supplies) closely matched the actual demand on those days. This was also because the simulation assumed no planned or unplanned outages that would reduce flowing supply.

Results for both September 9, 2015 and December 15, 2015 showed operational issues without Aliso Canyon, due partly to the large difference between the expected supply and actual demand on these days, and the concentration of demand in the Los Angeles Basin.

September 9, 2015 examination

The hydraulic analysis for September 9, 2015 showed that, technically, the simulation was successful. System pressures were maintained between the operational limits at all times, and system linepack was recovered. However, a closer examination of the results shows that SoCalGas and SDG&E would have likely issued curtailment orders.

Figure 6 shows the supply and demand profile for September 9, 2015. Demand on the system exceeds supply from 8 a.m. through 9 p.m., and all available supply is fully utilized beginning at 6 a.m., meaning that the system operator is utilizing all of its operational tools before the new gas day even starts at 7 a.m., leaving nothing else for contingencies and no operating flexibility during this time.

[3] This analysis focuses on summer 2016. Additional analysis may be necessary prior to winter 2016/2017.

Figure 6: September 9, 2015 – Demand & Supply

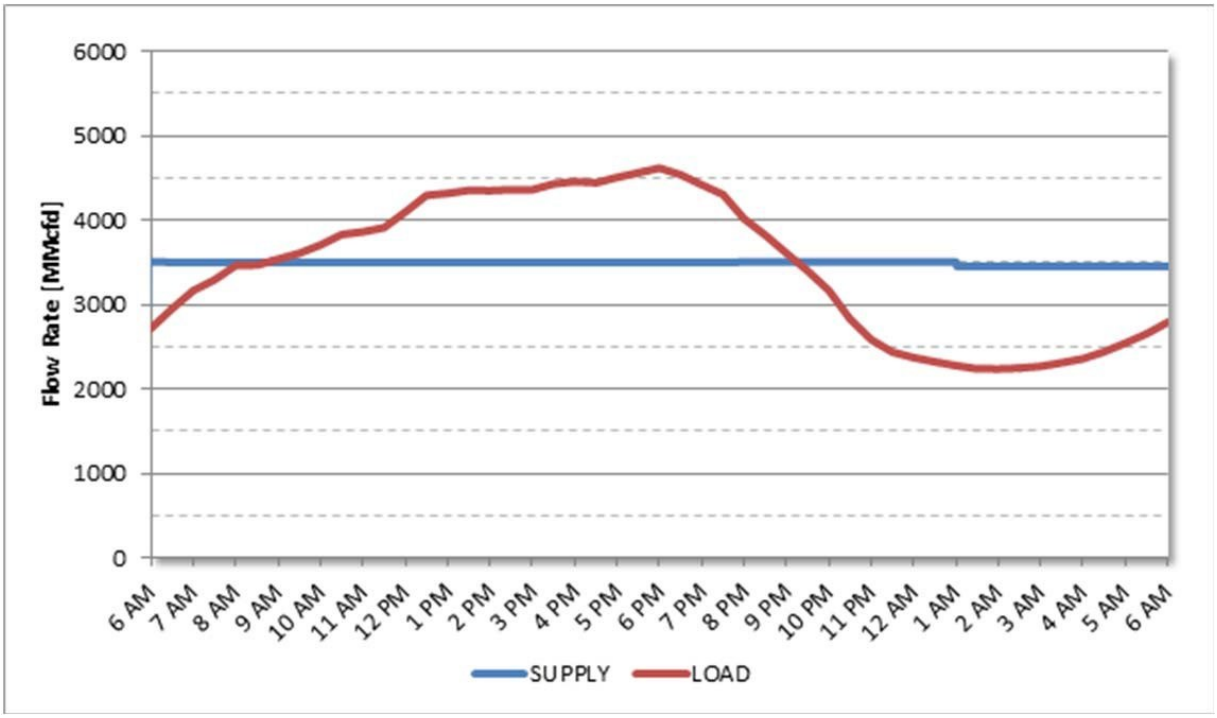


Figure 7 is a schematic showing the relationship between the SoCalGas Northern and Southern Systems. The Northern System is a primary supply source to the Los Angeles Basin, but also provides support to the Southern System serving San Bernardino, Riverside, Imperial, and San Diego counties. The Southern System currently lacks supply diversity. For the most part, it is dependent upon supply from a single interstate pipeline, with only a limited amount of support provided from Northern System. When supplies delivered on the Southern System are insufficient to support its level of demand, SoCalGas can divert some of the Northern System supplies from the Los Angeles Basin to the Southern System. Normally, SoCalGas would then supplement this loss of supply to the Los Angeles Basin with supply withdrawn from the Aliso Canyon storage field. However, in this scenario that is not an option, and any Northern System gas supply delivered to the Southern System comes at the expense of the Los Angeles Basin.

Figure 7: The Northern System Supports the Los Angeles Basin and Southern System

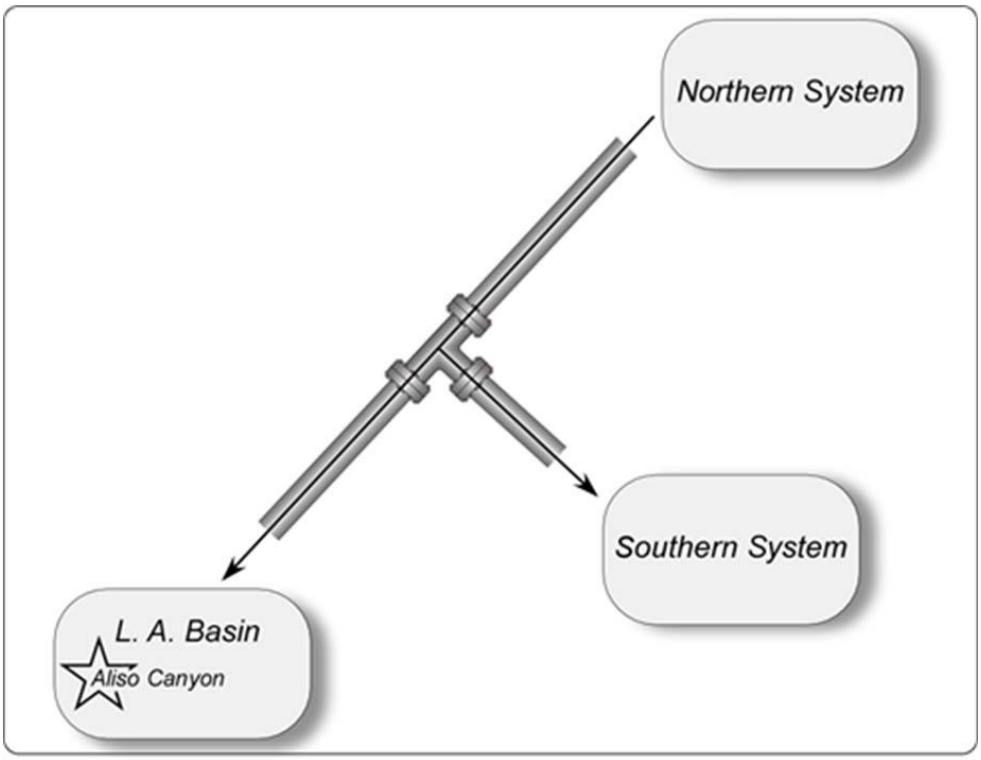
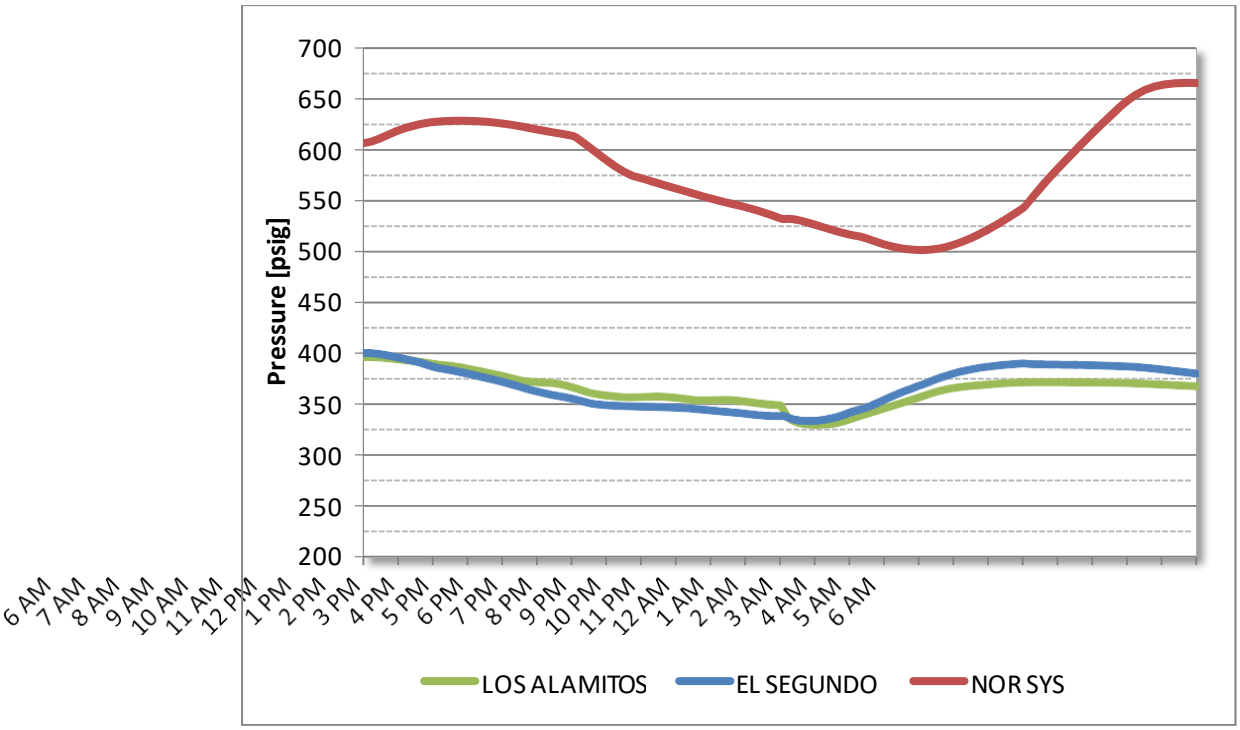


Figure 8 shows pressure on the Northern System and at points in the Los Angeles Basin near Los Alamitos on the east end and near El Segundo on the west.

Figure 8: September 9, 2015 – Northern System & Los Angeles Basin Pressures

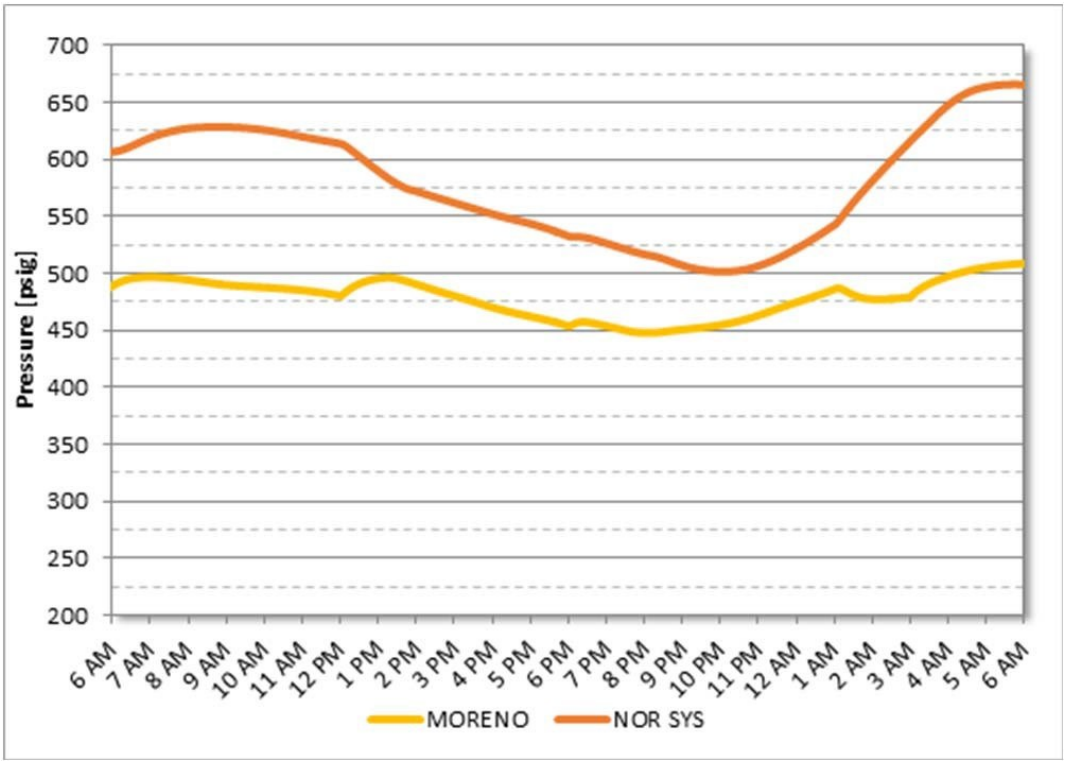


As shown in Figure 8, the Los Angeles Basin pressure is in a continuous decline from 6 a.m. through 5 p.m. While pressures eventually recovered and remained well above the minimum operating pressure, SoCalGas' Gas Control Department would have had no way to know that would happen during the early morning hours. When combined with the fact that all additional supply was fully utilized, as shown in Figure 1, that continuous drop in basin pressure would very likely have resulted in SoCalGas declaring a partial curtailment of noncore customer demand sometime in the morning of September 9, 2015 according to its standard operating procedures and assumptions.

Figure 9 also shows that pressure declined steadily on the Northern System as well. The Northern System supplies the Los Angeles Basin, and even though pressure on the Northern System dropped, it was not operating at minimum pressures. It is possible that sending additional supply to the Los Angeles Basin, and lowering the pressure on the Northern System, would slow the declining pressures in the Los Angeles Basin enough that the need for a curtailment could be eliminated. However, that is not an option in this scenario.

Figure 9 again shows the pressure on the Northern System and the pressure at Moreno Station. Moreno Station is the primary supply to the SDG&E system.

Figure 9: September 9, 2015 – Northern System & Moreno Pressures



Pressure at Moreno Station fell to near its minimum operating pressure despite receiving Northern System supplies. Had somewhat more supply been delivered from the Northern System to the Los Angeles basin as previously described to potentially prevent a curtailment in the Los Angeles Basin, a curtailment on the Southern System would have been required instead. Furthermore, pressures at Moreno Station, while just above minimum, are close enough to the minimum value that SoCalGas would have also declared a curtailment of noncore customer demand in late morning/early afternoon even with some additional supply from the Northern System.

The 250 MMcfd difference between the demand forecast and the actual demand technically resulted in a successful simulation, but nevertheless would have resulted in some noncore customer curtailment. In order to raise pressures in the Los Angeles Basin and at Moreno Station enough to avoid a customer curtailment, SoCalGas determined that another 100 MMcfd of supply would be necessary. Therefore, the maximum difference between the expected supply and actual demand that can be tolerated without Aliso Canyon supply is estimated at 150 MMcfd (this can thus be viewed as the maximum supply shortfall that could be tolerated). This resulting figure of 150 MMcfd was used in further analyses to quantify the frequency of curtailment without Aliso Canyon and is presented later in this report.

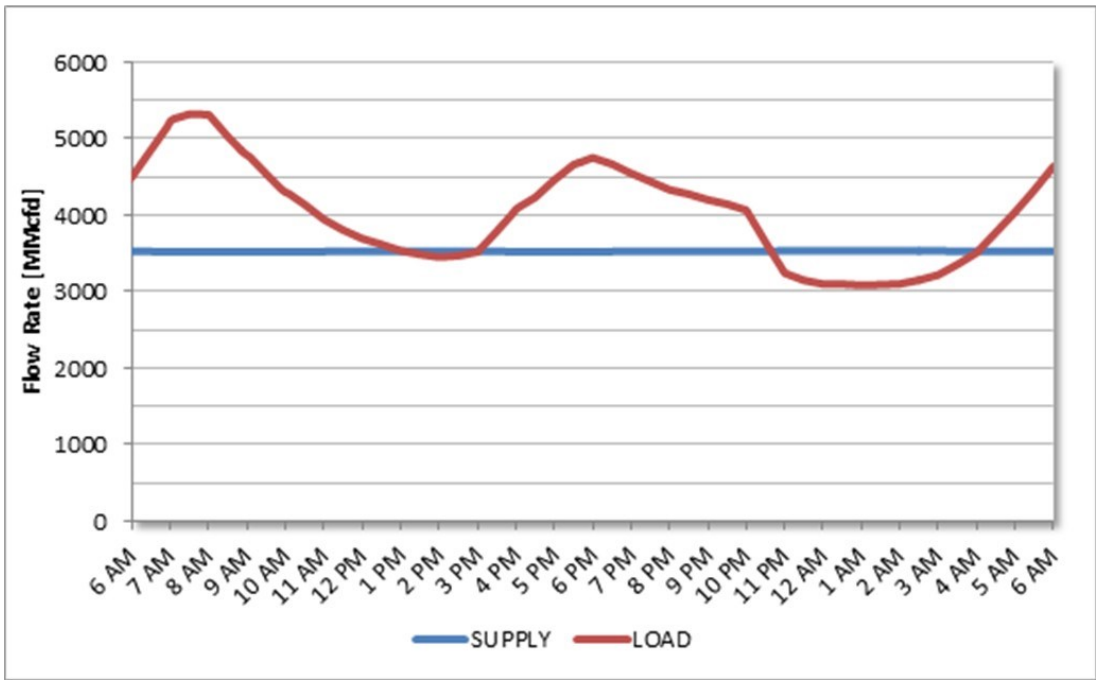
December 15, 2015 Examination

For December 15, 2015, the hydraulic results showed that a nearly 800 MMcfd difference in the demand forecast (or, equivalently, an 800 MMcfd loss of supply) is too much for the system to overcome without

the benefit of Aliso Canyon withdrawal supplies. Pressures dropped significantly and continuously across the entire system. System linepack was severely depleted at the end of the simulated operating day.

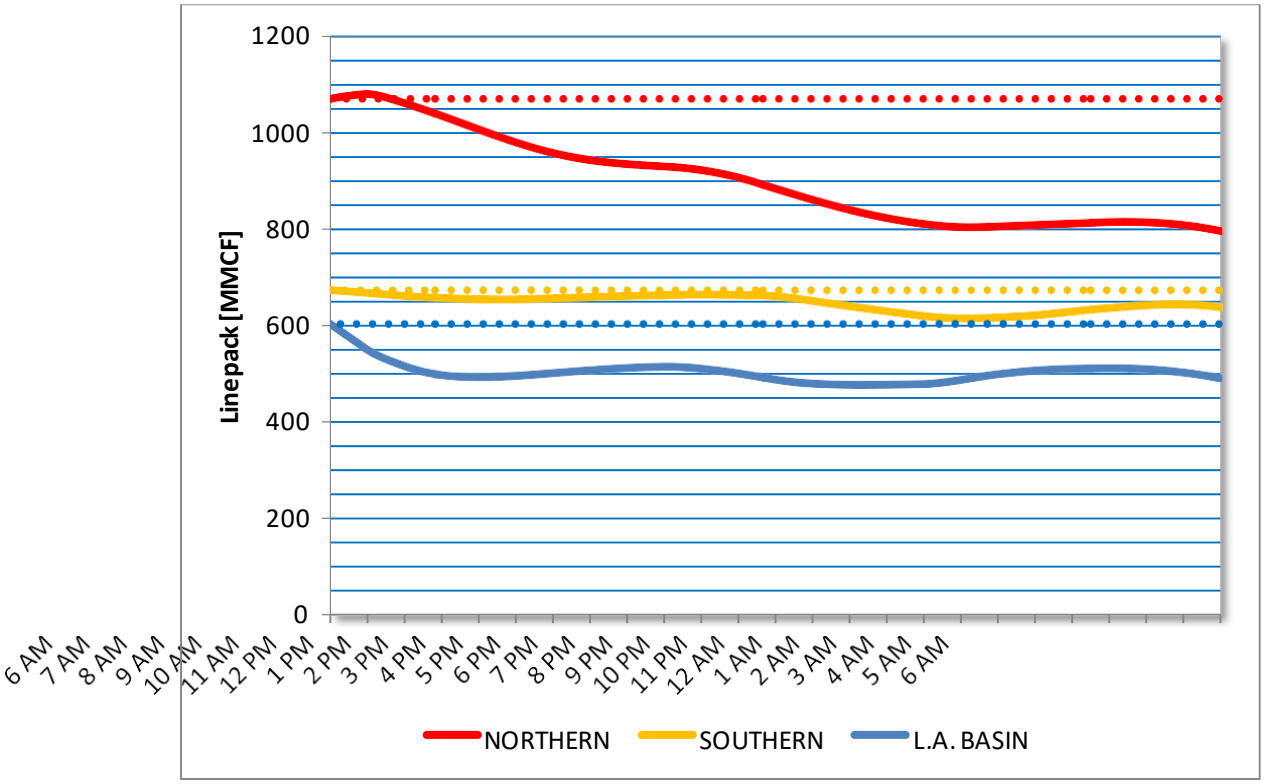
Figure 10 shows the demand and supply profile simulated for December 15, 2015. Demand exceeded supply at all times of the day until the late hours. As in the September 9, 2015 simulation, all available supply was fully utilized for the entire day beginning at 6 a.m. and provided no operational flexibility for the Gas Control Department.

Figure 10: December 15, 2015 – Demands & Supplies



As shown in the demand profile, a winter natural gas profile has two peaks: one in the morning as people wake up, turn the heater up, shower, and get ready for work; and a second in the evening when people return home. Typically, demand falls enough relative to supply after the morning peak such that the system can recover some linepack before the evening peak. In this simulation, however, there was no opportunity to recover linepack after the morning peak because supply never exceeded demand. This results in the continuous loss of linepack throughout the operating day, as shown in Figure 11, and any curtailment of customer demand on December 15, 2015 would have continued into at least December 16.

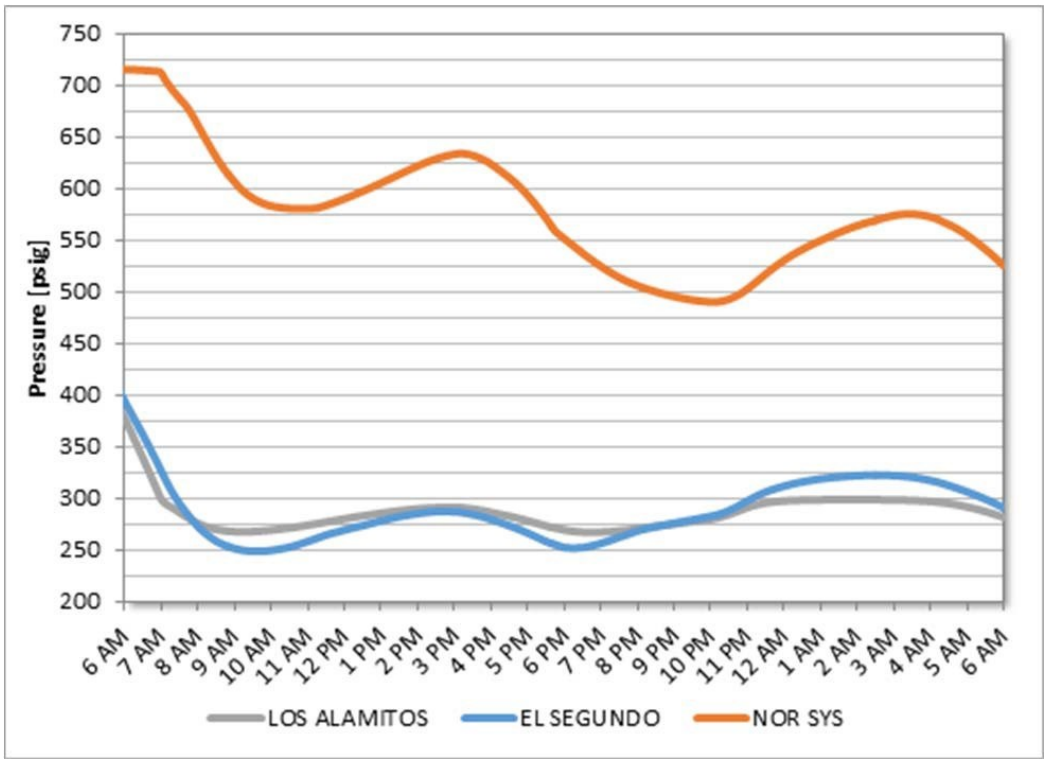
Figure 11: December 15, 2015 – System Linepack



As can be seen in Figure 11, the loss of linepack is most noticeable on the Northern System as SoCalGas once again uses gas from the Northern System to try and support both the Southern System and Los Angeles Basin.

Figure 12 shows the pressure on the Northern System and in the Los Angeles Basin near Los Alamitos and near El Segundo. Pressure on the Northern System never recovers at the end of the operating day and pressures in the Los Angeles basin approach minimum levels during both the morning and evening peaks.

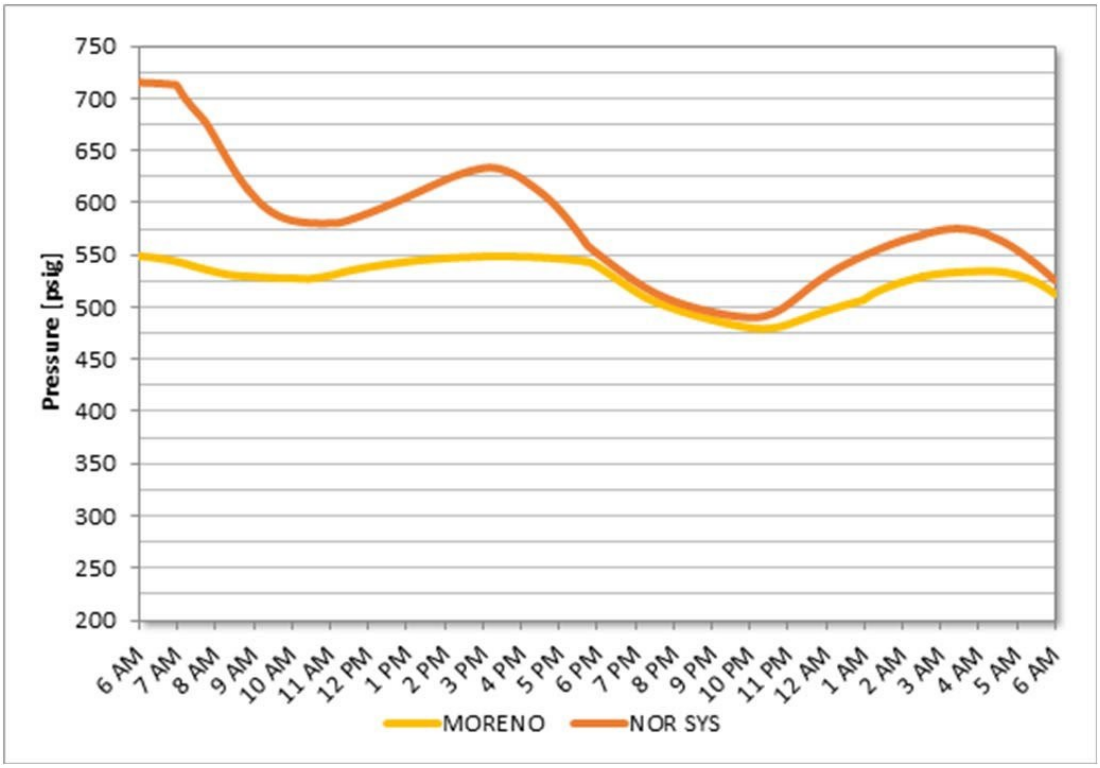
Figure 12: December 15, 2015 – Northern System & Los Angeles Basin Pressures



Furthermore, Los Angeles Basin pressures (Los Alamitos and El Segundo) fell rapidly, continuously, and significantly from 6 a.m. until 8 a.m. This rapid drop would have been enough to require SoCalGas to declare a curtailment of noncore service early in the day, likely lasting at least throughout the remainder of the day and into December 16.

Figure 13 shows pressure on the Northern System and at Moreno Station on the Southern System. The continuous loss of pressure on the Northern System leads to ineffective support to Moreno Station between the hours of 6 p.m. and 10 p.m. As shown in the figure, pressures equalize, at which point gas stops flowing from the Northern System towards Moreno Station, which results in the pressure drop at Moreno at this time. SoCalGas would have likely declared a curtailment of noncore service on the Southern System before 6 p.m.

Figure 13: December 15, 2015 – Northern System & Moreno Pressures



At the request of the Technical Assessment Group, SoCalGas re-examined this December 15, 2015 day to test the effects of possibly moving to 5 percent daily balancing.[4] Daily balancing, as proposed in the March 1, 2016 motion in Application 15-06-020, would require noncore customers to balance to within

[4] SoCalGas/SDG&E March 1, 2016 Motion for interim order establishing temporary daily balancing requirements.: http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=159669501 General link to filed documents in Application 15-06-020: http://delaps1.cpuc.ca.gov/CPUCProceedingLookup/f?p=401:56:17248206001161::NO:RP,57,RIR:P5_PROCEEDING_SELECT:A1506020

95 percent of their actual usage, not forecast. Daily balancing at 95 percent would mean 95 percent of the supply needed to serve the December 15, 2015 demand would come in as flowing supply, increasing to 3.822 Bcfd from 3.256 Bcfd assumed in the original analysis that reflected no daily balancing.

Not surprisingly, this extra gas supply helps significantly and linepack is fully recovered across the entire system at the end of the operating day. Figure 14 shows that supply can now help recover linepack between the morning and evening peak demand periods because supply exceeds demand during these times. While this case assumed daily balancing in order to test its impact, the Technical Assessment Group recognizes that daily balancing is difficult and may not be fully effective based on the dynamic nature of the electric system. Even if daily balancing is implemented as the action plan mitigation measures suggest, it will never eliminate all mismatches between scheduled gas and actual use. When some mismatches still inevitably occur, electric outages as a result of insufficient gas supply remain a risk

Figure 14: December 15, 2015 (5% Balancing) – Loads & Supplies

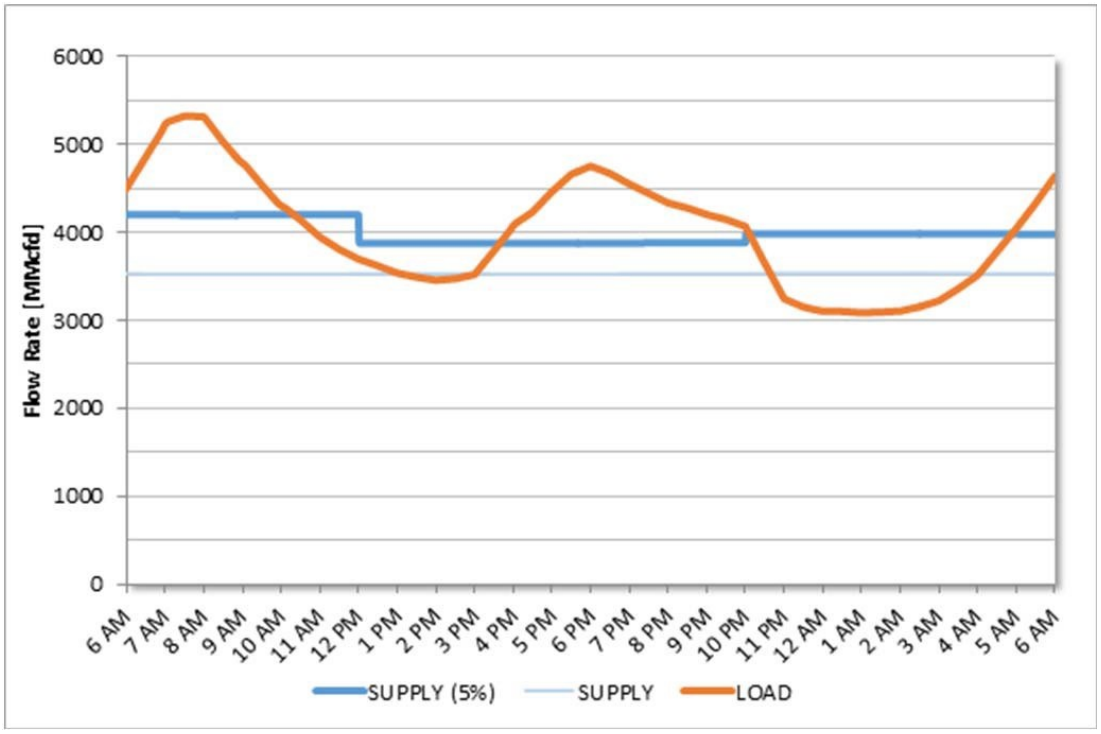
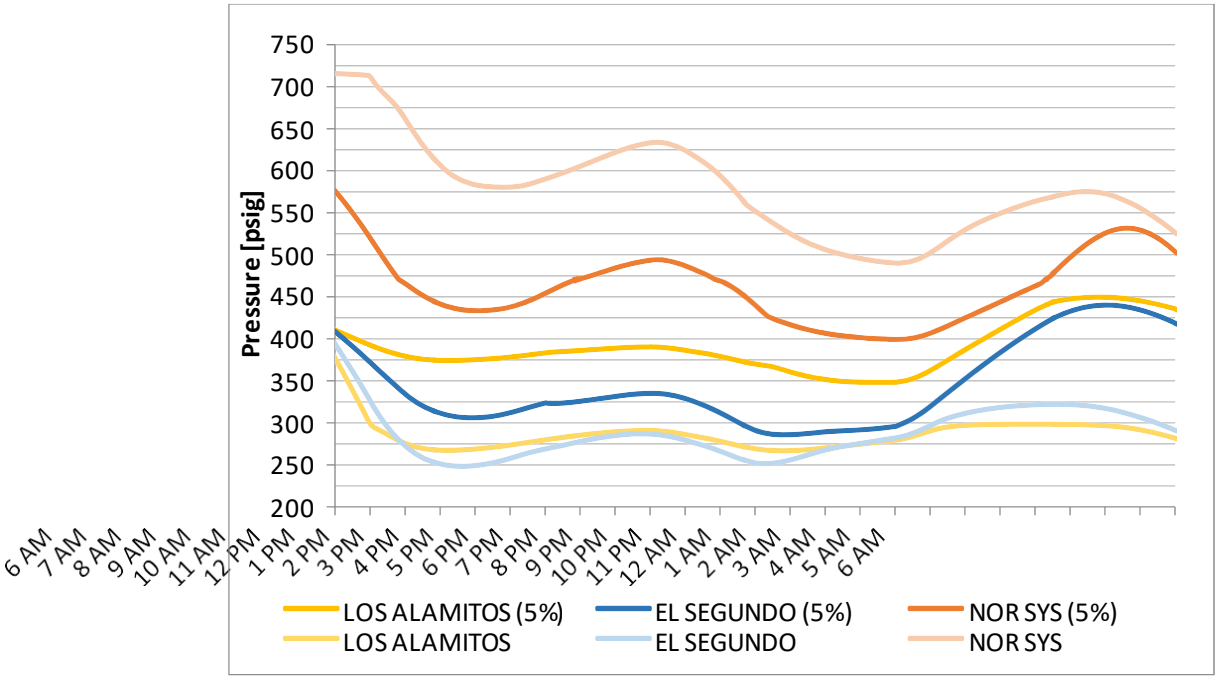


Figure 15 shows pressure improvement in the Los Angeles Basin.

Figure 15: December 15, 2015 (5 percent balancing) – Northern System & Los Angeles Basin Pressures



However, that the El Segundo area still experiences a sudden and continuous pressure drop from 6 a.m. through 9 a.m. While not as severe as previously examined, the extra supply from the interstate pipelines cannot travel quickly enough through the pipeline network to the pressure drop on the west side of the Los Angeles Basin. If SoCalGas Control department saw this pressure drop, it would almost certainly declare a noncore customer curtailment localized to the El Segundo area even with 5 percent daily balancing under this type of demand condition. Five percent daily balancing helps but even with it there may be days when demand changes quickly enough within the Los Angeles Basin that flowing supply cannot keep up and a gas curtailment for some number of hours will be needed.

CURTAILMENT RISK ASSESSMENT

The Reliability Task Force was asked to quantify the number of days throughout the year there would be a high risk of significant system stress on the SoCalGas and SDG&E pipeline systems absent supplies from Aliso Canyon. This risk assessment builds on the hydraulic analysis. In general, system stress and potential resulting curtailments cannot be predicted with certainty because there are so many variables that may occur on the SoCalGas pipeline and storage system. In addition, curtailments are possible during many combinations of sendout, receipts, temperature, and pipeline/storage facility outages. In order to develop an estimate of the number of days where the SoCalGas and SDG&E system could be in a state of stress thereby increasing the risk of curtailment, a statistical analysis was completed based on historical operating data, planned maintenance scenarios, and a historical average of forced outage events.

The scope of the analysis consisted of quantifying a range of days where curtailments resulting from significant system risk would be likely if Aliso Canyon were not available for withdrawal for the summer and winter seasons of 2016. The analysis was based on triggers from the hydraulic modeling performed, coupled with historical operating data from the years 2013 through 2015. In addition, four operating scenarios, each imposing an additional layer of stress on the system during a demand condition of 3.2 Bcfd or greater were reviewed to simulate possible plausible conditions.

Scenario 1: 150 MMcfd supply shortfall between scheduled receipts and actual gas flows (Potential Gas Curtailment: 180 MMcfd – 84 MMcf/eight peak hours)

Scenario 2: Scenario 1 in addition to a non-Aliso storage outage, reducing 400 MMcfd of system capacity (Potential Gas Curtailment: 480 MMcfd – 224 MMcf/eight peak hours)

Scenario 3: Scenario 1 in addition to a pipeline outage reducing 500 MMcfd of system capacity (Potential Gas Curtailment: 600MMcfd - 280 MMcf/eight peak hours)

Scenario 4: Combination of Scenarios 1, 2, and 3 resulting in an overall reduction of 900 MMcfd in system capacity (Potential Gas Curtailment 1100MMcfd -513MMcf/eight peak hours)

The supply shortfalls, loss of storage withdrawal (beyond Aliso), or loss of pipeline capacity could alternatively be real-time changes in demand (such as a fast/sustained ramp of gas-fired electric generation) or forecast variances. The criteria are applied over all the operating days. On some days, the system will be capable of tolerating variances from storage withdrawal or flowing supplies. This is due to the robust and redundant design of the pipeline system. That redundancy is removed as planned maintenance and outages occur. It should be noted that the 3.2 Bcf sendout threshold criteria for this analysis does not represent a “bright line,” where curtailments would not occur below that sendout level. Curtailments are possible during many different combinations of sendout, natural gas receipts, temperature, and pipeline/storage facility outages. For these analyses, 3.2 Bcfd was chosen because it represents a high sendout condition for the gas system during the summer. And it was also the sendout for the September 9, 2015 gas day scenario that was analyzed hydraulically. Historically, sendouts higher than 3.2 Bcf yield higher peak hourly rates.

Curtailment Risk Summary

Based on the historical data from years 2013 to 2015 and the scenario criteria, there are an estimated 23 to 32 days where the SoCalGas and SDG&E systems will be under significant stress with Aliso Canyon capabilities unavailable. Ultimately, the actual magnitude and distribution of the system stress and potential curtailments will vary based on conditions at the time of the incident. The range is based on whether SoCalGas and SDG&E incur a planned or unplanned outage. An outage is defined as a pipeline or piece of equipment that is taken out of service.

An analysis of this complexity is difficult to evaluate while trying to ensure as many variables as possible are taken into consideration to effectively calculate the probability of curtailments. This analysis has two major steps:

Identify the data set and determine the total number of potential days where the SoCalGas system would be under significant stress

Utilize the days identified in Step 1, and overlay planned maintenance scenarios in addition to unplanned outages

The data from steps 1 and 2 is then evaluated to establish a range of days where the gas transmission system will be under stress, and curtailments will be likely.

Analysis Discussion

Step one

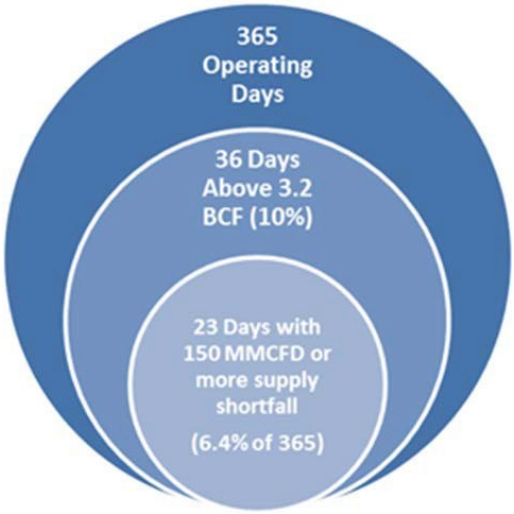
Since the analysis is based on historical data, it was important to ensure that an appropriate time span was utilized which encompasses representative operating conditions that could be expected in 2016. The task force determined that operating days from 2013 through 2015 were the most appropriate being that utilizing data from 2012 could skew the analysis because 2012 was the year the San Onofre Nuclear Generating Station (SONGS) was taken offline, resulting in abnormal operating conditions and electric generation compared to other years.

The data set consisted of operational data for each gas day for the chosen time span, where the results from the September 9 hydraulic analysis provided the governing criteria. The results from that hydraulic analysis indicated that if the difference between the expected flowing supplies and the actual demand exceeded 150 MMcfd, the pressures in the Los Angeles Basin and in the Southern System would not fully recover requiring the system operator to potentially call a curtailment in order to ensure system reliability is maintained.

The data for 2013—2015 resulted in a total data set of 1,095 operating days. Then, all days that had a daily sendout (total gas burn) of 3.2 Bcf or greater were identified, which resulted in a total of 108 days, or approximately 10 percent of the 1,095-day data set. Once the 3.2 Bcf or greater days were identified, the data set was further filtered to only those days where the difference in flowing supplies and sendout were 150 MMcfd or more, which gave a result of 70 days. This represented 6.4 percent of the 1,095-day data set.

Using the above percentages, about 10 percent of the year or 36 days will be 3.2 Bcf or above, and 6.4 percent of the year or 23 days will have a shortfall of 150 MMcfd or more. This is represented in Figure 16.

Figure 16: One Year Breakdown of Operating Data



Step two

Once the number of days where the gas transmission system is expected to be under stress and the risk of curtailments is high was identified (23 days per year), the estimated planned and unplanned outages on the gas system expected in 2016 were brought into the analysis (Scenarios 2 and 3). SoCalGas and SDG&E post outages that impact system capacity to its electronic bulletin board, Envoy, as soon as practical.

Next, SoCalGas created scenarios based on planned outages, like projects and maintenance on the gas transmission pipeline and storage systems that could occur in 2016. SoCalGas and SDG&E work regularly on their outage schedules—moving outages around to minimize reliability impacts to the extent possible. In order to continue to safely operate their systems, SoCalGas and SDG&E will continue to execute projects necessary for safety and regulatory compliance. The Step 1 analysis identified 23 days or 6.4 percent of the year where curtailments are likely, and the same percentage was applied to each of the planned outage conditions in order to determine how many days would occur under each condition. The following calculations in Table 3 describe the risk assessment for all the outages scenarios for 2016.

Table 3: Calculations to Determine Range of Estimated Days the SoCalGas and SDG&E Systems Will be Under Significant Stress:

Total Data set (3 years 2013-2015):				
Total number of days in data set:	1095	days		
Number of days above 3.2 BCF:	108	days	10%	of total data set
Number of days > 150 MMCFD supply shortfall:	70	days	65%	of 3.2 BCF days
Annualized Data:				
Days per year above 3.2 BCF:	36	days		
Number of days > 150 MMCFD supply shortfall:	23	days	6.4%	of calendar year
Planned Outage Scenarios:				
Storage Outages > 400 MMCFD impacts:	121	days		
Pipeline Outages > 500 MMCFD impacts:	158	days		
Outage overlaps (both above occur concurrently):	97	days		
Isolate Days ONLY Storage Outages (no overlap):	24	days	(121-97)	
Isolate Days ONLY Pipeline Outages (no overlap):	61	days	(158-97)	
Apply 6.4% of calendar days from above to determine the estimated number of storage and pipeline outage days under stress:				
Storage Outages > 400 MMCFD impacts:	2	days	(6.4% of 24)	
Pipeline Outages > 500 MMCFD impacts:	4	days	(6.4% of 61)	
Outage overlaps (both above occur concurrently):	6	days	(6.4% of 97)	
Estimated days of significant stress during a planned outage:	12	days	(sum of above)	
Estimated days of significant stress throughout the calendar year:	11	days	(23 - 12)	
Unplanned Outage Scenarios:				
Storage Outages > 400 MMCFD impacts:	21	days		
Pipeline Outages > 500 MMCFD impacts:	117	days		
Outage overlaps (both above occur concurrently):	5	days		
Isolate Days ONLY Storage Outages (no overlap):	16	days	(21-5)	
Isolate Days ONLY Pipeline Outages (no overlap):	112	days	(117-5)	
Apply 6.4% of calendar days from above to determine the estimated number of storage and pipeline outage days under stress:				
Storage Outages > 400 MMCFD impacts:	1	days	(6.4% of 16)	
Pipeline Outages > 500 MMCFD impacts:	7	days	(6.4% of 117)	
Outage overlaps (both above occur concurrently):	1	days	(6.4% of 5)	
Estimated days of significant stress during unplanned outages:	9	days	(sum of above)	

Total estimated range of days resulting in significant stress: 23 to 32 days
23 days based on planned outages
9 days based on unplanned outages (incremental to the planned outages)

Historical data for three years was utilized in order to forecast planned outages for 2016. Figure 17 shows the number of potential gas curtailment related to planned outages. The analysis utilized 6.4 percent of the days from Step 1 to estimate the condition under which a curtailment will occur. Based on this approach, the following is the breakdown of planned outages we might expect this year by scenario. The following bullets summarize the scenarios:

Scenario 1: Forecasted 11 days where the SoCalGas system will be under significant stress throughout the year

Scenario 2: Forecasted 121 days of planned storage outages with impacts greater than 400 MMcfd

Based on this methodology, it is estimated that there are two days where the system will be under significant stress in this condition

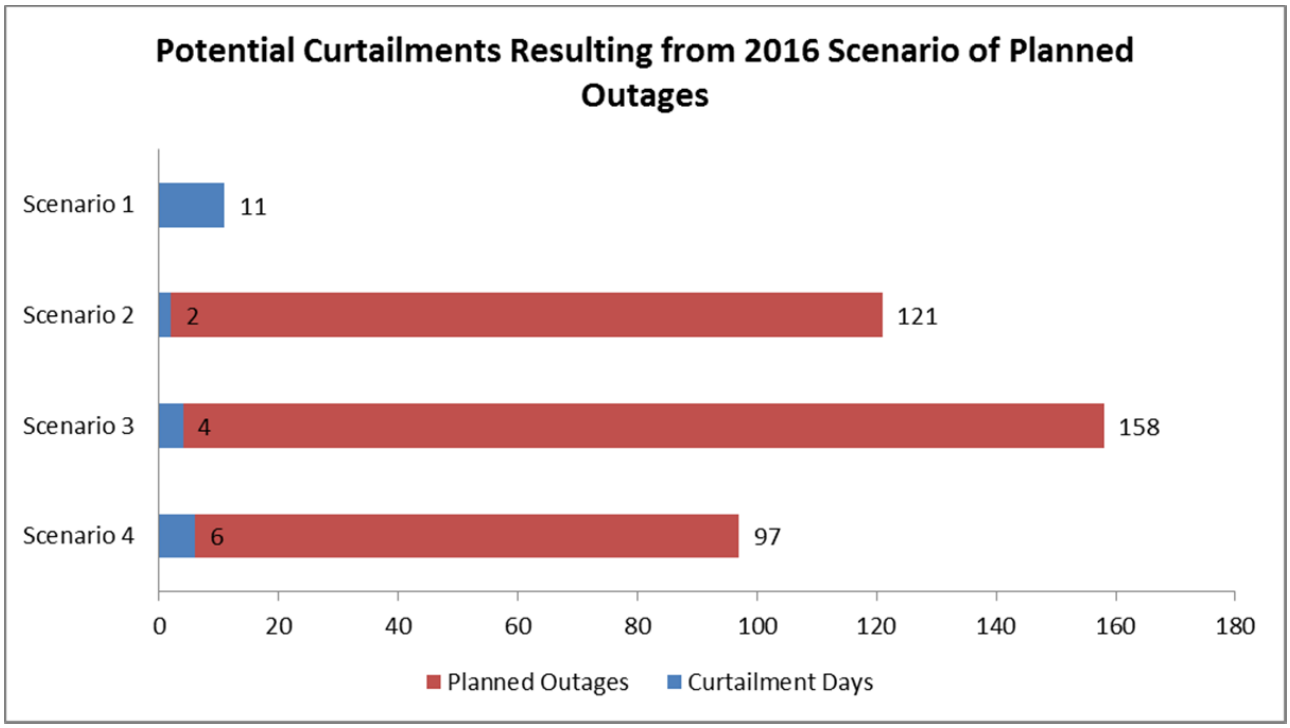
Scenario 3: Forecasted 158 days of planned pipeline outages with impacts greater than 500 MMcfd

Based on this methodology, it is estimated that there are four days where the system will be under significant stress in this condition

Scenario 4: There are 97 days where the two planned outage conditions above will overlap and occur concurrently

Based on this methodology, it is estimated that there are six days where the system will be under significant stress in this condition

Figure 17: Days of Potential Gas Curtailments Due to Planned Outages



Historical data for the same three years was utilized in order to forecast unplanned outages for 2016. Figure 18 shows the number of potential gas curtailment related to unplanned outages. The analysis used 6.4 percent of the days from Step 1 to estimate the condition under which a curtailment will occur. Based on this approach, the following is the breakdown of unplanned forced outages that might be expected this year:

Scenario 1: Forecasted 11 days where the SoCalGas system will be under significant stress throughout the year.

Scenario 2: Forecasted 21 days of unplanned storage outages with impacts greater than 400 MMcfd.

Based on this methodology, it is estimated that there is one day where the system will be under significant stress in this condition.

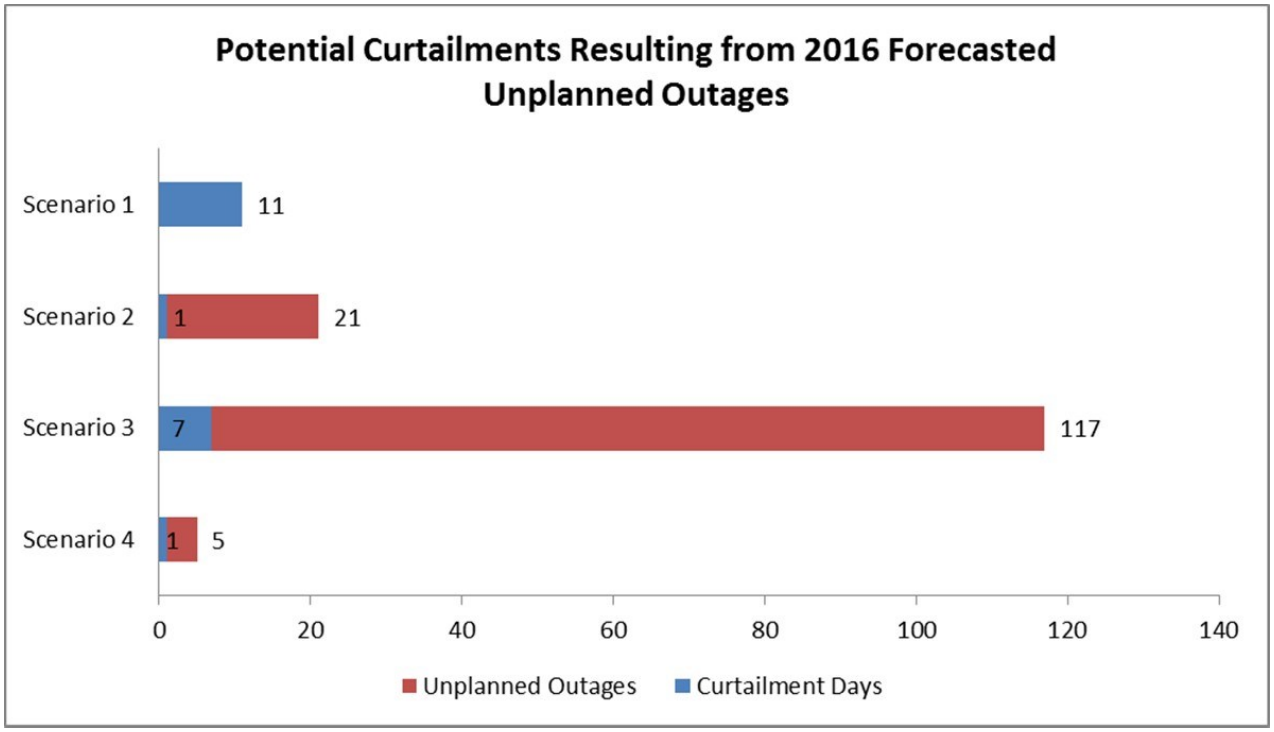
Scenario 3: Forecasted 117 days of unplanned pipeline outages with impacts greater than 500 MMcfd.

Based on this methodology, it is estimated that there are seven days where the system will be under significant stress in this condition.

Scenario 4: There are five days where the two outage conditions above will overlap and occur concurrently.

Based on this methodology, it is estimated that there is one day where the system will be under significant stress in this condition.

Figure 18 – Days of Potential Gas Curtailments Due to Planned Outages



Results

SoCalGas and SDG&E cannot forecast customer curtailment on their gas transmission system. Depending upon the level of demand, level and location of delivered supply, and availability of transmission assets, curtailment of customer demand can be avoided in one situation and be required in an otherwise similar situation. At the request of and under direction from the task force, SoCalGas and SDG&E have attempted to quantify the level of risk of uninterrupted service that may occur under a fixed set of assumptions.

Based on the historical data from years 2013 to 2015 and the analyses performed on specific historical days directed by the task force, SoCalGas and SDG&E have calculated a potential for 23 to 32 days where the SoCalGas and SDG&E systems will be under significant stress in 2016 without the Aliso Canyon storage field in operation, placing uninterrupted service to noncore customers at risk. The magnitude and distribution of this risk is grouped into the following "tranches" based on whether the SoCalGas and SDG&E systems incur planned or unplanned outages. These values are based on operating and outage data, and not on a hydraulic analysis based on specific operating conditions or days. The risk is expressed as a daily volume based on a 24-hour gas day (7 a.m. to 7 p.m.), and therefore hourly reductions are distributed across all 24 hours. For periods of risk that are less than 24 hours, the volume at risk may exceed these overall daily volumes.

Scenario 1 quantified 11 days in which the gas demand exceeds the amount of gas that customers planned to bring in by more than 150 MMcfd but with no other pipeline or storage outages beyond Aliso Canyon. SoCalGas estimates under Scenario 1, there is a daily gas curtailment potential up to 180 MMcfd of which 84 MMcf occurs over the eight peak electric hours of the day. Of those 11 days, two days in scenario 1 are summer days and the balance of the nine are non-summer days

Scenario 2 quantified two to three days based on planned and unplanned outages respectively in which there is a coincident planned or unplanned storage outage that reduces gas delivery capacity by 400 MMcfd in addition to the conditions of Scenario 1. SoCalGas estimates that gas curtailment up to 480MMcfd of which 224 MMcf for the eight peak electric hours would be necessary. Of those three days, two are summer days and one is non-summer.

Scenario 3 quantified four to 11 days based on planned and unplanned outages respectively in which there is a gas coincident planned or unplanned pipeline outages reduce gas delivery capacity by 500MMcfd in addition to the conditions of Scenario 1. SoCalGas estimates that under Scenario 3, there is a potential for gas curtailment up to 600 MMcfd of which 280 MMcf for the eight peak electric hours would be necessary. Of those 11 days, nine are summer and two are non-summer.

Scenario 4 quantified six to seven days based on planned and unplanned outages respectively in which there were combinations of storage and pipeline outages that reduces gas delivery capacity by 900MMcfd in addition to the conditions identified in Scenario 1. SoCalGas estimates that under this scenario 4, gas curtailment up to 1,100 MMcfd of which 513 MMcf for 8 peak electric hours would be necessary. Of those seven days, three are summer days in which high temperatures result in high demand.

An additional nine days of curtailment may be anticipated to occur incremental to the 23 days under an unplanned outage condition, resulting in a range of potential curtailments using this methodology of 23 to 32 days. Table 4 provides a summary of scenario findings.

Table 4: Days of Curtailment Risk by Scenario

Curtailment Scenarios	Days of Curtailment Risk for Electric Generators
Scenario 1: 150 MMCF supply shortfall between scheduled receipts and actual gas flows (Potential Gas Curtailment: 180MMCF/Day - 84MMCF/8 peak hours)	11 Days (2 summer, 9 non-summer)
Scenario 2: Scenario 1 in addition to a non-Aliso storage outage, reducing 400 MMCFD of system capacity (Potential Gas Curtailment: 480MMCF/Day - 224MMCF/8 peak hours)	2-3 Days (2 summer, 1 non-summer)
Scenario 3: Scenario 1 in addition to a pipeline outage reducing 500 MMCFD of system capacity (Potential Gas Curtailment: 600MMCF/Day – 280MMCF/8 peak hours)	4-11 days (9 summer, 2 non-summer)
Scenario 4: Combination of Scenarios 1,2, and 3 resulting in an overall reduction of 900 MMCFD in system capacity (Potential Gas Curtailment 1100MMCF/Day -513MMCF/8 peak hours)	6-7 days (3 summer, 4 non-summer)

ELECTRIC ANALYSIS

SoCalGas performed hydraulic simulation analysis for selected sample days from 2015 and 2014. The selected sample represented days that had a total gas demand that exceeded 3.2Bcf. Based on the results of the hydraulic analysis, SoCalGas determined that under certain conditions and without the availability of Aliso Canyon, critical operations gas pressures will be difficult to maintain when actual gas demand exceeds gas scheduled into the SoCalGas system by more than 150MMcfd. Under such conditions, SoCalGas indicated gas curtailments would be necessary to manage operational pressures. SoCalGas' assessment further determined the frequency and magnitude of gas curtailments can increase due to planned and unplanned outage to gas pipelines and other storage facilities in the SoCalGas system on days the system is already stressed due to differences between scheduled gas and actual gas demand. Based on the gas assessment, California ISO and LADWP Balancing Authorities[5] performed a complementary joint assessment translating the gas assessment to electric impacts.

Electric generation taking noncore service on the SoCalGas system is the first gas customers having to respond to gas curtailments.[6] The less time the California ISO and LADWP have to respond to a gas

[5] California ISO and LADWP Balancing Authorities include the municipal utilities of Anaheim, Riverside, Pasadena, Azusa, Banning, Colton, Burbank, and Glendale. The Balancing Authorities will be referred to as California ISO and LADWP throughout the Electric Analysis section of this document.

[6] Currently, SoCalGas and SDG&E curtail end use load defined as "interruptible" off the system first. Next, "firm" noncore load is curtailed in a system of rotating blocks between electric generation and non-electric generation load, until the desired amount of gas is taken off the system. SoCalGas and SDG&E have proposed in Application 15-06-020 the authority to revise their curtailment procedures to take up to 60 percent of the electric generation load off the system as the first step in a curtailment event.

curtailments notice, the fewer options the California ISO and LADWP have to secure additional import energy to serve load in southern California area to displace the gas-fired generation affected by the gas curtailment. This means that the tolerance of short-notice gas curtailments can only be absorbed by imported energy to the extent there is room available in the electric transmission system and available supply. Historically, when the Southern California system experiences high electric loads, the southwest is also experiencing high loads. Available import energy has been scarce during these times, especially in real-time operating hours.

As Balancing Authority and Transmission Operator, LADWP and California ISO are required to meet NERC Reliability Standards requirements. These requirements include:

The requirement for Balancing Authority to carry and maintain a minimum amount of contingency reserve

The requirement for Balancing Authority and Transmission Operator to meet unscheduled changes in system configuration and generation dispatch (at a minimum N-1 Contingency planning) in accordance with NERC, Regional Reliability Organization, sub-regional, and local reliability requirements

The California ISO and LADWP performed a joint assessment to determine the minimum generation requirements needed based on the actual September 9, 2015 operating conditions. This assessment included:

Power flow analysis to ensure acceptable electric system performance under pre- and post- contingency operations.

Assumed normal transmission system configuration with all lines in service.

The minimum generation levels to maintain local reliability, extrapolated to meet the load pattern.

Maximize Imports based on transmission and supply limitations required to meet customer demand not met by minimum generation levels within the SoCalGas service territory.

The local reliability assessment focused on local transmission reliability that did not include the contingency reserve requirement necessary to immediately meet the greater of the loss of the Most Sever Single Contingency (MSSC) or approximately six percent of the hourly peak load. The assessment also does not include capacity needed to recover required contingency reserves within one hour after they are dispatched. Separate from the local reliability assessment, LADWP and California ISO determined that they would not be able to maintain sufficient contingency reserve[7] in Southern California area to meet reliability requirements.

[7] While the California ISO may be able to maintain system-wide contingency reserves requirements, it would not be able to maintain sufficient distribution of contingency reserves in Southern California.

While the quantity and location of the generation commitment may vary depending load level and system topology each day, historical experience and the summer 2016 seasonal assessment performed by the California ISO and LADWP show the need to have minimum generation commitment inside the Los Angeles, Orange County and San Diego areas. Maintaining the minimum generation requirement needed to reliably operate each local system limits the ability for both LADWP and California ISO to shift electric supply from inside the Los Angeles Basin to other areas of the SoCalGas system. This includes municipal utilities in the Southern California gas area that also require minimum generation to ensure reliability in their systems.

Figure 19 shows the minimum generation identified in the assessment needed in both LADWP and California ISO Balancing Authority areas translates into an LADWP and California ISO gas requirement of approximately 1901 MMcf for the day. Should transmission contingencies or forced outages occur, generation will be dispatched in the impacted areas to reposition the electric system to avoid further transmission overloads. This may require additional gas burn within the Los Angeles Basin and SoCalGas southern system. Additional gas may or may not be available, given real time operating conditions, which could result in electric service curtailments.

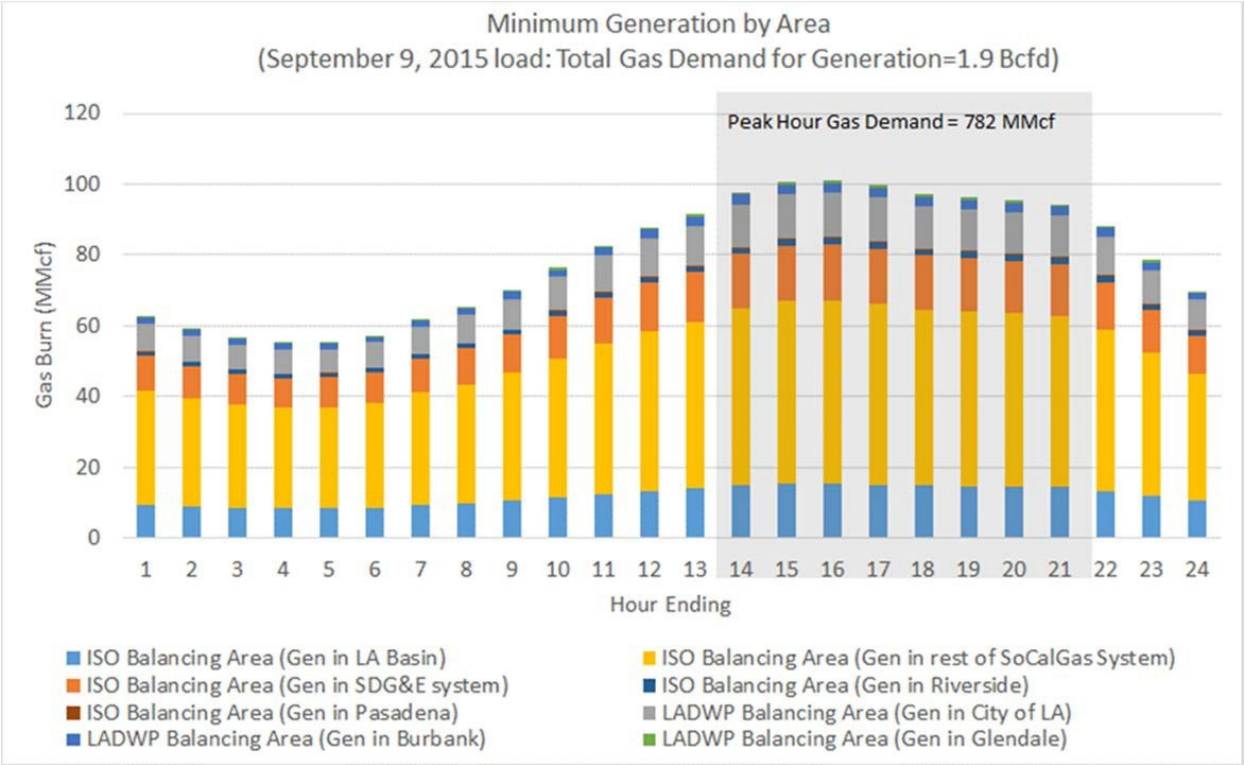
Case studies

Two power flow case studies were developed for this assessment utilizing the Western Electricity Coordinating Council - Operational Study Subcommittee's summer 2016 power flow case. The 2016 power flow cases modeled a 1-in-10 year load level. However, the load in the case was decreased to reflect a typical summer high load as represented by September 9, 2015. The case studies established the minimum generation in Orange County area and other areas to meet local reliability criteria while maximizing energy imports from the north and east into the Los Angeles Basin, Orange County and San Diego in order to minimize the use of gas fired generation needed throughout the remainder of the SoCalGas and SDG&E system.

A typical load pattern and maximum energy imports subject to transmission constraints[8] were assumed. Gas fired generation was scaled accordingly to meet the load pattern. The analysis calculated the hourly minimum generation in MW for the San Diego, Orange County, LADWP, and remaining areas within the SoCalGas and SDG&E system. The minimum generation requirement was then translated to the gas needed in MMcf per hour throughout the SoCalGas and SDG&E system to support the minimum generation requirement as illustrated in Figure 19.

[8] The most limiting transmission constraint in the California ISO system is the transmission running from northern California to southern California referred to as Path 26. The most limiting transmission constraint in the LADWP system is the Victorville to Los Angeles path.

Figure 19: Minimum Generation, Gas Requirements in MMcf



The minimum generation identified in the assessment needed in both LADWP and California ISO Balancing Authority areas translates into an LADWP and California ISO gas requirement of approximately 1901 MMcf for the day and more specifically 782 MMcf for the peak hours that would be most susceptible to gas curtailments as indicated by the shaded area in Figure 19 above.

Table 5 summarizes the inputs and results for the case studies. Rows 8 and 13 illustrates the amount of supply for California ISO and LADWP, respectively, that could be shifted assuming supply and transmission availability to support gas curtailment. Row 14 provides the total combined California ISO and LADWP supply that could shifted. Row 15 quantifies the approximate amount of gas curtailment relief that could be achieved by re-dispatching using the peak hour gas burn.

Table 5: Summary of Case Study Results

No	Case study with minimum ISO LA Basin and LADWP Generation	9/9/2015 Actual System Condition	9/9/2015 System Conditions with Minimum LA Basin and LADWP generation	2016 (1 in 10) Heavy Summer case with Minimum LA Basin and LADWP Generation
1	CAISO Southern California (SCE) Load + Losses (MW)	23,232	23,232	23,495
2	CAISO San Diego (SDGE) Load + Losses (MW)	4,938	4,938	5,292
3	CAISO Combinded Southern California Load (MW) (Rows 1 + 2)	28,170	28,170	28,787
4	CAISO LA Basin Gas Generation (MW)	3,816	1739	1739
5	CAISO Gas Generation taking service from SoCalGas (MW)	6,935	5,117	5,681
6	CAISO all other generation in Southern California not requiring service from SoCalGas (MW)	7,509	8,994	8,716
7	CAISO Imports into Southern California from North and East as measured by Southern California Import Transfer (SCIT) (MW)	14,932	16,399	16,204
8	CAISO Additional Import Requirement (Min Gen Case - Actual Case)		1,467	1,272
9	LADWP Load + Losses (MW)	6905	6905	7125
10	LADWP Gas Generation (MW)	2746	1646	1776
11	LADWP Other Generation (MW)	261	663	683
12	LADWP Import into Basin (MW)	3898	4596	4666
13	LADWP Additional Import Requirement (MW) (Min Gen Case - Actual Case)		698	768
14	Total CAISO and LADWP Import Requirement (MW) (Row 8 + 13)		2,165	2,040
15	Total additional gas required to replace additional Imports for 8 hour peak period (mmcf) (Row 14/103MWh*8 Hours)		168	158

California ISO Minimum Generation Requirements

For the California ISO balancing area, the amount of gas curtailment that can be managed depends on a number of factors. These factors include the electric load level in Southern California, local transmission constraints within California ISO's Southern California system and the amount of electric supply available that can use remaining transmission capacity between California ISO and neighboring balancing authority areas.

During the summer, the load in the California ISO southern system combines SCE and SDG&E transmission service areas.[9] On September 9, 2015, the southern system load was 27,526 MW.[10]

There are local transmission constraints that require specific generation to respond to transmission contingencies in Orange County and San Diego. Some local utilities that are embedded within the California ISO balancing area such as the city of Riverside and city of Pasadena also require minimum generation levels to maintain reliability on their local transmission or distribution systems depending on the load level. These transmission constraints require generation in specific areas to be prepared to respond to local transmission contingencies to avoid overloading other transmission lines or to maintain required voltage levels.

California ISO Ability to Shift Electric Supply from Basin/SoCalGas Area

Import capability in southern California from the northern California is limited by the north to south transmission path (Path 26) at a maximum of 4,000 MW total transfer capability when all lines are in service. If 3000 MW of energy is already flowing and 1000 MW available capacity on Path 26 remains, then the California ISO Balancing Authority could only absorb 1000 MW of generation curtailment in the Southern California area from the north. In addition, there is approximately 10,100 MW of east to west transmission capability between California ISO and Nevada[11] and Arizona. The real-time ability to increase energy delivery from the Southwest is limited by the small amount of supply available and remaining unused transfer capability. Lastly, there is approximately 3,000 MW of transfer capability between LADWP and California ISO. Typically during the summer 2500 MW is already flowing with energy from LADWP resources located outside the Los Angeles Basin leaving only 500 MW of capability for additional import energy assuming supply availability. In addition, the transmission throughout the system can become congested during times of high imports and may be limited in effectiveness to mitigate gas curtailments in times of high loading conditions.

There are some gas-fired resources located in southern California that take can take gas service from other pipelines other than those of SoCalGas for example the High Desert Generations facility. These resources can be used to help mitigate gas curtailments to gas fired resources on the SoCalGas system but may not serve to mitigate local transmission constrained areas such Orange County.

[9] Load includes cities of Riverside, Anaheim, Pasadena, Vernon, Azusa Banning and Colton.
[10] California ISO 2015 peak load occurred on September 8, 2015.
[11] In December 2016, NV Energy started participation in the Energy Imbalance Market (EIM). NV Energy's participation in the EIM there increases the real-time transfer capability between Nevada and Southern California and therefore increases the flexibility for the California ISO to respond to real-time gas curtailments.

LADWP Minimum Generation Requirements

LADWP has constraints similar to those noted by the California ISO and as a result LADWP can experience similar situations. The amount of absorbable gas curtailment will be highly correlated with the amount of transmission capacity left available in its Victorville-Los Angeles path.

Any amount of gas curtailment beyond what can be absorbed will most likely result in the electric demand curtailment.

LADWP's minimum generation is determined by a minimization process in which the following three reliability criteria are the major constraints.

Before the loss of any transmission circuit or generator, all circuit loadings shall be less than the circuits' continuous ratings, and all voltages shall be normal.

Following the loss of the most critical single generator or transmission circuit, the loading on the most severely stressed transmission circuit shall be less than that circuit's two-hour rating (emergency rating)

Following the loss of the most critical single generation or transmission contingency, or any credible multiple contingency, LADWP steady state voltage shall meet LADWP's voltage limits.

The minimum generation requirement is the minimum generation that meets all three criteria. The minimum generation dispatch is determined daily for the next day, monthly and seasonally assuming worst-case conditions for the period. In real time, the system is continuously monitored to determine the minimum generation requirement is being satisfied.

In addition, a minimum generation commitment/availability is also determined by the same minimization process in which the following fourth reliability criterion is the major constraint.

Assuming the worst single contingency is not restored within two hours, sufficient LADWP generation shall be available within two hours to relieve loading on all circuits to the circuits' continuous ratings, and to restore voltage to 100 percent of normal.

Assuming all lines in service and generation available at each plant:
The minimum generation output (to meet 1, 2 and 3 above) typically ranges from 226 MW to 457 MW at 3,900 MW (nominal spring peak) to 1,523 MW to 2, 198 MW at 6905 MW (typical summer peak).
The minimum generation commitment (to meet 4 above) ranges from 549 MW at 3,900 MW (nominal spring peak) to 2,897 MW at 6,905 MW (typical summer peak).

The values will be higher if there are transmission limitations.

LADWP's Ability to Shift Electric Supply from Basin/SoCalGas Area

A daily resource plan is developed and used to ensure LADWP has adequate resources to meet its projected load including reserves for contingencies minimum generation requirements and regulation of variable generation resources such as wind and solar. This daily plan is used to forecast the amount of

gas required to be used in the LADWP basin generators. This gas forecast is used to procure the necessary gas for each day.

During a gas curtailment a reduction in available gas will require the generators within the Los Angeles Basin or across SoCalGas system, depending on the operational gas conditions, to re-dispatch to reduce gas burn to some value as determined by SoCalGas. The options to make up for this reduction of in- basin generation are limited to imports of additional purchased power from outside the Los Angeles Basin, or use other uncommitted resources (not included in daily resource plan) outside the Los Angeles Basin. These options are limited by transmission import capability.

Some energy may be shifted from gas fired generation to the Castaic Power Plant in real time. But energy from Castaic is limited by reservoir elevation, and Castaic cannot sustain maximum output for more than a few hours, particularly on successive days. LADWP's ability to shift supply from the Los Angeles Basin to external sources is limited by the following three constraints:

The minimum generation requirements described above. A portion of the LADWP load must always be supplied by local gas-fired generation to meet Reliability Criteria 1, 2, and 3 above.

LADWP's ability to import external resources is limited by transmission capability. Based on the results of a joint power flow study with the California ISO that maximized imports, the total imports into the LADWP Balancing Authority at a peak load of 6,900 MW is 4,666 MW.

Market availability of capacity and energy from external resources.

Energy may be shifted from gas fired generation to imports within an hour or two, contingent on the availability of unloaded transmission capacity and sufficient resources from LADWP external resources or counterparties for purchase. Of the 4,666 MW of imports required to minimize the gas burn, 72 percent of the available import capability is already committed to importing LADWP, Burbank, and Glendale resources from external wind, solar, geothermal, coal, and nuclear resources owned by the Balancing Authority members. The remaining 28 percent of the import capability is useful in meeting load only if counterparties on the other end of the transmission paths have energy to sell. This is a critical point especially during high temperature and high demand events. During the July 1, 2015 gas curtailment, LADWP was unable to purchase energy in the real-time wholesale market at any price.

Electric Service Reliability Risk Assessment

The study considered the NERC Contingency Reserve requirements which dictate that available unloaded generation is available to be called on and loaded to cover the loss of generation or transmission elements within the LADWP system. This reserve is required to be dispatched to cover the loss of the LADWP Most Severe Single Contingency (MSSC) and usually is within the 700 to 800 MW range. The reliability requirement is to cover this loss within 15 minutes and a second requirement to restore the contingency reserves within 60 minutes of activation. For many scenarios, this reserve energy must come from in basin gas-fired generation. Since the analysis was completed with the intent to maximize the ability to curtail gas, this requirement is not included for LADWP. Ultimately, this will place an additional unscheduled burden on the gas supply or reduce the ability to absorb some of the gas curtailment.

The LADWP reliability assessments are conducted based on the expected electrical system conditions for the operating time period being analyzed. Currently the focus is for the upcoming summer operating season. These studies are performed using the appropriate WECC seasonal base case, modified as needed to simulate the conditions expected for this season. This includes all planned transmission and generation outages. These conditions are modeled in an off-line power flow program that runs a battery of transmission and generation contingencies to determine minimum generation commitment and post contingency generation increases to maintain NERC reliability requirements[12].

This is an assessment using best-case rather than worst-case assumptions. If any of the import transmission paths are not available or limited more than specified, or if market energy is not available, then LADWP will not have sufficient resources to meet the peak demand and electric demand curtailments are a likely result.

JOINT CALIFORNIA ISO AND LADWP IMPACT ANALYSIS AND RESULTS

The SoCalGas hydraulic analysis indicated that at times of high forecasted gas demand 3.2 Bcf or higher the gas system had the capability to maintain gas reliability within a 150MMcfd tolerance before pipeline pressures would be at unreliable levels. To the extent, the difference between the forecast gas and actual gas demand is more than 150MMcfd, the possibility of gas curtailment on the system increase. SoCalGas estimated four scenarios resulting in increasing depth of curtailment volume on the gas system with approximate number of days of curtailment. The assessment of the impact that a gas curtailment could have on the LADWP and California ISO electric system is limited to summer 2016. Curtailment on the gas system at the volumes estimated in the studies will significantly impact the reliability of the electric system. The chart below shows the impact on the electric system with increasing depths of curtailment volume estimated by SoCalGas.

The four scenarios of gas curtailment, indicated in Table 4 above, are:

Scenario 1: If there is a difference of 150 MMcfd between scheduled gas and the actual gas demand, would translate into the 84 MMcf of curtailment on the gas system for the eight hour peak period (1 p.m. to 9 p.m.).
Scenario 2: If there is a difference of 150MMcfd, plus non-Aliso Canyon storage outage reducing gas supply by an additional 400 MMcfd, would translate into 84 to 224 MMcf of curtailment on the gas system for the eight hour peak period.
Scenario 3: If there is a difference of 150 MMcfd, plus pipeline outage reducing gas supply by an additional 500 MMcfd, would translate into about 224 to 280 MMcf of curtailment on the gas system for the eight hour peak period.
Scenario 4: If there is a difference of 150MMcfd, plus impact of coincident outages of both pipeline and non-Aliso Canyon storage reducing gas supply by the combined 900 MMcfd, resulting into 280 to 513 MMcf of curtailment on the gas system for the eight hour peak period.

[12] Minimum generation commitment and post-contingency generation are key drivers for gas usage and are necessary to avoid post-contingency load shed.

Table 6 shows the impact analysis of curtailment during the summer peak period from Hour Ending 14 to Hour Ending 21 (1:00 p.m. to 9:00 p.m.) (eight hours) as represented by September 9, 2015 and estimated by SoCalGas.

Table 6: Summary of Assessment of Electric Impact of Gas Curtailments for a typical summer day (September 9. 2015)

Row	Description	Formula	Gas Curtailment Scenario			
			Scenario 1: No Outage	Scenario 2: Storage Outage	Scenario 3: Pipeline Outage	Scenario 4: Overlap Outage
1	Original Curtailment for day - Volume by SCG (MMcfd)		180	480	600	1100
2	Number of Hours of Curtailment	8	8	8	8	8
3	**Curtailment Volume - During 8 hour Peak Period (MMcf for 8 hour)**	**(Row 1/24)*1.4*Row2**	**84**	**224**	**280**	**513**
4	Total ISO Balancing Area in SoCalGas system Gas Burn with minimum generation (MMcf)		659	659	659	659
5	Total LADWP Balancing Area Minimum Generation Burn (MMcf)		124	124	124	124
6	Combined ISO and LADWP Minimum Gen Gas Burn (MMcf)	Rows 4 + Row 5	**782**	**782**	**782**	**782**
7	Actual ISO SCG system September 9 Gas Burn (MMcf)		760	760	760	760
8	Actual LADWP September 9 Gas Burn (MMcf)		163	163	163	163
9	Combined Actual ISO And LADWP Gas Burns	Row 7 + Row 8	**923**	**923**	**923**	**923**
10	(ISO + LADWP) Actual Burns - Total Gas Curtailment (MMcf)	Row 9 - Row 3	839	699	643	409
11	**ISO + LADWP Gas Burn Short/Surplus (Delta) (MMcf)**	**Row 10 - Row 6**	**56**	**-84**	**-140**	**-373**
12	ISO LADWP Energy Conversion of Gas Burn Short for the day (MWh)	Row 11*103MWh/mmc	5,802	-8,618	-14,386	-38,420
13	ISO LADWP MW Conversion of Gas Burn Short per hour (MW)	Row 12/Row2	725	-1,077	-1,798	-4,802
14	Customer Impacted	Row 13*700	0	754,098	1,258,798	3,361,715
15	Estimated Days of Curtailment - Summer		2	2	9	3
16	**Total Aliso Withdrawal Needed for Summer for 8 hour peak period (MMcf) per scenario**		0	167	1257	1119

Analysis

California ISO and LADWP used September 9, 2015 as the summer peak load day on the electric generation system for the joint analysis. The minimum generation required for the California ISO to maintain electric transmission system reliability in the southern system would be about 659 MMcf for the eight hour peak period. Similarly, LADWP would need about 124 MMcf of gas to maintain reliability in LADWP's Balancing Authority for the eight hour peak period.

Assumptions for the Minimum Generation Peak Case: September 9, 2015 loading was used to study the impact of gas curtailment without Aliso Canyon Gas Storage. The summer case was built in way to study the minimum generation required in the Southern System to maintain electric system reliability. The fleet of resources dependent on gas operated by SoCalGas inside LA Basin and Southern System were kept at minimum to maintain reliability of the electric system. The assumptions include maximizing the transmission capability for imports into the Southern System while keeping the electric system reliable. The study assumes no contingency reserves (which are required to be maintained per NERC standard), and no planned or forced transmission or generation outages. The electric assessment study is not accounting for reserves. If the imported energy from outside the area or State is not available, additional gas would be need to dispatch generation to maintain contingency reserves to standard levels, manage approved planned or forced outages, relieve the transmission overloads, and provide contingency reserves or meet electric demand.

Results

The combined California ISO plus LADWP Balancing Authority would need about 782 MMcf of gas during the peak period to maintain reliability. These estimates are from power flow studies and might vary depending on the real – time conditions of the system. For the analysis, September 9 was selected because it was the peak load day in Southern California and Los Angeles Basin for 2015, with the highest gas burned for the electric generation system. Although September 9, 2015 was the peak day for 2015, it was not an all-time peak day but represents a typical high load summer day. The actual California ISO gas burned for September 9 for the entire SoCalGas fleet of resources was about 659 MMcf for the eight hour peak period. Similarly, LADWP had about 124 MMcf of gas burned for same 8 hour period. Based on the curtailment analysis, the allowable gas burn under each scenario for September 9, 2015 over the eight hour peak period would be the combined actual burns (California ISO plus LADWP Balancing Authorities) reduced by the curtailment volume (shown in the chart above). For the first scenario, the combined California ISO and LADWP Balancing Authorities gas burn was 923 MMcf for the eight hour peak period. With the curtailment volume of 84 MMcf, the allowable gas burn for the time period is about 839 MMcf (923 – 84). The difference between allowable gas burn of 930 MMcf and the gas burn needed to maintain the minimum generation would be the difference (either surplus or shortage) that California ISO plus LADWP can burn, in this scenario, it was 56 MMcf. If the difference is a positive, it would mean that California ISO and LADWP would have sufficient room to increase the energy produced by their gas resources up to the additional amount. If the difference is a negative, it would mean that California ISO and LADWP would be short of the gas needed to maintain electric reliability, if faced with

the gas curtailment by the amount indicated in Table 5. In these scenarios, the minimum generation levels could not be maintained, the California ISO and LADWP would have to declare an emergency and prepare to interrupt load to maintain electric system reliability and not cause cascading outages into a greater electric footprint. The load curtailment may mean using interruptible load but could result in utilities to call for rotating blackouts per emergency procedures. Row 12 and Row 13 explain the amount of electric load (megawatt hours (MWh) and MW) impacted during peak hours by the gas curtailment due to the four scenarios.

One MW of electric curtailment roughly equals enough electricity for the instantaneous demand of 700 homes at once. All the scenarios, except for the first scenario, with only a difference of 150MMcf between the scheduled gas and actual gas, would have a load curtailment of varying impact with as many as 3.36 million customer homes impacted without the Aliso Canyon gas storage facility. To avoid load curtailment on the electric system on the summer days estimated for gas curtailment, withdrawal of 2.5 Bcf from Aliso Canyon storage is needed. That 2.5 Bcf is the total gas requirement for only the eight hour peak period for summer electric reliability. There could be additional gas needed for off-peak periods and winter outage days. The 15Bcf of working gas available in the Aliso Canyon appears to be sufficient to meet the summer reliability needs so long as the gas withdrawal capability necessary is available when needed and is effectively managed to meet reliability. Until SoCalGas is allowed to inject into Aliso Canyon and use the cycling capabilities of the field, SoCalGas will work with the CPUC to establish guidelines for how the remaining 15 Bcf of inventory will be used from Aliso Canyon for gas and electric reliability. When there is a stressful event on the system, SoCalGas will use all its tools to to limit using the gas that is remaining in Aliso Canyon. SoCalGas will also work with the grid operators and noncore customers to relieve the stress on the system using tools available to them. If this does not adequately alleviate the gas system problem, SoCalGas will follow the pre-established CPUC guidelines on how to use the gas in Aliso Canyon to best ensure reliability and safety of the gas and electric system.

MITIGATION MEASURES

Mitigation measures are being developed by the action plan entities reduce, but not eliminate, the risk and impact of electricity service interruptions. The action plan entities and the Technical Assessment Group believe there are risks to electric reliability that these measures cannot eliminate.

APPENDIX A: Analysis of Summer Gas Curtailment June 30, 2015 to July 1, 2015

The California ISO completed on June 29th, its Integrated Forward market run for trade date June 30, 2015 and reported to the gas utilities the expected gas burn resulting from market awards to electric generators. As a result of the combination of a high load forecast, low level of imports into the California ISO, and low levels of hydroelectric generation, the market committed a large amount of gas fired generation in the LA Basin, resulting in a high demand for natural gas.

SoCalGas reviewed the estimated gas burn and contacted the California ISO to report that there would be a supply line issue with that level of gas burn[13]. With its Envoy information system showing a projected total projected natural gas demand for the day of 3.8 Bcf, SoCalGas posted a curtailment watch at approximately 8:15 a.m. on June 30, 2015. The notice warned that *"SoCalGas and SDG&E are projecting a high gas send out for the next several days that may affect service to noncore customers in some localized areas. Customers are advised that they may be receiving a notice to curtail service sometime later today or tomorrow."*

SoCalGas expanded the watch area at approximately 12:15 p.m. At 3 p.m., SoCalGas initiated an emergency localized curtailment for the Los Angeles Basin beginning at 3 p.m. on Tuesday, June 30, 2015 and continuing to 8 p.m. on July 1, 2015: *"Due to the heat wave currently facing the western US, both the natural gas and electric systems are experiencing high utilization, which has resulted in SoCalGas calling an emergency localized curtailment for the Los Angeles Basin service area beginning at 3 PM PCT today. Currently SoCalGas does not need to curtail other areas, but we anticipate that demand will peak today in Southern California from 3 PM to 8 PM. We are closely monitoring the situation and will provide updates on Envoy as more information becomes available."*

Table 7: Receipt Point Capacity Maximum versus Available June 30 Curtailment Day

Supply (MMcfd)	Maximum	June 30
California Line 85 Zone	160	86
California Coastal Zone	150	16
Wheeler Ridge Zone	765	771
Southern Zone	1,210	913
Northern Zone	1,590	852
Total Flowing Supply at Receipt Points	3,875	2,638
From Storage June 30		812
Demand Served June 30		3,424
Demand Served July 1		3,429

[13] California ISO Market Update Call Meeting Minutes July 9, 2015.

Several conditions contributed to the adverse operating conditions. Extreme hot weather in the Western U.S., and especially the entire West Coast, along with drought impacts that decreased availability of hydro-electric generation, created a significant demand for natural gas to fuel electric power plants. In addition, an outage to conduct required compliance testing on Line 4000, a SoCalGas transmission pipeline that brings natural gas from the California border to the Los Angeles Basin, reduced the natural gas delivery capacity available to meet this increased demand. The testing and remediation work on Line 4000 reduced capacity into SoCalGas' Northern Zone by: 1) 540 MMcfd in the Needles/Topock Area starting on June 3, 2015; 2) 200 MMcfd in the Needles/Topock Area starting on June 12, 2015; and 3) 150 MMcfd at the Kern RIver/Mojave – Kramer Junction receipt point starting on June 14, 2015.[14] These capacity reductions were scheduled to continue through most of the summer and were all in effect during the June 30/July 1 curtailment event. The combination of high demand with reduced capacity to meet that demand required SoCalGas to call the emergency localized curtailment in order to preserve their ability to meet the demands of higher priority core customers.[15]

The curtailment affected electric generation customers in the Los Angeles Basin, who received limited gas service during the curtailment. Both California ISO and LADWP were required to use less gas. They modified operations to meet electricity demand while generating less electricity within the curtailment zone.

On June 30, California ISO System Operations worked with SoCalGas to determine what level of generation could be supported in the Los Angeles Basin. The gas curtailment amount was converted to MWs and the California ISO applied a pro-rata curtailment percentage to all gas fired generation in the LA Basin. The California ISO was requested to reduce generation output up to 1,700 MW to reduce gas usage on a select set of units in the north and south Los Angeles Basin. The California ISO curtailed approximately 1,600 MW using exceptional dispatch to the following generating facilities in the Los Angeles Basin in response to SoCalGas' request for gas curtailments at various hours on June 30, 2015[16]:

Malberg Generating Station

Glen Arm Unit 1-4

Center peaker

Carson Cogeneration

Canyon Power Plant Unit 1-4

Anaheim Combustion Turbine

El Sungundo Energy Center Unit 5 - 8

[14] Real-time notice of the capacity reductions were posted on the Envoy™ system and later reported in response to the 24th Data Request from Southern California Generation Coalition in CPUC Application No. 13-12-013 by SDG&E and SoCalGas.
[15] SoCalGas submitted Advice No. 4827 on June 30, 2015 to notify the CPUC and affected parties of a curtailment event in its service territory.
[16] California ISO Draft 2015/2016 Transmission Plan.

El Segundo Generating Station Unit 4
Harbor Cogen Combined Cycle
Hinson Long Beach Unit 1-2
Alamitos Generating Station Unit 1-4
Alamitos Generating Station Unit 5-6
Barre Peaker
Huntington Beach Unit 1-2
Redondo Generating Station Unit 5-8
Watson Cogeneration Company.

In addition to the generation curtailments mentioned above, the California ISO told market participants in its peak day conference call that morning that it had or would be taking the following additional steps:

Declare a Stage 1 Energy Emergency.
Deciding whether or not to issue a Flex Alert notice at about 10 a.m.
Expect to call baseload interruptible programs "very likely" throughout the Balancing Area
The California ISO and LADWP outage management teams will be meeting to coordinate outage issues for tomorrow to help avoid further problems.

The California ISO issued a Flex Alert urging voluntary conservation. SCE implemented approximately 400 MW of demand response. Most of this was obtained from its AC cycling program.

The following table provides a summary of the aggregated MW output and estimated total gas volume usage (in million standard cubic fed per hour - MMcfh) for California ISO generating facilities in the Los Angeles Basin and San Diego areas.

Table 8 Summary of Existing Generating Facilities Maximum Output and Estimated Total Gas Volume Usage in the LA Basin and San Diego Areas

	Gas Transmission Zone	Aggregated Generation Output (MW)	Estimated Total Gas Volume Usage (MMcfh)[117]
1	South of Moreno/SDG&E	2,997	27.35
2	South of Moreno / SCE	742	6.75
3	West of Moreno	748	6.8
4	East of Moreno	1,425	12.95
5	North of LA Basin	384	3.49

6	South of LA Basin	5,798	52.71
7	Northern Gas Transmission Zone	1,937	17.61

LADWP also bore a portion of the gas outage. In implementing the gas curtailment, SoCalGas asked LADWP what was the minimum quantity of natural gas that was needed. LADWP, at the time was experiencing an outage of its own at its coal-fired Intermountain generating station in Utah. It asked SoCalGas how much gas it could have. The result was a split of roughly 75 percent of the June 30 gas curtailment going to generators within the California ISO balancing authority and 25 percent going to LADWP.[17] LADWP curtailed about 500 MW of generation. On July 1, LADWP was asked to consume no more than what the hourly burn had been on June 30. LADWP's daily gas burn was approximately 190 MMcfd, on both days, which it was able to accommodate on the second day only because temperatures were lower on the second day, reducing electricity demand slightly.[18]

The sequence of phone calls and requests leads to LADWP stating that the curtailment rules are not clear as they do not specify what the curtailment would be based on or how it would be spread among gas fired generators. Also, the curtailment notice was given at 3 p.m., after the day-ahead wholesale market closed at 10 a.m. Once the day-ahead wholesale market is closed, the only option remaining is to purchase make up electricity in real-time markets. However, LADWP was unable to purchase energy in the real-time wholesale market at any price on July 1. By July 2 demand eased to levels within SoCalGas' system capability and the gas curtailment ended.

In ending the episode, SoCalGas modified the schedule to remediate Line 4000, moving a portion of the work to October. This pushed the work out of potentially high demand days during the summer but still allowed the pipeline work to be completed before start of the higher gas demand winter season. With Line 4000 restored and more moderate weather, Southern California avoided further gas curtailments and impacts to electric generation for the rest of the summer.

A review of this recent curtailment event highlights that stress conditions on the gas system can occur, resulting in gas curtailments, even with Aliso Canyon in operation.

[17] SoCalGas reports that California ISO accounts for approximately 75 percent of the electric generation demand on the SoCalGas/SDG&E system. SoCalGas 2015 Customer Forum, Sixth Annual Report of System Reliability Issues, page 3.

[18] LADWP reported 198,451 British Thermal units (MMbtu) for June 30 and 197,907 MMbtu for July 1, which were converted to MMcfd at a heating value conversion of 1.035 MMBtu per thousand cubic feet (MCF).

(END OF ATTACHMENT 1)

ATTACHMENT 2

California Public Utilities Commission

Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability

Revised Report – Public Utilities Code Section 715

Energy Division

1/17/2017

Table of Contents

Introduction 1
Statutorily Required Determinations 3
Background 6
Current Situation 7
Winter and Summer Reliability 8
Winter Reliability 8
Peak Day Demand 9
Aliso Inventory Requirement for Winter Peak Day Demand 10
Balancing 10
Summer Reliability 14
Impact of Tighter Non-Core Balancing 15
Production Capacity 15
Wells Necessary to Support Production and Injection Capacity 16
Production/Withdrawal 16
Injection 16

Introduction

Public Utilities Code (PU Code) Section 715 requires the California Public Utilities Commission (CPUC) to publish a report assessing the need for natural gas from the Aliso Canyon storage facility to meet the region's natural gas and electricity demand. Specifically, the statute requires the CPUC to determine:

The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at a just and reasonable rates in California;
The amount of natural gas production at the facility needed to meet safety and reliability requirements;
The number of wells and associated injection and production capacity required; and
The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation.

On June 28, 2016, the CPUC issued the report required by PU Code Section 715. The report was based on working conditions of the field at the time and the fact that new injections would likely be prohibited over the course of the summer. The report acknowledged that it would need to be update in the future as conditions in the field changed. This update to the report addresses near-term winter and summer seasons based on the existing conditions of both the Aliso facility and the Southern California Gas Company (SoCalGas) system.[1] These conditions are likely to change over time depending on operational capabilities of wells in the field, SoCalGas' ability to inject into the field, and the effectiveness of mitigation measures. Additionally, the impact of new regulations concerning storage fields will potentially limit, at least in the short term, the ability of other SoCalGas storage facilities to absorb any shortfalls due to conditions at Aliso. These changing conditions will require the CPUC to further update this report in the future.

The determination of whether and how the storage facility will be used over the long term will be the subject of a CPUC proceeding, which by statute must begin no later than July 1, 2017.

As written, the statute requires the four determinations to be made independent of each other. That is, the determination of the amount of inventory necessary for reliability in determination 1 is to be identified independently of whether there is sufficient injection and production capacity. However, these factors are interrelated. For example, since withdrawal rates increase with higher pressure, fewer wells are needed to achieve a specific production rate when the volume of gas in the facility is increased.

[1] For planning purposes SoCalGas defines winter as beginning on November 1 and ending on March 31. Summer begins April 1 and ends on October 31.

This report endeavors to make the statutorily required determinations based on current conditions, while acknowledging that a variety of combinations of inventory, capacity, and wells could address the identified reliability needs. Additionally injections into the field are currently prohibited and even if injections were authorized this winter a fairly minimal volume of gas could be injected into the field to impact winter reliability; the report must take this limitation into account.

The report and its findings are based on the Aliso Canyon Risk Assessment Technical Report dated April 4, 2016, that addressed summer reliability risks, and the Aliso Canyon Winter Risk Assessment Technical Report dated August 23, 2016. These reports were prepared by the CPUC, the California Energy Commission (CEC), the California Independent System Operator (CAISO), and the Los Angeles Department of Water and Power (LADWP), and the reports were independently reviewed by Los Alamos National Lab and other outside experts.[2] SoCalGas also participated in the preparation of the two technical assessments.

This report also considers:

The methodology and revised tables that form the monthly gas balance and storage simulation that was prepared by the California Energy Commission and incorporated in the Aliso Canyon Gas and Electric Reliability Winter Action Plan (Winter Action Plan);3
Forecasted gas demand information provided by SoCalGas for the 2016 California Gas Report (CGR);4
Publicly available data including information posted on the Sempra Envoy website (https://scgenvoy.sempra.com), which provides historical daily operating information including information on sendout and receipts and storage injections and withdrawals; and

[2] These two reports have undergone an independent review by the Los Alamos National Lab and Walker & Associates (Independent Review of Hydraulic Modeling for Aliso Canyon Risk Assessment. Walker & Associates Consultancy, Los Alamos National Laboratory. August 19, 2016). The review noted that the modeling used in the technical assessments is consistent methodologically with industry practice. Further the review noted that the modeling produced reasonable outcomes and that the SoCalGas capacity estimates used are appropriate.

[3] Aliso Canyon Gas and Electric Reliability Winter Action Plan. California Public Utilities Commission, California Energy Commission, the California Independent System Operator and the Los Angeles Department of Water and Power. August 22, 2016. The gas balance and storage simulation examines supply and demand over the course of the winter and considers system wide needs and their impact on Aliso. The gas balance analysis was prepared by the California Energy Commission (CEC) independent of SoCalGas. The analysis included herein relies on the balance analysis in the August 22, 2016, Winter Action Plan, as modified by the CPUC and CEC and updated to reflect current information.

[4] 2016 California Gas Report. Southern California Gas Company, Pacific Gas and Electric Company, San Diego Gas & Electric Company, Southwest Gas Corporation City of Long Beach Gas & Oil Department, Southern California Edison Company.

- Additional data provided by SoCalGas in response to CPUC data requests.

Statutorily Required Determinations

Consistent with SB 380, the CPUC has a statutory requirement to make four determinations concerning the Aliso Canyon storage facility prior to the approval of injections. These determinations are summarized below; the background and analysis supporting these determinations are provided later in this report.

The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates in California:

The CPUC has determined that 29.7 Bcf of inventory at the Aliso Canyon Storage Field is necessary for SoCalGas to maintain safe and reliable service, limited by the mandated maximum safe operating pressure as specified by Division of Oil Gas and Geothermal Resources (DOGGR). As seasonal demand declines the inventory may be appropriately drawn down if necessary but should be maintained with a range that is managed to remain above 15.4 Bcf at the low and managed to target 29.7 Bcf. Managing the facility in this manner is estimated to address safety and reliability needs and will provide flexibility to respond to gas market conditions to support just and reasonable rates.

The 29.7 Bcf inventory level cannot be achieved for the much of the 2016/17 winter season. This reflects the injection rates for the wells available (as discussed in Determinations #3 and #4 below) and the fact that a portion of the 2016/17 winter season will already have passed by the time that injections could begin. However, mid-season injections that increase the amount of working gas and the field production rates for the remainder of the winter season will contribute to improved safe and reliable service for winter gas demands.

Storage has historically been used as a means of hedging against both seasonal differences in natural gas prices and short-term spikes in prices resulting from pipeline constraints or extreme weather events. Purchasing natural gas in times of year when it is inexpensive reduces the need for the utility and noncore users to purchase gas at peak-demand times when it can be significantly more expensive. Consequently, complying with the statutory requirement to maintain just and reasonable rates, suggests that at times storage inventories may need to be kept at levels above what is needed strictly for reliability. However, natural gas production in North America is at historic highs, resulting in low wholesale prices and minimal differentials between off

season and on season prices. So while future updates to this report may need to account for storage's ability to ensure just and reasonable rates, storage inventories in Aliso Canyon in 2017 will likely have little impact on rates in the current gas supply environment.[5]

The amount of natural gas production at the facility needed to meet safety and reliability requirements:

To meet reliability requirements, the CPUC estimates that SoCalGas needs to provide .839 Bcf per day (Bcfd) of production (withdrawal capacity) to meet winter peak-day needs, which are typically at their maximum in the month of January. A production level of .906 Bcfd is required to meet peak summer demand. As indicated below, this level of production is not currently available.

The number of wells and associated production and injection capacity required:

Using estimates based on current plans, a total of 66 wells producing at estimated withdrawal levels equivalent to production rates at a 29.7 Bcf inventory are needed to meet the highest production/withdrawal rate, which is the summer peak-day need of .906 Bcfd. There is no significant difference (65 vs. 66) in the number of wells estimated as necessary to serve the winter peak of .839 Bcfd. These numbers incorporate anticipated well reliability rates and losses due to mitigation measures underway in the 'West Field' at Aliso.[6] It is noted that wells not yet brought into service may not perform at the same level estimated for wells included in current plans.

Based on current estimates, a level of 66 wells may not be achieved until the fourth quarter of 2017.

Using estimated injection rates and the 31 wells that are expected to be available the beginning of January, it would take approximately eight weeks [7] to

[5] A review of historical rates charged by SoCalGas and relative to peer companies used by SoCalGas Gas Acquisition indicate that rates have remained largely stable and even decreased and there has been no discernible change in SoCalGas rates relative to those of the peer companies. Note: Peer company comparisons are reviewed for relative position evaluation only and are not intended to be used for rate-to-rate comparison purposes.

[6] The western part of the field is currently limited to one well making access to gas in this part of the field limited and reducing the overall withdrawal capacity of the field.

[7] Using information from SoCalGas, an injection rate of 250 MMcfd for 30 days then improving to 300 MMcfd was calculated to require approximately 8 weeks. At more optimistic rates of 300 to 350 each day and adding 6 wells over the period, the inventory level could potentially be achieved in six weeks. Note: the fact that the wells may be available does not presuppose that injection will have been approved at the beginning of January.

increase the current inventory of 14.9 Bcf to the 29.7 Bcf working range identified in Determination #1.

The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation:

There are currently 29 wells that have completed the required testing and remediation and are available for service. SoCalGas indicates that this number will increase to 31 in January of 2017. SoCalGas' intent is to continue having DOGGER test wells that have currently been isolated. For those wells that have passed DOGGER tests, SoCalGas will complete any remediation needed and then wells will become available for service.
However, it is noted that a significant number of wells may need to be plugged and abandoned. Based on SoCalGas estimates and considering wells that may need to be plugged and abandoned the number of wells available may increase by as few as four wells per month.

Assuming that on average an additional 4 wells can be returned to service per month it will take a minimum of 9 months to add the 35 wells necessary to reach a total of 66 operating wells. Under the most optimistic production rates presented in Determination #3 66 wells are required to reach the withdrawal rates necessary to meet winter peak day production.

In summary, the current number of wells available, even assuming optimistic production rates, is not sufficient to assure reliability in the short term. As additional wells are tested and brought into service and with improved withdrawal rates, capacity requirements should, under current estimates, be able to be met; however, the timing is such that there will not be enough completed wells for the 2016/17 winter season nor will there be sufficient wells available to meet a peak summer day demand.

To summarize the interdependence of these determinations, Determination #1 above accurately states the inventory level required, but as indicated in Determination #4 there currently are not enough wells to support the production required for reliability at their current withdrawal rates. However, increasing the amount of inventory beyond the amount identified for working gas volume needs in Determination #1 would increase the withdrawal capacity of each well, which would reduce the number of wells required to achieve the withdrawal rates needed for reliability purposes.

Background

In response to a gas leak at Aliso Canyon, on January 21, 2016, the CPUC ordered SoCalGas to continue to withdraw gas from Aliso Canyon until the facility reached an inventory level of 15 Bcf.[8] The withdrawals were ordered to reduce the pressure in the field thereby lowering the rate at which gas leaked and facilitating efforts to stop the leak. Based on then current conditions, 15 Bcf was identified as necessary to provide sufficient supply to meet reliability risks through the end of the 2015/16 winter season, meet summer reliability risks, and maintain sufficient pressure in the field to support adequate withdrawal capacity rates.[9] Due to a mild end to the 2015/16 winter, a mild summer, coordination between the balancing authorities and SoCalGas, and the implementation and effectiveness of a number of mitigation measures developed by the energy agencies,[10] no material withdrawals were made during the summer. The inventory remains slightly below 15 Bcf (specifically, at 14.9 Bcf).[11]

At the time SoCalGas was ordered to reduce Aliso inventory to 15 Bcf, it was anticipated that no gas injections would be made at Aliso until the facility was determined to be safe for operation including ongoing injections and withdrawals of inventory. This anticipated limitation on injections was later codified in Senate Bill (SB) 380 signed by the Governor on May 10, 2016. SB 380 placed a moratorium on injections into the field pending each well passing a series of well safety tests or being isolated or taken out of service. Injections cannot be resumed until this process is completed and the entire field has been determined to be safe for operations. This determination is to be made by the DOGGR, and the CPUC's Executive Director must concur with DOGGR's determination.[12]

Letter from Executive Director, California Public Utilities Commission Timothy Sullivan to Jimmie Cho, Senior Vice President, Southern California Gas Company, "Aliso Canyon Draw Down Levels," January 21, 2016.

The Preliminary Staff Analysis, February 16, 2016, prepared by the Energy Division of the California Public Utilities Commission provides a discussion of the determination of the 15 Bcf inventory level.

[10] Aliso Canyon Action Plan to Preserve Gas and Electric Reliability for the Los Angeles Basin. California Public Utilities Commission, California Energy Commission, California Independent System Operator, Los Angeles Department of Water and Power. April 5, 2016, p. 24.

[11] On August 1, 2016, in response to a request from SoCalGas, the CPUC authorized withdrawals from Aliso Canyon for the purpose of flow testing. The testing provided information that allowed SoCalGas to determine the number of wells that should be kept available for withdrawal in order to meet reliability standards. The tests reduced the inventory by a nominal amount. Authorization to Perform Flow Testing on Specified Wells at Aliso Canyon Storage Facilities. Letter from Timothy Sullivan, Executive Director, CPUC. August 1, 2016.

[12] DOGGR oversees the drilling, operation, maintenance, and plugging and abandonment of oil, natural gas, and geothermal wells.

As required by SB 380, the CPUC issued its preliminary report addressing the 2016 summer gas season on June 28, 2016. This revised report determines the needed gas ranges for reliability purposes for both winter and summer seasons based on the existing conditions of both the Aliso facility and the SoCalGas system, recognizing that conditions are likely to change overtime requiring further updates of this report.

Current Situation

Twenty-nine Aliso wells have successfully completed DOGGR testing.[13] The remaining wells have been isolated from the field. Having completed these steps, on November 1, 2016, SoCalGas requested authorization to resume injections at Aliso Canyon.[14] That request initiated the review and inspection of the field; at a point in the future, a public meeting will be held and a decision will be made about whether the storage field can be operated safely.

Authorization to inject would allow both withdrawing gas from and injecting gas into the field and for Aliso to be used to support operations and manage reliability. However, there is significant uncertainty concerning both injection and withdrawal capacity and the amount of inventory achievable over the short term at Aliso. That uncertainty reflects questions concerning the performance of the wells using tubing only as required by SB 380 rules (vs. flowing gas through tubing and casing) and the performance of the field as pressure increases with injections.

Further, the injection season for winter reliability traditionally ends at the end of October. As winter progresses the opportunity to inject will compete with the need to withdraw to meet winter demand. In order to build inventory at Aliso, SoCalGas will need to rely on its other three storage fields for withdrawals as injections are made into Aliso. At times demand may require that all fields be used for withdrawal providing very limited or no opportunity for injections.

Additionally, as winter demand in California and nationwide begins to build, competition for gas will limit the availability and/or increase the cost of gas for injection. Under certain winter circumstances all available gas that can be brought into the system will need to be

[13] The actual number of wells is subject to change. Additional wells may be approved and made available for service (pending the DOGGR/CPUC certification that the field is safe for use) in the near term and a well may be taken out of service if issues are identified. Information concerning the number of wells and their status is current as of 11/4/16. It is anticipated that additional wells will go through testing and, if approved, be incorporated into use pending the certification that the field is safe for use.

[14] Letter from Rodger R. Schwecke (Vice President, Gas Transmission and Storage, SoCalGas) to both Kenneth A. Harris Jr. (State Oil and Gas Supervisor, Division of Oil, Gas, and Geothermal Resources) and Timothy Sullivan (Executive Director, California Public Utilities Commission), "Safety Review for Underground Gas Storage Facilities at Aliso Canyon," November 1, 2016.

dedicated to serving current demand, and none will be available for injection. Under more extreme winter conditions, gas flows into the system may not be available in the amounts needed to meet demand. Under these conditions, storage including Aliso has historically been used to offset the resulting shortfalls in flowing supplies.

Given the uncertainties noted above, the inventory level and availability of wells needed to support necessary withdrawals indicated in this report are subject to change as conditions change and new information becomes available.

Winter and Summer Reliability

The following sections present winter and summer risks and the level of inventory necessary at Aliso Canyon in order to address these risks.

Winter Reliability

The critical role of the Aliso Canyon storage facility is expressed in the independent review conducted by the Los Alamos National Laboratory and Walker & Associates. The report states:

"The most critical concern for the winter season is the availability of the reserve in the Aliso Canyon storage facility. Using the gas stored in Aliso Canyon is very important to reducing the risk of gas curtailments and electrical service interruption this coming winter. Because in the past the Aliso Canyon facility has provided a large reserve supply of gas in the winter, SoCalGas was previously able to supply the LA Basin with that supply while servicing areas outside of the LA Basin with flowing supplies from pipeline interconnections. Without this reserve available, SoCalGas will have to choose whether to maintain service to their peripheral customers or supply those within the basin."[15]

As explained below in more detail, an Aliso inventory level of 29.7 Bcf is necessary for winter reliability and should be managed around this level, although the level can drop to as low as 15.4 Bcf at the end of the winter season. This 29.7 Bcf inventory level is needed to meet 1-in-10 peak-day demand, maintain a gas balance across the entire SoCalGas system during the winter season and provide a reasonable level of system wide storage at the beginning of the summer season.

A number of mitigation measures from the Summer Action Plan are continuing through the winter, and new measures for the winter also have been implemented. However, while the impact of some summer measures can be taken into account when addressing summer

[15] Op. cit., Independent Review of Hydraulic Modeling for Aliso Canyon Risk Assessment. p. 16.

reliability, there is no data yet indicating whether and to what extent the existing and new measures will impact winter demand.

Peak Day Demand

To serve its core and noncore customers during winter, SoCalGas must be able to meet a 1-in-10 year peak-day demand.[16] That peak-day demand is largely driven by weather and the weather's impact on the various customer end uses.

Under existing conditions, and considering current outages and historic receipt utilization that are expected to last into the winter season, the Aliso Canyon Winter Risk Assessment Technical Report (Winter Technical Assessment) determined that SoCalGas could support a gas demand of 4.1 Bcfd without the use of Aliso Canyon. Anything exceeding this level of demand would require curtailment of gas to electric generators.[17] The balancing authorities —the CAISO and LADWP—determined through a joint power-flow study that electric reliability could be satisfied for 1-in10 year winter peak electric load conditions with a minimum gas burn of 96 MMcfd by electric generation in the SoCalGas/SDG&E service territories (required to meet a defined level of risk; i.e., N-1) associated with the "next worst single contingency" and to as low as 22 MMcfd under normal pre-contingency conditions and the ability to import generation into the LA Basin.[18] These lower levels could be managed by resupply options. Resupply will require efforts to re-dispatch to other energy resources including gas-fired generation served by providers other than SoCalGas. These resources are limited to imports or other uncommitted gas resources.[19] However, if demand of 4.1 Bcfd cannot be supported, further curtailments of gas to electric generators

[16] Core customers are made up of residential homes, small commercial buildings and operations, and small industrial customers. Core customers represent over 95% of SoCalGas customers. During the winter they typically represent approximately 60% of peak gas demand. Noncore customers consist of large industrial and commercial customers including electric generators (power plants), hospitals, and oil refineries. During the winter noncore electric generation customers represent approximately 20% of peak gas demand and other noncore the remaining 20%.

[17] SoCalGas Rule No. 23 defines the process and service priority in the event of a curtailment. During the winter up to 60% of dispatchable electric generation (eg) is first curtailed and up to 40% for the summer. Following eg curtailment up to 100% of non-eg noncore customers are next to be curtailed (with the exception that refineries will not be curtailed below a defined minimum usage requirements). The next step curtails any remaining refinery load and eg not already curtailed. This if followed by remaining, smaller demand, noncore customers and then ultimately core customers.

[18] Aliso Canyon Winter Risk Assessment Technical Report dated August 23, 2016, "Summary of Electric Filings" p. 31.

[19] Aliso Canyon Winter Risk Assessment Technical Report. California Public Utilities Commission, California Energy Commission, the California Independent System Operator, the Los Angeles Department of Water and Power and Southern California Gas Company, August 23, 2016. P. 38.

would be required and these would likely require curtailment of electric load without the use of Aliso Canyon.

For the winter season the forecast peak day to meet both core and noncore demand as determined in the SoCalGas Triennial Cost Allocation Proceeding[20] (TCAP) reaches a high of 5.293 Bcf. However, a lower winter peak-day demand based on an updated demand forecast is provided in SoCalGas' most recent 2016 California Gas Report. At its highest, this newer peak demand level is forecast to be 4.939 Bcf. The lower level is based on a decline in winter electric generation demand resulting from an increase in renewable energy sources and replacement of older gas generation with new, more efficient generation. Consequently, the CPUC considers this lower demand to be sustainable over time, and as such this lower demand level is used in this reliability analysis instead of the values from the TCAP analysis that were used in the previous version of this report.

The minimum inventory at Aliso Canyon necessary to support the forecast January peak demand of 4.939 Bcfd is 29.4 Bcf.

After January, the forecast peak day declines and the inventory level could proportionately decline. The level of inventory needed in Aliso to support peak-day demand for each of the months is shown below. The highest peak month amount is used as the determining amount.

Aliso Inventory Requirement for Winter Peak Day Demand

Table 1 Most Recent demand forecasts based on 2016 CGR data[21]

Month	Peak Demand	Withdrawal Need	Aliso Inventory*
January	4.939 Bcf.	.839 Bcf	29.4 Bcf
February	4.653 Bcf.	.553 Bcf	20.9 Bcf
March	4.428 Bcf.	.328 Bcf	15.4 Bcf

*Inventory necessary to provide sufficient pressure to support indicated Withdrawal Need

Balancing

The peak-day demand and the hydraulic analysis used in the Winter Technical Assessment is focused on the need to serve load on a given peak day. However, it does not consider the demand supply requirements over the course of the winter season and the role that Aliso

[20] SoCalGas and San Diego Gas and Electric filed Application (A.) 14-12-017 to open the proceeding.

[21] Peak demand amounts are based on *CGR* assumptions, data, and calculation methodology but are not currently included in the 2016 report. A higher rate of inventory, 29.7 BCF is required to meet summer peak day demand and discussed later in this report.

storage plays in meeting those needs. To address this issue, the Aliso Canyon Gas and Electric Winter Action Plan (Winter Action Plan) incorporated a "balance analysis" conducted by the California Energy Commission (CEC). As described in the Winter Action Plan, the gas balance analysis provides a calculation of the margin/difference between demand and gas supply each month. The Winter Action Plan notes that a gas balance "is a standard utility planning tool that simply compares supply . . . to demand to see if all demand can be served."[22] The analysis covers the entire winter season as well as the remainder of the year. As stated in the Winter Action Plan, "Looking across the entire year allows modeling of total monthly injections and withdrawals for their impact to monthly inventory levels."[23] As noted in the Winter Action Plan the balance analysis looks at periods longer than a single day. The analysis "cannot assess the impact of intraday events or calculate operating line pressures."[24] However, the balance analysis does compare supply to demand to see how much excess (or shortfall) may exist. As such, it provides an initial indication of potential curtailments and their magnitude. It also allows simulation of the resulting month-end and season-end storage inventory.

As indicated in the following paragraphs and table, the inventory necessary for winter peak-day demand is above what is needed on an average monthly basis as shown in the balance analysis. As such, the inventory needed for winter peak days addresses the needs identified in the balance analysis and represents the inventory necessary for reliability.

The balance analysis identifies the difference between demand and required supply in millions of cubic feet (MMcf) and this difference is also expressed as a "reserve margin," i.e., the percent by which supply available through the system exceeds or falls below the demand. It also provides an indication in percentage terms of how much supply can be lost, for example due to outages or supply shortfalls, while still serving demand. [25] There is no explicit reserve margin requirement. The balance analysis in the Winter Action Plan generally raises concerns when the reserve margins drop below 10%. The reserve margin recognizes that the balance analysis is based on an average day around which there can be a significant range above or below that average depending on exact conditions. It is worth noting that since the balance analysis is based on conditions over the period of a month the

[22] Aliso Canyon Gas and Electric Reliability Winter Action Plan. California Public Utilities Commission, California Independent System Operator, California Energy Commission and the Los Angeles Department of Water and Power, August 22, 2016. p. 27.

[23] Ibid. p.27.

[24] Ibid. p. 13.

[25] See Table 2 Winter Balance Analysis. For example, in Table 2 where supply is 3225 and demand is 2530, the reserve margin is 27%. Supply-Demand = Difference and Difference/Supply = Reserve: (3223 – 2530 = 695) and 695/3225 (the supply) = 27%.

reserve of 10% is not necessarily sufficient to cover all peak day conditions (however, these conditions have been considered in our prior discussion of peak-day demand).

The balance analysis in the Winter Action Plan determines results under normal and cold weather conditions. For the purposes of this report a revised analysis was conducted based on a cold weather/dry hydro year winter scenario (1-in-35 year cold temperatures and a 1-in-10 year with low hydroelectric output).[26] The new analysis was adjusted from the Winter Action Plan to consider updated conditions and to reflect more accurately end-of-season inventory levels across the system. The results, shown in the following table, indicate that an inventory level of 21 Bcf is needed to maintain a reasonable reserve margin. However, the reserve margin that can be achieved is less than a desired 10% margin for most of the winter period, November through February. While these lower margins are concerning, mitigation measures carried over from summer and new winter measures are likely to reduce demand and result in a higher reserve margin. It should be noted however that the winter impact of the mitigation measures is not known nor can it be reasonably determined.

The balance analysis indicates that, with injections as below, combining the end of March Aliso inventory of 15.6 Bcf with what would remain in SoCalGas' other non-Aliso storage facilities results in a system wide inventory of 24.7 Bcf. A system-wide inventory level at the beginning of summer of 24.7 Bcf is below the average SoCalGas system wide beginning summer storage inventory of 66 Bcf experienced over the last ten years but above the low beginning of summer inventory of 23.8 Bcf in 2014. The balance analysis for the winter months is shown on the following Table 2.

[26] Under the analyses presented in the Winter Action Plan there is only a small difference, 1.2 Bcf, between levels of demand over the course of a 'normal temperature' versus the cold/dry winter scenario.

Table 2 Winter Balance Analysis

	End Summer	Winter Months Nov-Mar				
	Oct	NOV*	DEC	JAN	FEB	MAR
DEMAND						
Demand Total(MMcfd)	2530	2944	3563	3440	3372	2918
Non Aliso InJ	0	110	0	0	0	0
Aliso Inj	0	0	187	100	0	0
Total Injection	0	110	187	100	0	0
Total System Throughput	2530	3054	3750	3540	3372	2918
SUPPLY						
Pipeline	3225	3225	3225	3225	3225	3225
Storage Withdrawal						
Non Aliso	0	0	700	425	155	0
Aliso	0	0		50	180	0
Total	0	0	700	475	335	0
TOTAL SUPPLY	3225	3225	3925	3700	3560	3225
BALANCE	695	171	175	160	188	307
RESERVE MRG	27%	6%	5%	5%	6%	11%
STORAGE Bcf						
Non Aliso	45	48.3	26.6	13.425	9.1	9.1
ALISO INVENORY	15	15.0	19.9	21.0	15.6	15.6
TOTAL STORAGE INVENTORY	60	63.3	46.462	34.387	24.647	24.647

*Injections and November inventory based on 11.17.16 actual and forecast Sempra Envoy posting

As noted previously the 21 Bcf shown as the resulting inventory needed for January is below the amount of withdrawal needed to meet peak day demand. Therefore, the higher peak demand levels identified in this report, rather than the gas balance analysis, define the inventory levels necessary to provide safe and reliable service. The balance analysis

confirms that monthly demand levels are adequately met by the peak day driven inventory levels previously identified.

Summer Reliability

During the winter months Aliso plays a role both in managing peak winter day demand and overall system balancing. During the summer months, total system demand decreases dramatically and the most essential function of Aliso is meeting peak day summer demand — and in particular rapid ramps in demand—to serve electric generation in the Los Angeles Basin. In addition to this primary summer function, Aliso may also be required to address system-wide problems due to unexpected outages on either the gas or the electric system. Full explanations of the dynamics of summer supply, demand, and the operation of the SoCalGas system under summer conditions is presented in the Aliso Canyon Action Plan to Preserve Gas and Electric Reliability for the Los Angeles Basin, April 5, 2016 (Summer Action Plan) and the Aliso Canyon Risk Assessment Technical Report April 4, 2016 (Summer Technical Assessment) and are not replicated here.

Aliso's role in addressing peak summer days was identified in the Summer Technical Assessment. The assessment described the risk using four scenarios. Scenario 4 presents the worst case which combines the impact of a high demand day, a shortfall of 150 MMcf in supply versus forecast demand, and two overlapping outages.[27] Similar to the winter analysis, the scenarios were considered in light of the ability to manage electric demand without access to Aliso withdrawals such that electric load would not need to be curtailed. The analysis indicated that Scenario 1 could be managed without the use of Aliso. However the remaining three scenarios could not be managed without the use of Aliso. By default, the capability to solve for Scenario 4 allows for solving the remaining conditions of concern, Scenario 2 and Scenario 3, so from a reliability perspective, Scenario 4 represents the controlling scenario.[28]

Scenario 4 begins with an original curtailment of 1.1 Bcf. After the balancing agencies (the CAISO and LADWP) take all available actions a short fall remains. The scenario is based on a peaking demand for an eight-hour period resulting in a curtailment. During this eight-hour period demand is calculated to be 1.4 times the average, off-peak hourly rate. Meeting this level of demand in each of the eight peaking hours requires a daily capacity withdrawal

[27] Aliso Canyon Risk Assessment Technical Report. California Public Utilities Commission, California Energy Commission, the California Independent System Operator, the Los Angeles Department of Water and Power, and Southern California Gas Company, April 4, 2016. pp. 49 – 51.

[28] The preliminary report of June 28, 2016, was completed before the implementation of tighter balancing rules and as a result does not account for the impact of tighter balancing rules. Without the balancing rules, given the inventory in the field, Scenario 4 could not be solved. This report considers the impact of balancing rules on summer reliability.

rate of 1.119 Bcfd. To generate this level of withdrawal, an Aliso working gas inventory of 22.4 Bcf would be required.[29]

Impact of Tighter Non-Core Balancing

A key summer mitigation measure was to tighten the mismatch between the amount of gas that noncore customers use and the amount they bring in on a given day. Traditionally, the availability of significant storage allowed for considerable flexibility in meeting the mismatch using storage assets. Without the use of Aliso that flexibility is significantly decreased. Operating experience suggests that tightened balancing can eliminate a mismatch during the summer of 150 MMcf. [30] Eliminating this mismatch (essentially increasing supply by 150 MMcf) directly reduces the amount of the original curtailment identified in the four Summer Technical Assessment scenarios. Accounting for the reduction allows Scenario 2 to be solved without the use of Aliso. It also reduces the amount needed to solve for Scenario 4, and by default, Scenario 3.

Applying the 150 MMcf reduction to Scenario 4 results in lowering the withdrawal rate requirement from 1.119 Bcfd to .906 Bcfd. This lower withdrawal rate requirement reduces the inventory needed at Aliso from 35 Bcf to 29.7 Bcf. With the potential to re-inject during the summer season SoCalGas should be able, using the 31 approved wells (which number will likely increase before summer), to maintain this level.

Production Capacity

The range of inventory to which Aliso Canyon should be managed is defined by the production capacity required for reliability. As indicated above and assuming reasonably expected flowing supply, the key drivers of winter reliability are the ability to withdraw for a peak winter day and to supply the system with sufficient gas to balance. That demand level is supported by an inventory level of 29.4 Bcf. That inventory and the resulting production rate can decrease consistent with the range of inventory indicated in

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[29] The Preliminary Staff Analysis of February 2016 identified that 15 Bcf would be sufficient to meet demand through the summer *except* for days when gas-fired electric generation in the LA Basin requires withdrawals at a rate in excess of .888 Bcfd. On those days, a requirement for any part of the day that gas be withdrawn from Aliso at a withdrawal rate greater than .888 will not be met. (see Preliminary Staff Analysis, California Public Utilities Commission, Energy Division. February 16, 2016. p. 40.). The Aliso Canyon Technical Report of April 2016 identified a required withdrawal rate in excess of ,888. A rate of 1.119 Bcfd was determined as necessary to meet an identified risk presented in Scenario 4 (scenarios 2 and 3 could potentially be addressed at the 15 Bcf inventory level. The above analysis targets an inventory level that will solve for Scenario 4 taking into account the effectiveness of tighter summer balancing rules.

[30] As indicated in the section discussing winter this measure is continued into winter. However, given different demand levels and the source of demand the amount for summer is not necessarily applicable to winter and the winter impact cannot be determined at this time.

Determination 1. As indicated in the previous table, Aliso Inventory Requirement for Winter Peak Day Demand, at the end of the winter season, i.e., March, the necessary inventory could be drawn down to 15.4 Bcf with the intent of rebuilding the inventory to manage to the summer peak requirement of 29.7 Bcf.

Wells Necessary to Support Production and Injection Capacity

Production/Withdrawal

Based on flow tests that have been conducted by SoCalGas, at an inventory level of approximately 15 Bcf the average production rate per tested well at Aliso Canyon is 10.5 MMcfd. At this rate, 80 wells would be required to meet the winter reliability withdrawal rate of .839 Bcfd. Critically, this number of wells is not achievable nor are flow rates at a 15 Bcf inventory likely to be maintained. As noted previously, it is likely that only a total of 66 wells will be made available between the current number of 31 and the fourth quarter of 2017. The required production rates to meet reliability requirements are likely to be achieved only when the full 66 wells are in operation and only if their withdrawal capacity approximates the results estimated from the current 31 wells[31]. As such, until that time there remains a reliability risk – if significantly fewer than 66 wells are able to be brought on line in 2017, then increases to inventory beyond the 29.7 Bcf identified in this report may be needed to achieve the level of production associated with maintaining reliability. Consequently, this report should be revised appropriately as the 29.7 inventory level is approached and any additional information concerning withdrawal capacity is identified.

Injection

Based on rates as reported by SoCalGas the average current injection per well is approximately 8 MMcfd. Using the 29 fully tested wells that have passed all safety tests to inject at an injection rate or 8 MMcfd equates to a total injection rate of 232 MMcfd. In January SoCalGas estimates that it will have 31 wells available for injection. These wells will have a total injection capacity of approximately 248 MMcfd. As noted previously at estimated rates it will take approximately eight weeks of injection to achieve an inventory level of 29.7 Bcf.

As noted earlier, the analysis and conclusions in this report are based on current information, and many of these determinations are likely to change as a result of changes in field operations, the impact of mitigation measures, and any other relevant factors. These factors and their impact should be reviewed periodically to determine if adjustments to Aliso inventory levels are merited.

[31] The estimated number assumes a rate that, based on a higher inventory varies from the flow test rate.

(END OF ATTACHMENT 2)

ATTACHMENT 3

California Public Utilities Commission

Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability

Revised Report – Public Utilities Code Section 715

Energy Division

7/19/2017

Table of Contents

Introduction 1
Statutorily Required Determinations 4
Aliso Canyon Reliability Developments Since January 17, 2017 8
Current Situation 9

Introduction

Public Utilities Code (PU Code) Section 715 requires the California Public Utilities Commission (CPUC) to publish a report assessing the need for natural gas from the Aliso Canyon storage facility to meet the region's natural gas and electricity demand. Specifically, the statute requires the CPUC to determine:

The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates in California;
The amount of natural gas production at the facility needed to meet safety and reliability requirements;
The number of wells and associated injection and production capacity required; and
The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation.

The most critical of the findings required by PU Code Section 715 is the finding of the range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates. As discussed in detail below, in this updated 715 report we find that the range of working gas necessary to maintain reliably is 14.8 billion cubic feet (Bcf) at the low end and 23.6 Bcf at the high end.

On June 28, 2016, the CPUC issued the first version of the report required by PU Code Section 715. That report was based on the working conditions of the field at the time and the fact that new injections would likely be prohibited over the course of the summer. The report acknowledged that it would need to be update in the future as conditions in the field changed.

On January 17, 2017, the CPUC issued an update to the June 28, 2016, Section 715 report (January 2017 Section 715 Report) to address near-term winter and summer seasons based on the then-existing conditions of the Aliso facility and the Southern California Gas Company (SoCalGas) system.[1]

This update to the Section 715 report incorporates information acquired since January 17, 2017, chiefly from the *Aliso Canyon Risk Assessment Technical Report Summer 2017 Assessment* (2017 Summer Assessment) issued May 19, 2017. In addition, it incorporates changes to storage levels, well conditions, and storage withdrawal capacity at all SoCalGas storage facilities since the time of the 2017 Summer Assessment. This update also considers a higher level risk from an unplanned outage for the summer of 2017 than that presented in

[1] For planning purposes SoCalGas defines winter as beginning on November 1 and ending on March 31. Summer begins April 1 and ends on October 31.

the 2017 Summer Assessment. The higher level of risk is based on findings and recommendations made by the Independent Review Team as a result of its review of the 2017 Technical Assessment.

Conditions are likely to continue to change over time depending on the operational capabilities of wells in the field, SoCalGas' ability to inject into the field, and the effectiveness of mitigation measures. In anticipation of new regulations concerning storage fields, SoCalGas independently implemented a storage plan that reduces the short-term ability of other storage facilities to absorb any shortfalls caused by conditions at Aliso.
These changing conditions will require the CPUC to further update this report in the future.

The determination of whether and how the storage facility will be used over the long term will be the subject of CPUC proceeding I.17-02-002.

As written, the statute requires the four determinations to be made independent of each other. That is, the determination of the amount of inventory necessary for reliability is to be identified independently of whether there is sufficient injection and production capacity.
However, these factors are interrelated. For example, since withdrawal rates increase with higher pressure, fewer wells are needed to achieve a specific production rate when the volume of gas in the facility is increased.

This report endeavors to make the statutorily required determinations based on current conditions, while acknowledging that a variety of combinations of inventory, capacity, and wells could address the identified reliability needs. Additionally, injections into the field are currently prohibited.

The January 2017 Section 715 Report and its findings are based on the *Aliso Canyon Risk Assessment Technical Report* dated April 4, 2016, (2016 Summer Assessment) that addressed summer reliability risks, and the *Aliso Canyon Winter Risk Assessment Technical Report* dated August 23, 2016, as supplemented with information concerning updated peak demand levels and the impacts of measures taken to mitigate demand. Additionally, the January report recognized the expected impacts of reconfigured wells with reduced withdrawal capacity and the limited availability of wells at Aliso Canyon.

The revised findings in this report are based on the results of the 2017 Summer Assessment, the SoCalGas Modified Storage Safety Enhancement Plan presented to the CPUC by SoCalGas in its letter of March 30, 2017, the SoCalGas Advice Letter 5139 filed with the CPUC on May 19, 2017,[2] and on confidential information provided by SoCalGas to the CPUC concerning the status of wells at Aliso Canyon and current storage withdrawal capacity. In

[2] SoCalGas Advice Letter 5139 was approved by the Commission on June 29, 2017, in Resolution G-3529. The resolution can be found at http://docs.cpuc.ca.gov/resolutionsearchform.aspx.

addition, it incorporates findings and recommendations concerning unplanned outages in the Independent Review Team's review of the 2017 Technical Assessment.

The technical assessments were prepared by the CPUC, the California Energy Commission (CEC), the California Independent System Operator (CAISO), and the Los Angeles Department of Water and Power (LADWP). The reports were independently reviewed by Los Alamos National Lab and other outside experts.[3] SoCalGas also participated in the preparation of the technical assessments.

This report also considers:

The methodology and revised tables that form the monthly gas balance and storage simulation that was prepared by the California Energy Commission and incorporated in the Aliso Canyon Gas and Electric Reliability Winter Action Plan (Winter Action Plan);[4]
Forecasted gas demand information provided by SoCalGas for the 2016 California Gas Report (CGR);[5]
Publicly available data including information posted on the Sempra Envoy website (https://scgenvoy.sempra.com), which provides historical daily operating information including information on sendout and receipts and storage injections and withdrawals; and
Additional data provided by SoCalGas in response to CPUC data requests.

[3] These reports have undergone an independent review by the Los Alamos National Lab and Walker & Associates (*Independent Review of Hydraulic Modeling for Aliso Canyon Risk Assessment*, Walker & Associates Consultancy, Los Alamos National Laboratory, August 19, 2016, and *Independent Review of Southern California Gas Hydraulic Modeling*, Walker & Associates Consultancy, Los Alamos National Laboratory, May 19, 2017). The reviews noted that the modeling used in the technical assessments is consistent methodologically with industry practice. Furthermore, the reviews noted that the modeling produced reasonable outcomes and that the SoCalGas capacity estimates used are appropriate.

[4] *Aliso Canyon Gas and Electric Reliability Winter Action Plan*, California Public Utilities Commission, California Energy Commission, the California Independent System Operator and the Los Angeles Department of Water and Power, August 22, 2016. The gas balance and storage simulation examines supply and demand over the course of the winter and considers system wide needs and their impact on Aliso. The gas balance analysis was prepared by the California Energy Commission (CEC) independent of SoCalGas. The analysis included herein relies on the balance analysis in the August 22, 2016, Winter Action Plan, as modified by the CPUC and CEC and updated to reflect current information.

[5] *2016 California Gas Report*. Southern California Gas Company, Pacific Gas and Electric Company, San Diego Gas & Electric Company, Southwest Gas Corporation City of Long Beach Gas & Oil Department, Southern California Edison Company.

Statutorily Required Determinations

Consistent with SB 380, the CPUC has a statutory requirement to make four determinations concerning the Aliso Canyon storage facility prior to the approval of injections. These determinations are summarized below. The background and analysis supporting these determinations are provided later in this report.

The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates in California:

The CPUC provided a range of working gas inventory at Aliso Canyon necessary for adequate reliability in the CPUC's January 2017 Section 715 Report. The amounts identified in the January report ranged from a targeted minimum level of 15.4 Bcf to a maximum of 29.7 Bcf. The 15.4 Bcf represents the minimum amount that would be expected to be maintained at the end of the winter season, which ends on March 31. From that minimum Aliso Inventory was to increase over the course of the summer to
29.7 Bcf, a level determined to be sufficient to support summer demand. At the time the report was produced, inventory at Aliso was approximately 14.9 Bcf and minor withdrawals made on January 24-25 reduced inventory to an estimated 14.8 Bcf.[6]

The January 2017 Section 715 Report anticipated that updates would be required to reflect changing conditions and new information. To date, restrictions on injecting into Aliso remain in place. However, information provided since the last report indicates that revisions should be made.

Taking into account new conditions, in this update, the CPUC has determined that 23.6 Bcf of inventory at the Aliso Canyon Storage Field is necessary for SoCalGas to maintain safe and reliable service, limited by the mandated maximum safe operating pressure as specified by Division of Oil Gas and Geothermal Resources (DOGGR)[7]. As seasonal demand declines, the inventory may be appropriately drawn down if necessary but should be maintained within a range that is managed to target 23.6 Bcf and should not drop below 14.8 Bcf. Managing the facility in this manner is estimated to address safety and reliability needs while providing sufficient flexibility to respond to gas market conditions to support just and reasonable rates.

Range Maximum

The 23.6 Bcf maximum reflects the Aliso inventory needed to provide withdrawal capacity at rates necessary to meet the following conditions:

DOGGR identified safe pressure for the field based on its current information. That pressure corresponds to an inventory level of 67 Bcf. The inventory range in this report at 23.6 Bcf falls significantly below that limit.

95% of flowing gas supplies;
Unplanned outages of up to 400 MMcfd;
1.57 billion cubic feet per day (Bcfd) gas withdrawal capacity from non-Aliso storage facilities
85% electric transmission import utilization; and
1–in–10 peak day electric demand

These conditions, after incorporating actions taken to reduce gas demand for electric generation and additional factors as reported in the 2017 Technical Assessment, result in a withdrawal capacity need at Aliso Canyon of .860 Bcfd.

The conditions used to set the maximum of the range differ in part from those used in the 2017 Technical Assessment. The 2017 Technical Assessment used a 90% flowing supply level. This 10% reduction from 100% of flowing supply capacity in the assessment represented 5% to account for new balancing rules that reduced the mismatch between customer deliveries and customer demand and 5% to account for unplanned outages. The 5% for unplanned outages equates to an outage of approximately 150 MMcfd. The Independent Review Team's findings determined that the 150 MMcfd unplanned outage level does not sufficiently account for the level of outage risk. Based on discussions with the Independent Review Team, this report increases the 150 MMcfd for unplanned outages from the assessment to 400 MMcfd. Finally, based on information provided by SoCalGas, the withdrawal capacity from non- Aliso storage facilities has been increased to 1.57 Bcfd. from the 1.47 used in the assessment.

As indicated in the January 2017 Section 715 Report, .839 Bcfd of withdrawal capacity is needed at Aliso in the event of such a January peak day. As such the indicated inventory level of 23.6 Bcf with a withdrawal capacity of .860 Bcfd is sufficient to meet both the summer peak and winter peak.

The 23.6 Bcf inventory level is 5.8 Bcf lower than the 29.4 Bcf inventory identified in the January 2017 Section 715 Report as necessary for winter and the 29.7 Bcf determined to be necessary for summer. This lower level is in part a result of the higher Aliso Canyon withdrawal rates presented in SoCalGas' Advice Letter 5139.
However, these withdrawal rates are uncertain estimates and are not a replacement for the gathering of actual well flow data. Therefore these withdrawal rates should be reviewed prior to the end of the summer and in the context of the results of a future technical assessment.

Range Minimum

The minimum of the range, 14.8 Bcf, equals the current Aliso inventory level. This level recognizes that as winter peak demand declines, inventory levels at Aliso can be drawn down until the beginning of the injection season at the start of spring. The 14.8 Bcf provides a sufficient minimum withdrawal capacity to meet demand when demand

tends to be at lower levels. Importantly, the level provides a base/floor sufficient for injections to build inventory to meet higher summer demand. Depending on circumstances including weather and overall demand and inventory drawdown needs, actual inventory levels may remain above the minimum. However, as indicated in the discussion of the range maximum, inventory levels should be managed to the maximum of the range as discussed above.

The amount of natural gas production at the facility needed to meet safety and reliability requirements:

To meet reliability requirements, the CPUC estimates that SoCalGas needs to provide .839 Bcfd of Aliso withdrawal capacity to meet winter peak day needs, which are typically at their maximum in the month of January. An Aliso withdrawal capacity of ..860 Bcfd is required to meet peak summer demand.[8] This improvement from the .906 Bcfd required in the 2016 Summer Assessment is due in large part to tighter gas system balancing rules and CAISO electric transmission upgrades. See the Aliso Canyon Demand-Side Resource Impact Report (May 2017 Update).

The number of wells and associated production and injection capacity required:

Using estimates based on the model used in the previous Section 715 report and updated confidential SoCalGas data, a total of 69 wells at 23.6 Bcf of inventory would be necessary to meet the highest summer withdrawal rate of .860 Bcfd. However, wells not yet brought into service may not perform at the same level as estimated, and there is substantial uncertainty as to actual well performance (see "Current Situation" below). Based on current SoCalGas estimates, Aliso Canyon will not have 69 wells ready for withdrawal until the first quarter of 2018.

The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation:

As of June 1, 2017, 42 Aliso Canyon wells have completed DOGGR testing and remediation and are available for service. SoCalGas' intent is to continue having DOGGR test wells that have been isolated. For those wells that have passed DOGGR tests, SoCalGas will complete any remediation needed, and then wells will become available for service. However, a significant number of wells may need to be plugged and abandoned. Based on SoCalGas estimates and considering wells that may need to be plugged and abandoned, the number of wells available may increase by as few as four wells per month.

The Aliso withdrawal capacity is in addition to the 1.57 Bcfd assumed to be available from non-Aliso storage fields.

Assuming that an average of four wells can be returned to service per month, it would take until sometime in the first quarter of 2018 to reach 69 wells that have passed testing, been remediated, and are available for service.

To summarize the interdependence of these determinations, Determination #1 above accurately states the inventory level required, but as indicated in Determination #4, there are currently not enough wells to support the production required for reliability at their current withdrawal rates for summer peak. However, increasing the amount of inventory beyond the amount identified for working gas volume needs in Determination #1 would increase the withdrawal capacity of each well, which presumably would reduce the number of wells required to achieve the withdrawal rates needed for reliability purposes.

Aliso Canyon Reliability Developments Since January 17, 2017

The January 2017 Section 715 Report goes into great detail about the background of the Aliso Canyon gas leak. In the interest of brevity, that background information is omitted for this report. Instead, this report will focus on the notable developments that have occurred since January 17, 2017. These developments are listed on the CPUC's Aliso Canyon page at http://www.cpuc.ca.gov/aliso/. A summary of the comments to the January 2017 Section 715 Report as well as CPUC staff responses is attached as Appendix A to this report.

On January 27, 2017, the CPUC issued an Order Instituting Investigation pursuant to Senate Bill 380 to determine the feasibility of minimizing or eliminating the use of the Aliso Canyon natural gas storage facility (CPUC Proceeding I.17-02-002).

On February 1 and February 2, 2017, DOGGR and the CPUC held a public meeting in Woodland Hills to seek public comment on the findings from DOGGR's well safety review and proposed pressure limits. The CPUC submitted a presentation summarizing the CPUC's involvement and role. Participants submitted comments, which are summarized in Appendix B to this report along with CPUC staff responses.

On March 23, 2017, the CPUC issued Decision (D.) 17-03-020, which extended the tighter gas balancing rules through November 30, 2017.

On February 15, 2017, SoCalGas sent a letter to the CPUC announcing its Storage Safety Enhancement Plan in which the utility would begin converting all non-Aliso wells to tubing-only flow starting on March 1, 2017. The utility stated that any well that was not converted by April 1, 2017, would be temporarily plugged and isolated from the storage field. Under this proposal, SoCalGas estimated that withdrawal capacity would be reduced by 50% to 80% at the Honor Rancho field and by up to 34% at the Goleta and Playa del Rey fields. The utility estimated that the proposal would have impacts of a similar magnitude on injection capacity. SoCalGas planned to have eight to 10 Honor Rancho wells back in service by August 1, 2017, which is typically the beginning of the peak summer load period.

On March 16, 2017, the CPUC replied to SoCalGas' February 15th letter, stating that the Safety Enhancement Plan would result in insufficient withdrawal capacity to meet summer demand, increasing risks to energy reliability. The CPUC ordered SoCalGas to attain a minimum system wide storage withdrawal capacity of 2.065 Bcfd by June 1, 2017, and increase withdrawal capacity to 2.420 Bcfd as quickly as possible. SoCalGas was required to submit a revised plan by March 30, 2017.

On March 30, 2017, SoCalGas submitted the revised plan as required, noting that the CPUC was imposing a new requirement for SoCalGas to maintain sufficient inventory and withdrawal capacity to support noncore customers. SoCalGas stated that the revised plan would require the continued use of tubing and casing flow at the non-Aliso storage fields. With these changes, SoCalGas said it could achieve 2.070 Bcfd of system wide withdrawal capacity by June 1, 2017. To reach that level of inventory, SoCalGas would need to inject
Bcfd at Goleta and .085 Bcfd at Honor Rancho between April 1 and June 1. The utility estimated that it could reach a withdrawal capacity of 2.420 Bcfd by October 1, 2017, with withdrawals from Aliso Canyon. However, the utility noted several scenarios under which it would be difficult to attain or maintain that level of withdrawal capacity. Lastly, SoCalGas predicted that frequent High and Low OFOs would make it challenging for customers to bring in extra gas for injection and proposed making gas allocated to the balancing function available in Cycle 1 so that it could be used for injection.

On April 28, 2017, SoCalGas submitted a letter to the CPUC, CAISO, and CEC warning that above normal temperatures are predicted for summer 2017 and arguing that the conditions assumed in the 2017 Summer Assessment are too optimistic. SoCalGas stated that the non-Aliso storage fields had 40% less inventory than the previous year due to increased use in winter 2016-17 and limited spring injection. At these reduced inventory levels, withdrawal rates might be insufficient to support peak summer and winter demand. SoCalGas also maintained that if Aliso Canyon is used as a back-up, its withdrawal capacity could decline rapidly without new injection.

On May 8, 2017, the CPUC responded to SoCalGas' letter, directing the utility to file an expedited Advice Letter with a proposal for how it would increase storage injection. The proposal was required to include the following: minimum month-end storage targets, a forecast of the additional gas that the SoCalGas Gas Acquisition Department would need to procure to meet those targets, and an estimate of the cost to procure the additional gas on an accelerated timetable.

SoCalGas submitted Advice Letter 5139 on May 19, 2017. In it, the utility stated that it had already begun releasing 100,000 dekatherms (Dth) of gas allocated to the balancing function on Cycle 1 for injection and deferring maintenance not critical for safety or regulatory compliance. In addition, SoCalGas proposed to 1) set aside a portion of the injection allocated to the balancing function before the monthly Bid Week so that Gas Acquisition could obtain reliable, reasonably priced gas supplies for injection; 2) determine whether additional gas can be released for injection on Cycle 1 on the day before each flow day; 3) determine whether additional gas can be released for injection on Cycle 3 on the

morning of each flow day; 4) post injection capacity that exceed the actual physical injection capacity; 5) direct the Gas Acquisition Department to accelerate procurement of 3 Bcf of gas to meet summer inventory targets; and 5) create a memorandum account to track the costs of accelerated procurement, which were estimated to range from $1.5 to $3 million. Since the Gas Acquisition Department is legally precluded from communicating with the System Operator under normal conditions, the Advice Letter also proposed an Injection Enhancement Memorandum, which would expire on September 30, 2017, to determine how interactions between the two groups will be conducted to maximize storage injections.

The Indicated Shippers filed a response to Advice Letter 5139 on May 26, 2017, in which they noted that the proposal violates three settlement agreements and maintained that it would lead to more frequent High OFO events and receipt point capacity reductions.
Resolution G-3529 was approved by the Commission on June 29, 2017. The resolution granted most of SoCalGas' requests but did not approve posting injection capacity above actual physical injection capacity.

Current Situation

As of June 1, 2017, 42 Aliso wells have successfully completed DOGGR testing and are available for service.[9] The remaining wells have been isolated from the field. Having completed these steps, on November 1, 2016, SoCalGas requested authorization to resume injections at Aliso Canyon.[10] That request initiated the review and inspection of the field. On February 1 and February 2, 2017, DOGGR and the CPUC held a public meeting in Woodland Hills to seek public comment on the findings from DOGGR's well safety review and proposed pressure limits. However, as of June 30, 2017, DOGGR has yet to make a determination about whether the storage field can operate safely and thus has not yet made a determination about allowing injection of gas at Aliso Canyon.

As of July 17, 2017, the estimated withdraw capacity was 1.570 Bcfd at non-Aliso gas storage facilities and .500 Bcfd at Aliso Canyon for a total system wide capacity of approximately 2.070 Bcfd. This is slightly above the 2.065 Bcfd target set forth by the

[9] The actual number of wells is subject to change and does not include wells that have passed DOGGR testing but have not yet been remediated by SoCalGas to be available for service. Additional wells may be approved and made available for service (pending the DOGGR/CPUC certification that the field is safe for use) in the near term and a well may be taken out of service if issues are identified. It is anticipated that additional wells will go through testing and, if approved, be incorporated into use pending the certification that the field is safe for use.

[10] Letter from Rodger R. Schwecke (Vice President, Gas Transmission and Storage, SoCalGas) to both Kenneth A. Harris Jr. (State Oil and Gas Supervisor, Division of Oil, Gas, and Geothermal Resources) and Timothy Sullivan (Executive Director, California Public Utilities Commission), "Safety Review for Underground Gas Storage Facilities at Aliso Canyon," November 1, 2016.

CPUC's March 16, 2017 letter. However, it was in line with SoCalGas's targets in AL 5139. SoCalGas expects to reach its AL 5139 targets for July and for the rest of the summer.

Authorization to inject would allow both withdrawing gas from and injecting gas into the field and for Aliso to be used to support operations and to manage reliability. However, there is significant uncertainty concerning injection and withdrawal capacity as well as the amount of inventory achievable over the short term at Aliso.

That uncertainty reflects questions including but not limited to concerns about:

the performance of wells using tubing-only flow as required by Senate Bill 380 (Pavley, 2016), as opposed to flowing gas through tubing and casing;
the performance of the Aliso Canyon field at low starting pressures;
the performance of Aliso Canyon if further depleted;
the impact of fluids at the bottom of the well that could lead to lower well performance;
the lack of historical data about field-level operating performance at low inventory levels for an extended period of time; and
the uncertainty as to whether the SoCalGas Gas Acquisition Department will be able to inject enough gas into the non-Aliso Canyon storage fields to meet the targets set out in Advice Letter 5139 despite frequently called High OFOs and receipt point capacity reductions.

Given the uncertainties noted above, the inventory level and availability of wells needed to support necessary withdrawals indicated in this report are subject to change as conditions change and new information becomes available.

APPENDIX A

Reliability-Related Public Comments to January 17, 2017, Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability Revised Report pursuant to Public Utilities Code Section 715

Public Comments on Reliability: Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity and Well Availability (Revised Report – Public Utilities Code Section 715, Energy Division 1/17/2017)	
Gary Saleba: EES Consulting For the County of Los Angeles	
Comments	Staff Response
EES comments/assessments regarding the need to utilize the Aliso Canyon gas storage facility. Approval of gas injection in February 2017 would have no material impact on gas reliability for the period February through June Mitigation measures and increased availability of hydro will reduce gas demand and provide greater generation such that withdrawals from Aliso 'should' not be necessary this summer. There will not be enough wells available at Aliso Canyon to meet summer peak day demand. Absent an unlikely extreme worst-case scenario, there should not be a need to withdraw gas from Aliso Canyon during the summer of 2017 There is sufficient time to implement demand-side management and mitigation measures that will eliminate the need for 2017/18 winter withdrawals. Withdrawals from Aliso can be made without additional injections using the 14.8 Bcf currently in Aliso. This supports the argument that there is no need to inject at Aliso.	The CPUC staff agrees with several overall aspects of the EES analysis. Most notably we agree that several mitigation measures have been successful in *helping* avoid the use of Aliso Canyon and that additional effort should be made to refine measures and implement new ones. The success of the mitigation measures was already incorporated into the analysis for this Draft Revised 715 Report. We also agree on the need to further refine the estimated impacts of mitigation measures, particularly those that impact electricity demand, and the May 2017 update of our Aliso Demand-Side Mitigation Efforts report will provide these refinements. However, we note that many EES assertions are not fully supported, and the probability (defined in the Technical Assessment) and consequences of the worst-case scenario presented as Scenario 4 in the Summer Technical Assessment are dismissed in the EES report. Additionally, the impact of mild winter and summer weather in 2016 and into 2017 was not acknowledged as an uncontrollable contributing factor to the ability to limit the use of Aliso Canyon. While the summer of 2016 was on average historically warm, there were only two weekdays where temperatures exceeded 90 degrees on the coast. Peak electric (and thus summer gas) demand generally occur during sustained heat events with multiple days above 90 degrees on the coast. Injections before June do not eliminate reliability risk during that period, however, if made they will lower the risk and the impact of a supply shortfall that could result in curtailments. Given limitations on how much can be injected on a particular day, injections in advance of the summer will allow for an inventory more able to support withdrawals if needed to meet summer peak. This reasoning also extends to the conclusion concerning the number of wells available. As noted in the Section 715 report, there are a number of combinations of inventory and wells that can yield differing results.

Public Comments on Reliability: Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity and Well Availability (Revised Report – Public Utilities Code Section 715, Energy Division 1/17/2017)	
Gary Saleba: EES Consulting For the County of Los Angeles	
Comments	Staff Response
EES comments/assessments contd. Various CPUC/CEC reports are confusing and fail to provide a complete picture of the mitigation measures and need for withdrawal. Based on CPUC reliability studies the withdrawals on 1/24 and 1/25 were not necessary. Impact of DR omitted and impact of all mitigations omitted. Mitigation measures have been successful in preventing gas curtailments and forestalled the need for Aliso withdrawals.	Response to EES Comments/Assessments/Recommendations, contd. For example, generally the withdrawal capacity of a given well increases with the inventory in the field (up to a physically limited maximum). Thus, while a curtailment may not be able to be avoided, the risk is lowered and the depth of the curtailment could be mitigated. Hydro will have limited impact on local needs that drive electric generators (EG) demand for gas. The amount of impact is not yet known. There is no quantification/analysis in the EES report to support the statement that with increased hydro combined with other mitigation measures Aliso withdrawals 'should' not be required. There is an opportunity to identify potential new mitigation measures and implement them and to further refine existing measures in advance of next winter. However, those mitigation measure need to be active before we can 'eliminate' the need for withdrawals. This is particularly true given that there has been no apparent consideration of the possibility of more extreme weather than that experienced over the last two seasons. The EES statements concerning the availability of inventory to support multiple withdrawals do not consider the key relationship between the level of inventory and the ability to withdraw it at the rate required to meet demand. While there is inventory in Aliso that can be withdrawn, the analysis does not account for the fact that withdrawal capacity declines as inventory (and thus pressure in the field) declines. While only a limited amount of supply may be used on a particular day, the key metric is the ability to withdraw it with the speed needed to meet immediate short term and sustained periods of 3-4 hours of peak demand (typically occurring twice a day).

Public Comments on Reliability: Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity and Well Availability (Revised Report – Public Utilities Code Section 715, Energy Division 1/17/2017)	
Gary Saleba: EES Consulting For the County of Los Angeles	
Comments	Staff Response
Additionally EES comments made related to LADWP: SCE or LADWP should consider pursuing demand responses *outside* of the LA Basin. LADWP should expand its demand response program offerings to target residential customers Measures should be put in place to assure that the Castaic pumped storage project's reservoir elevation is maintained during summer days with potentially high peak system demands. Additional solar and wind generation should be expedited in southern California and incentivized with long-term contracts with the LADWP and SCE.	Response to EES Comments/Assessments/Recommendations, contd. As inventory decreases withdrawal rates decrease. The 715 report makes this clear, and the inventory levels indicated in that report and other CPUC reports are significantly driven by the withdrawal capacity needed to support demand, rather than the amount of inventory. The report specifically notes that during periods where peaks are lower, inventory can be managed lower, for example during the shoulder months of the spring. The CPUC is currently revising its assessment of the impact of mitigation measures with the goal of providing an ongoing accurate, consistent, and understandable method of defining and presenting those impacts. This information will provide more meaningfully data to evaluate the impacts of mitigation measures on the reliability risk and role of Aliso Canyon in meeting those needs. The intent is to incorporate the new data into the updated versions of the Section 715 report. The Section 715 Report did incorporate revised peak data as it relates to the 1-in-10 peak day. Those revisions lowered the amount of inventory needed to meet the peak. A reexamination of the 1-in-10 and 1-in-35 day reliability standards is beyond the scope of the Section 715 Report and would require a longer term formal proceeding to revise the current standards. The Aliso Canyon Risk Assessment Technical Report dated April 4, 2016, addressed summer risk. The Curtailment Risk Assessment section (pages 32-39) describes the methodology and outcomes of a risk assessment based on historical data. Page 37 of the report presents a 'forecast' of the likelihood/frequency with which each of the four scenarios could be expected to occur.

Public Comments on Reliability: Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity and Well Availability (Revised Report – Public Utilities Code Section 715, Energy Division 1/17/2017)	
Gary Saleba: EES Consulting For the County of Los Angeles	
Comments	Staff Response
EES provided a number of recommendations as part of its comments. These are summarized below: Continue and expand 17 mitigation measures Prepare a report detailing impact to date and anticipated new impacts and incorporating results into risk assessments Re-evaluate the existing 1-in-10 and 1-in-35 planning criteria Assess the probability of Scenario 4 identified in the Summer Technical Assessment.	Response to EES Comments/Assessments/Recommendations, contd. Responses provided by LADWP to EES comments regarding LADWP operations: The LADWP service area is the city of Los Angeles which is entirely within the LA Basin. As a result there is no opportunity for LADWP-related demand response outside of the basin. LADWP is currently developing a residential Demand Response pilot program along with its existing commercial program. Castaic Power Plant (CPP) is an important resource for LADWP. DWP plans and operates CPP to provide energy, flexible reserves necessary to reliably integrate renewables, and provide regulation and contingency reserves (spin and non-spin). CPP is and will always be energy limited as there are limitations to the working elevations at both Pyramid Lake and Elderberry tail bay. These limitations effectively limit the amount of energy that can be generated on any given day. DWP currently does coordinate the reservoir elevations to maximize CPP full capability, particularly in the summer. The good water year will have minimal impact on the overall daily capability of the plant as the lake elevations change quickly during full output, and daily water schedules into Pyramid will not make up the difference. Pumping can restore some of the capability for future days, but there is inadequate time and ability to fully restore the lake elevations to optimum levels by pumping. All maintenance to all DWP generation facilities is done in preparation for the summer run when loads are the highest. This includes Castaic. LADWP has added a significant amount of renewables throughout the last year and this year. They have contracts to build up to 150 MW more throughout the summer months.

Public Comments on Reliability: Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity and Well Availability (Revised Report – Public Utilities Code Section 715, Energy Division 1/17/2017)	
Name: Issam Najm, Ph.D., P.E.: Porter Ranch Neighborhood Council (PRNC)	
Comments	Staff Response
In the cover letter Re: Comments on the "Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability" and attached report, "Reliable Gas Delivery without the Aliso Canyon Gas Storage & Processing Facility" PRNC indicated its intent to address three main areas regarding the Section 715 report. These are: The Volume Calculation – specific reference is made to limiting "supply" to 85% of capacity in the technical assessment, a storage volume of 18.2 Bcf at Aliso and the number of wells available for withdrawal at Aliso. The Lack of Risk Analysis Component – i.e., consideration of the potential health risk and damage to the environment The Status of the Facility – i.e., that Aliso Canyon only be maintained as an "emergency supply" facility	Of the PRNC three main areas of comment, only the first, "The Volume Calculation" is specific to the Section 715 Report. The report attached to the letter does not reference the Section 715 Report but provides analyses that dispute the need for additional inventory at Aliso Canyon. The PRNC report is the source of the eight recommendations (mandates). Section 715 of the Public Utilities Code requires that the CPUC provide a report that makes four specific and distinct determinations. These determinations concern the range of gas at Aliso (inventory), the amount of gas production (withdrawal capacity), the number of wells for production and injection and the availability of production wells. The required determinations are listed on page 1 of the report. Other than the first item, The Volume Calculation, the remaining two areas noted in the PRNC letter and the eight mandates in the accompanying report are beyond the scope of the Section 715 report. Some of the items raised are addresses elsewhere (e.g., retiring Aliso Canyon is subject to a proceeding, core balancing and forecasting will be addressed in an Application to the CPUC this September), and certain issues, such as consideration of health and environmental issues are the domain of other state and/or local agencies. CPUC staff disagrees with the specific statements concerning the Volume Calculation that state that SoCalGas could support a gas demand of 4.1 Bcf without the use of Aliso Canyon. The remarks comment on use of a receipt point utilization rate of 85% associated with a support level of 4.1 Bcf.

Public Comments on Reliability: Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity and Well Availability (Revised Report – Public Utilities Code Section 715, Energy Division 1/17/2017)	
Name: Issam Najm, Ph.D., P.E.: Porter Ranch Neighborhood Council (PRNC)	
Comments	Staff Response
The report concludes (10.0 Moving Forward) with eight recommendations: Mandate that SoCalGas develop better predictions of its gas demand, including hourly fluctuations. Mandate that SoCalGas impose on itself the same core demand balancing as those imposed on non- core customers. Mandate that SoCalGas maintain the same gas storage volume of 60 Bcf in its four fields as it had done between April and November 2016. This includes no more than 15 BCF in Aliso Canyon Mandate that SoCalGas restrict its use of Aliso Canyon as an emergency supply only and only after maximizing its supply capacity. Mandate that SoCalGas expeditiously replenish any gas it withdraws from its fields to restore them to the "emergency" supply volume of 60 Bcf noted above. Mandate that SoCalGas provide full transparency on days that it withdraws gas from any of its storage fields. This should include an explanation for why the supply was not sufficiently adjusted to match its demand. Mandate that SoCalGas design and implement the necessary measures to remove the hydraulic bottlenecks from its system. Mandate that SoCalGas develop a clear and expeditious short-term roadmap to retiring the Aliso Canyon facility.	However as noted in the winter Technical assessment, historically receipt point utilization has been between 60 and 80%. The PRNC report appears to suggest that the utilization rate should be 100% of the sum of the highest historic utilization levels. Assuming 100% receipt point utilization ignores the very real risk that physical and market place circumstances out of the control of California entities (e.g., freeze-offs that limit the physical ability to produce gas on certain cold days and demand in other regions that may limit the availability of gas supply) will result in deliveries of less than receipt point capacity and any probability of an outage of any type on a high demand day. Additionally, the analyses suggest that SoCalGas could or should have brought in additional supply on those days when receipt point utilization was below 100%. This may not be possible. The analysis indicates that systemwide inventories significantly below 60 Bcf have been experienced without concern in the past. However, the analyses does not acknowledge that the extremely low historic inventory levels cited were remedied by significantly greater injection capacity than is currently available at Aliso Canyon and the fact that the low inventory levels were after very aggressive systemwide withdrawals (including withdrawals from Aliso) from inventory levels at the beginning January and in response to cold weather conditions. As indicated in the Section 715 Report, meeting summer reliability needs requires inventory levels above those indicated for winter. The PRNC letter and analysis does not consider nor challenge the summer requirements identified in the Section 715 Report.

APPENDIX B

Public Comments Concerning the DOGGR/CPUC Aliso Safety Presentation on February 1-2, 2017

On February 1 and February 2, 2017, DOGGR and CPUC held a public meeting in Woodland Hills to seek public comment on the findings from DOGGR's well safety review and proposed pressure limits. The CPUC submitted a presentation summarizing the CPUC's involvement and role.

On February 6, the County of Los Angeles submitted comments to the Division of Oil, Gas and Geothermal Resources in response to the Aliso Canyon Comprehensive Safety Review. While beyond the scope of the *safety* review, the County incorporated comments concerning the *reliability* of gas service. CPUC staff responses are below.

Los Angeles County Comments to DOGGR's Comprehensive Safety Review:

Los Angeles County Comment 1: Page 5, "Injection Should not be Approved Until After the CPUC Concludes its Legislatively Required Investigation to Determine the Feasibility of Minimizing or Eliminating Aliso Canyon. A. The CPUC Will Be Voting on Opening the Proceeding on the Future of Aliso Canyon and a Final Decision is Expected in Mid-2018."

The County requests that a decision on approving injections at Aliso Canyon be delayed until after the completion of this legislatively mandated CPUC process.

CPUC Staff Response: *SB 380 (Pavley, 2016) acknowledges that Aliso Canyon could be needed for reliability in the short term and that changes could be made to the overall gas system in Southern California that could reduce or eliminate that need in the long term. The investigation referred to in comment "A" is the long-term study required under Public Utilities Code 714. Public Utilities Code section 715 addresses the requirement to assess short-term reliability issues by requiring the CPUC to issue a report that determines the range of working gas needed in the field to ensure reliability and for the CPUC Executive Director to order the utility maintain that specified range of working gas. The County does not provide any basis for why the directive in Public Utilities Code Section 715 should be ignored. Later comments suggest that mitigation measures are working, thus eliminating the need for Aliso as a reliability resource. These comments are best framed as suggesting that the 715 report should set the amount of need working gas needed for reliability at or near zero. Those comments are discussed further below.*

Los Angeles County Comment 2: Page 6, B. A Review by Engineering and Consulting Firm EES Demonstrates that the Success of Mitigation Measures in Reducing Gas Demand Provide Sufficient Time to Delay a Decision on Injection until After the CPUC Proceeding. The County further comments that "Based on the success of the mitigation measures in reducing gas demand, and recommended actions in EES's comment letter, it is EES's opinion that withdrawals from Aliso Canyon are very unlikely to be necessary between now and the end

of 2018. As a result, there is time to complete the CPUC feasibility proceeding and for all parties to have the benefits of that proceeding on the future of Aliso Canyon before authorizing re-injections at the facility."

CPUC Staff Response: *We agree that mitigation measures were successful in reducing gas demand and that extension of and enhancements to these measures as well as the addition of new ones will further limit gas demand. However:*

The Section 715 Report already accounts for the success of the mitigation measures.

EES does not consider the impact of a mild summer, in terms of peaking temperature which drives peak demand on the need for withdrawals. While the summer of 2016 was on average historically warm there were only two weekdays where temperatures exceeded 90 degrees on the coast. Peak electric (and thus summer gas) demand generally occur during sustained heat events with multiple days above 90 degrees on the coast. By ignoring a key driver of demand — temperatures (daily and hourly) — EES inappropriately attributes the lack of withdrawals solely to mitigation measures;
EES' analysis focused on balancing the gas system over a full day; in the summer gas storage is critical to meet hourly changes in demand caused by ramping of electric generation. While the joint agency Summer Analysis modeled hourly demand, EES did not;

Los Angeles County Comment 3: Page 21, IX. Approval of Gas Injection Would Have No Material Impact on Gas Reliability for the Two Months Remaining this Winter because it Will be the Middle of February, at the Earliest, Before Any Injection Could Occur. A. Approval of Injection in the Near Term Would Not Materially Impact Gas Reliability For the Rest of the Winter.

CPUC Staff Response: *This comment is now moot since the focus is on summer reliability and not winter.*

Los Angeles County Comment 4: Mitigation Measures are Proving to be Successful in Reducing Overall Demand for Gas and Gas Withdrawals Should not be Necessary During Summer 2017 or Winter 2017-18. The comments further note that higher hydro generation and the impacts of mitigation measures will eliminate the need to withdraw from Aliso Canyon. Further the comment states that even with injections there will not be sufficient wells available to meet peak day demand.

CPUC Staff Response: *Due to electric transmission constraints, increased hydro generation will only minimally reduce the need for generation in the Los Angeles region, and those impacts will be addressed in updates to the 715 Report. We agree the mitigation measures will reduce gas demand, and the success of these programs is incorporated into* the Public Utilities Code Section 715 Report.

In addition to Los Angeles County's comments, there were three reliability related comments made during the February 1 and 2 Public Meetings:

Comment 1: Dr. Najm of the Porter Ranch Neighborhood Council stated that his own extensive analysis of the data makes clear that the natural gas delivery infrastructure can operate without Aliso Canyon.

CPUC Staff Response: *Dr. Najm's analysis was submitted with a cover letter as comment to the CPUC mandated Public Utilities Code Section 715 report. A summary of the recommendations from that analysis and staff's response is provided in Appendix A.*[11]

Comment 2: Multiple people expressed their belief that the facility is not needed to meet California's energy needs.

CPUC Staff Response: *The CPUC independently and jointly with the California Energy Commission, the California Independent System Operator, and Los Angeles Department of Water and Power conducted and made public multiple studies and analyses of the natural gas infrastructure. These studies and analyses identified the need for the use of the Aliso Canyon Gas Storage Facility to avoid curtailments and maintain public safety under conditions that have occurred and are reasonably expected to occur in the future. These studies have also been peer reviewed by Los Alamos National Laboratories.*

Specific information describing the operation of the gas system, demand, supply and the role of storage can be found in the Aliso Canyon Risk Assessment Technical Report, April 4, 2016; the Aliso Canyon Winter Risk Assessment Technical Report, August 23, 2016; the Aliso Canyon Action Plan to Preserve Gas and Electric Reliability for the Los Angeles Basin, 2016; the Aliso Canyon Gas and Electric Reliability Winter Action Plan, August 22, 2016; and the Aliso Canyon Risk Assessment Technical Report Summer 2017 Assessment, May 19, 2017. These and additional studies can be accessed on the CPUC website at: http://www.cpuc.ca.gov/aliso/.

Comment 3: One commenter supported reopening of the facility following completion of tests in the interest of ensuring a reliable energy supply.

[11] Correction: Based on Feedback on the 7/19/17 715 report, Comment 1 by Dr. Najm for the Porter Ranch Neighborhood Council has been corrected indicate that his letter and accompanying were timely submitted ;and remove a reference to support of the use of Aliso Canyon as an emergency facility. Dr. Najmdid not reference the use of Aliso as an emergency supply facility at the workshop. References to use as an emergency supply facility were included in the cover letter to his analysis and made in the context of an overall statement that the field should not be returned into service as an operating facility.

CPUC Staff Response: *As noted in the responses to comments 1 and 2 above, the CPUC and the joint energy agencies have conducted extensive analysis to determine and identify the risk of curtailments without the use of Aliso Canyon. Additionally, the CPUC and joint energy agencies have developed and implemented independently and with the cooperation of SoCalGas measures to reduce demand or otherwise limit the risk.*
The technical assessments and action plans as well as additional supporting analyses are available at the CPUC website at: http://www.cpuc.ca.gov/aliso/ .

(END OF ATTACHMENT 3)

ATTACHMENT 4

STATE OF CALIFORNIA EDMUND G. **BROWN** JR., *Governor*

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

July 19, 2017

Rodger Schwecke Senior
Vice President
Gas Transmission and Storage
Southern California Gas Company
505 West Fifth Street, GT21C3 Los
Angeles, California 90013

Re: Directive to maintain a range of working gas in **the Aliso Canyon gas storage facility that ensures safety and reliability for the region, and just and reasonable rates in California**

Dear Mr. Schwecke:

Public Utilities ("PU") Code Section 715 requires that, once the State Oil and Gas Supervisor ("Supervisor") allows injections to resume at the Aliso Canyon gas storage facility ("Facility"), the Executive Director of the California Public Utilities Commission ("CPUC") must consult with the Supervisor and direct Southern California Gas Company ("SoCalGas") to maintain a range of working gas in the field necessary to "ensure safety and reliability for the region, and just and reasonable rates in California." I have complied with the requirement to consult with the Supervisor before issuing my directive to SoCalGas to manage the Facility with a working gas storage level that ensures safety and reliability in the Los Angeles Basin, and just and reasonable rates in California. For the reasons stated below, I direct SoCalGas to manage the facility to target a working gas level of 23.6 Bcf and maintain a level above 14.8 Bcf at all times.·

In January 2017, consistent with PU Code Section 715 requirements, CPUC staff consulted with the California Energy Commission, the California Independent Systems Operator, and the Los Angeles Department of Water and Power ("Joint Agencies") and published an updated report finding that Aliso Canyon should maintain a working gas inventory of 29.7 Bcf for SoCalGas to maintain safe and reliable service.[1] That report found that as seasonal demand declines, the inventory may be appropriately drawn down if necessary but should be managed to target 29.7 Bcf and to remain above 15.4 Bcf at the low end. The report also noted that the numbers would need to be updated periodically to account for the continuing effectiveness of mitigation measures to reduce the need for the Facility and increases in the number of wells that become available after passing safety tests.

[1] The report was first published in summer 2016, updated in winter 2017, and recently updated on July 19, 2017.

On July I 9 , 20 17, CPUC staff released an updated PU Code Sectio n 715 report that took into account recent studies of the natural gas system in So uthern California conta ined in the Joint Agencies "2017 Summer Assessment ," [2] comments on the January 2017 report, the continuin g success of mitigation measures, and the increasing avai la bili ty of wells at the Facilit y that had passed safety review. The updated report found that the range of working gas needed to maintain re lia bilit y is between 14 .8 Bcf and 23.6 Bcf. As seasonal demand declines, the inventory may be appropriately drawn down if necessa ry, but should be ma intained within this range. T hus,
SoCalGas sha ll maintain an inventory of working gas co nsistent w ith the findings of the updated report, and continue to adhere to the Aliso Canyon Summer 2017 Withdrawals Protocols - described in my June 1 6 , 20 17 le tter to SoCalGas.[3]

My direc tiv e will ultimately be superseded by the California Public Utiliti es Co mmission ' s determination in the formal investigation of this matter - "Order Instituting Investiga tion pursuant to Se nate Bill 380 to determine the feasibility of minimi zin g or e lim ina ting the use of the Aliso Ca nyon na t.ural gas s tora ge facility locat ed in the County of Los Angeles while sti ll mainta inin g energy and elec tric re lia bility for the region." ln the interim, CPUC staff will continue to evaluate the success of mitigation measures to reduce relianc e on the Facility. If CPUC stafrs continuin g evaluation leads them to amend their previous findings, J may amend this directive to reflect our most current conc lusions.

Sincerely ,

im o■hy J.
Sulliva n
Exec ut ive
Director
Ca lifornia Public Utilities Commission

[2] Aliso Canyon Ris k Assessment Technical Repon Summer 2017 Assessmen t: hnp://docketpubl ic.en ergy.ca.gov/Pub!icDocuments/ I7 - IEPR - l 1/r N2 I763920 I705I9 T l04800 Aliso Ca nyon Ris k Assessment Technical Report Summer 2017 Asses. pd[

[3] Aliso Canyon Summer 2017 Withdrawals leller: hup://www.cpuc.ca.gov/uploadedFiles/CPUC Public Website/Content/News Roorn/61617TSltrrcJ\lis oCanvonSu rnmer20I 7Withdrawals.pdf

(END OF ATTACHMENT 4)

ATTACHMENT 5

California Public Utilities Commission

Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability

Final Supplemental Report for Winter 2017-18

Public Utilities Code Section 715 December 11, 2017

Energy Division

Introduction

This Supplemental Report provides an update to the Public Utilities Code Section 715 Report of July 19, 2017.[1] That report established the then-relevant range of working gas for Aliso Canyon (Aliso); the necessary production, i.e. the withdrawal capacity from the storage facility; the number of production wells needed; and the availability of those wells. On July 19, 2017, Southern California Gas Company (SoCalGas) received California Public Utilities Commission (CPUC) approval to inject into Aliso Canyon and to maintain Aliso Canyon working gas inventory between 14.8 and 23.6 billion cubic feet (Bcf).

The determinations in this Supplemental Report reflect significantly changed conditions, most notably an unprecedented level of outages on the SoCalGas system that include all of the major system elements: storage facilities, pipelines, and compressor stations.[2] The outages collectively put SoCalGas system reliability at risk this winter. It is likely that SoCalGas will withdraw gas from Aliso Canyon this winter in order to meet gas demand that cannot be met by gas from pipelines or other storage fields. This Supplemental Report authorizes a greater range of Aliso Canyon gas inventory so that SoCalGas may store and withdraw more gas inventory from Aliso Canyon in order to meet gas demand on a peak winter demand day (a 1-in-10 year cold day), as well as under "normal" conditions (average temperature winter throughout the season).

Summary of Determinations

The CPUC authorizes SoCalGas to maintain Aliso Canyon working gas inventory within a range of 0 Bcf to 24.6 Bcf. As mentioned above, the CPUC's previous authorization was for a range of 14.8 Bcf to 23.6 Bcf. The new maximum inventory of 24.6 (1 Bcf above the previous maximum of 23.6) allows for improvement in withdrawal capacity and overall supply and is consistent with the Aliso Canyon Winter Risk Assessment Technical Report 2017-18 Supplement (2017-18 Winter Supplement) referenced in footnote 2 below. The lower minimum of 0 Bcf (from a former minimum of 14.8 Bcf) increases the amount of gas available for use. Effectively, by lowering the minimum of the range, SoCalGas can access 24.6 Bcf of the gas stored compared to 8.8 Bcf under the previous range. Aliso Canyon

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See Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability, July 19, 2017.

The series of outages and maintenance issues are described in detail in the Aliso Canyon Winter Risk Assessment Technical Report 2017-18 Supplement prepared by the Staff of the California Public Utilities Commission, the California Energy Commission, The California Independent System Operator, and the Los Angeles Department of Water and Power. November 28, 2017. The report is available at: http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-11/TN221863_20171128T103411_Aliso_Canyon_Winter_Risk_Assesment_Technical_Report_201718_Supp.pdf.

inventory may not be drawn down below zero Bcf of working gas *or* the level that a prudent operator would maintain in order to preserve the integrity of the field.

The maximum of 24.6 Bcf of working gas may provide the withdrawal capacity needed to meet winter demand reliably. This assumes that the 44 Aliso withdrawal wells reported by SoCalGas to the CPUC as in-service remain in-service and that there are no further changes to expected well withdrawal numbers. Stated differently, the Aliso withdrawal capacity in addition to the total inventory levels across all fields as of November 26, 2017, will provide sufficient withdrawal capacity to meet a 1-in-10 year cold day peak demand, as well as "normal," i.e. average temperature winter demand throughout the season. It should be noted that multiple peak days requiring the use of Aliso could occur during a "normal" winter. There will remain a risk of curtailments should a "cold" winter develop during the remainder of the season, i.e., December through March.

Background

Public Utilities Code Section 715 (Section 715) requires the CPUC to publish a report assessing the need for natural gas from the Aliso Canyon storage facility to meet the region's natural gas and electricity demand. Specifically, the statute requires the CPUC to determine:

The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates in California;
The amount of natural gas production at the facility needed to meet safety and reliability requirements;
The number of wells and associated injection and production capacity required; and
The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation.

Consistent with Section 715 requirements, prior reports made the four determinations independently of each other. They also noted that the four determinations are highly interdependent. This report provides responses to the determinations that recognize the interrelationships among inventory, withdrawal capacity, and the number of wells available for withdrawal.

This update to the Section 715 report incorporates information acquired since January 17, 2017, chiefly from the 2017-18 Winter Supplement dated November 28, 2017. In addition, this update incorporates changes to storage levels, well conditions, and storage withdrawal capacity at all SoCalGas storage facilities since the time of the Aliso Canyon Risk Assessment Technical Report Summer 2017.[3] This Supplemental Report also uses SoCalGas storage

[3] Aliso Canyon Risk Assessment Technical Report Summer 2017Assessment prepared by the Staff of the California Public Utilities Commission, the California Energy Commission, The California Independent System

inventory numbers as of November 26, 2017. The actual November 26, 2017, inventory is higher than the storage inventory projection in the 2017-18 Winter Supplement due to unusually warm November weather. Barring additional problems, well conditions at Aliso Canyon are likely to remain relatively static during the remainder of the winter season. It is unlikely that a significant number of additional wells will be brought into service beyond mid-December. However, as indicated previously, there are a sufficient number of wells available to provide the necessary withdrawal capacity. There is an opportunity to inject additional gas into Aliso to reach an inventory level consistent with this report's findings. This will increase both the available supply level and the withdrawal capacity.

This Supplemental Report incorporates the impact of recent significant pipeline outages on Lines 3000, 4000, and 235-2. This Supplemental Report also accounts for planned outages for system upgrades on the Los Angeles Department of Water and Power's (LADWP) electric transmission system. These planned upgrades were deferred to February 2018 in an attempt to mitigate the impact of SoCalGas outages by reducing reliance on in-basin electric generation. Upon completion, the electric transmission upgrades will reduce reliance on natural gas as fuel for electric generation.

This Supplemental Report also includes one significant factor not incorporated in the 2017-18 Winter Assessment: the warm weather experienced through the month of November to date (and expected over the remainder of November and into December) and its impact on storage levels. Because there were only very limited withdrawals relative to injections during November, total inventory levels across all storage fields have increased and will be significantly higher at the beginning of December than the cold year estimate in the 2017-18 Winter Supplement (69 Bcf versus 58 Bcf, respectively).

This report also considers:

The methodology and revised tables that form the monthly gas balance and storage simulation that was prepared by the California Energy Commission and incorporated in the 2017-18 Winter Supplement;
Forecasted gas demand information provided by SoCalGas for the 2016 California Gas Report (CGR);[4]

Operator, and the Los Angeles Department of Water and Power with input from Southern California Gas Company.. May 19, 2017. The report is available at: http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-11/TN217639_20170519T104800_Aliso_Canyon_Risk_Assessment_Technical_Report_Summer_2017_Asses.pdf.

[4] *2016 California Gas Report*. Southern California Gas Company, Pacific Gas and Electric Company, San Diego Gas & Electric Company, Southwest Gas Corporation City of Long Beach Gas & Oil Department, Southern California Edison Company.

Publicly available data including information posted on the Sempra Envoy website (https://scgenvoy.sempra.com), which provides historical daily operating information including information on sendout and receipts and storage injections, withdrawals and inventory levels; and
Additional data provided by SoCalGas in response to CPUC data requests.

The determination of whether and how the storage facility will be used over the long term will be the subject of CPUC proceeding I.17-02-002.

Statutorily Required Determinations

Consistent with SB 380, the CPUC has a statutory requirement to make four determinations concerning the Aliso Canyon storage facility prior to the approval of injections. These determinations are presented below.

The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates in California:

Taking into account new conditions, the CPUC has determined that 24.6 Bcf of inventory at the Aliso Canyon Storage Field is sufficient for SoCalGas to maintain safe and reliable service, limited by the mandated maximum safe operating pressure as specified by Division of Oil Gas and Geothermal Resources (DOGGR).[5] This represents a 1 Bcf increase in inventory at the field. As seasonal demand declines, the inventory may be appropriately drawn down if necessary but should be maintained within a range of 0 Bcf to 24.6 Bcf. However, there are practical limits and potentially significant impacts on withdrawal capacity when operating at low inventory levels. Managing the facility in this manner is estimated to address safety and reliability needs while providing sufficient flexibility to respond to gas market conditions to support just and reasonable rates.

It is noted that there remains a risk of curtailments, particularly should a "cold" winter weather season develop into January. This risk declines after the end of January. Cold weather to California's east is still a factor, however, that could reduce pipeline deliveries and require gas from storage in order to avoid curtailments.

Range Maximum

DOGGR identified safe pressure for the field based on its current information. That pressure corresponds to an inventory level of 67 Bcf. The inventory range in this report at 23.6 Bcf falls significantly below that limit.

The 24.6 Bcf maximum reflects the Aliso inventory needed to provide the withdrawal capacity needed to meet peak day winter demand and to balance the system overall.

Peak Day Demand

The 2017-18 Winter Supplement determined that, on a winter peak 1-in-10 year cold day, Aliso Canyon would need to be used to avoid curtailments of electric load.[6] That is, after taking all steps available to reduce demand, additional supply not available from pipeline sources or non-Aliso storage would need to come from Aliso. If that supply were not provided by withdrawals from Aliso Canyon, electric generators would be curtailed at a level that would not allow them to fully serve their customers.

The level of withdrawal capacity needed from Aliso to address the projected supply shortfall is estimated to be at its highest in mid-December 2017. That shortfall is 510 million cubic feet per day (MMcfd) if electric generators are able to reduce their demand to the minimum generation levels identified in the 2017-18 Winter Supplement. The shortfall is expected to decline after mid-December based on the return of some portion of Line 4000 capacity. The estimated shortfall is expected to increase beginning February 1, 2018. The increase reflects the initiation of LADWP's deferred planned transmission line improvement outages. Table 8 of the 2017-18 Winter Supplement, reproduced below, presents the demand in MMcfd needed after taking steps to reduce demand; the supply supported without using Aliso Canyon; and the resulting shortfall. The shortfall would need to be supported with withdrawal capacity from Aliso.[7]

SoCalGas asserts in its Advice Letter 5208[8] and in its own Winter 2017-18 Technical Assessment[9] that in order to meet peak demand, SoCalGas requires a systemwide minimum inventory level of 43.3 Bcf throughout winter. This figure is also used in the analysis in the 2017-18 Winter Supplement. During a "cold" winter there remains a risk

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Aliso Canyon Winter Risk Assessment Technical Report 2017-18 Supplement, Table 11, page 19.

Aliso Canyon Winter Risk Assessment Technical Report 2017-18 Supplement, 11/28/17. Table 8, p. 16.

SoCalGas Advice Letter 5208, page 9, available at https://www.socalgas.com/regulatory/tariffs/tm2/pdf/5208.pdf. This figure is based on having the following levels of inventory at each field: 22 Bcf at Honor Rancho, 11 Bcf at La Goleta, 1.5 Bcf at Playa del Rey, and "the 8.8 Bcf available to use at Aliso Canyon." The 8.8 Bcf SoCalGas refers to is the amount of gas available given the range of working gas authorized at Aliso under the previous version of this Supplemental Report (23.6 Bcf – 14.8 Bcf = 8.8 Bcf). As noted in footnote 16 of the 2017-18 Winter Supplement, SoCalGas' estimate of minimum systemwide inventory has not been independently confirmed.

Southern California Gas Company Winter 2017-18 Technical Assessment, October 30, 2017, p. 5

that systemwide inventory could drop below 43.3 Bcf, which could result in curtailments if a peak day should occur in the month of January.

Based on the current Aliso maximum inventory level of approximately 23.6 Bcf and the number of wells currently reported as in service, Aliso Canyon is estimated to be able to support a withdrawal capacity rate of approximately 675 MMcfd.[10] This rate is sufficient to meet the shortfall of 510 MMcfd under conditions that could occur from the present time through December 18, 2017.

Table 8: Shortfall on a 1-in-10 Year Peak Day with Minimum Electric Generation and an N-1 Contingency

(MMcfd)	Present-12/18/2017	12/18/2017-12/30/2017	12/30/2017-1/31/2018	Post-2/1/2018
Adjusted 1-in-10 Customer Demand	4,167	4,167	4,167	4,348
Supported Demand without Aliso	3,657	3,917	4,117	4,117
Shortfall without Aliso	-510	-250	-50	-231

A balance analysis estimating monthly inventory levels at Aliso and other storage fields demonstrates that in a normal winter there will be sufficient withdrawal capacity to meet the shortfalls and the peak demands shown in the table. The analysis also supports the need to increase the Aliso maximum to provide more inventory to meet the withdrawal demands of a possible late-January cold snap and to provide a base for inventory going into the following winter. Finally, the changes in the range minimum and maximums will reduce, but not eliminate, the risk of curtailments during a cold winter.

Range Minimum

The minimum amount of working gas at Aliso Canyon is set at zero Bcf. Aliso Canyon inventory may not be drawn down below zero Bcf of working gas *or* the level that a prudent operator would maintain in order to preserve the integrity of the field.

The amount of natural gas production at the facility needed to meet safety and reliability requirements;

[10] The Aliso withdrawal rate is based on current in-service wells and estimated withdrawal rates at the current inventory level. SoCalGas has received permission from the CPUC to conduct flow tests and those tests are currently underway and expected to conclude in early December 2017. The tests should verify Aliso withdrawal rates and may produce results differing from current estimates.

To meet peak day demand 510 MMcfd of production capacity is necessary.

The number of wells and associated injection and production capacity required;

Approximately 37 wells would be needed under current estimates to provide for the necessary production capacity of 510 MMcfd. Well flow tests currently underway will confirm the number of production wells needed.

The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation.

Currently there are a sufficient number of wells (44) that have completed all safety tests and are available for withdrawal in order to meet the reliability needs in determination #3.

Comment Responses

SoCalGas timely submitted comments on the draft version of this report on December 6, 2017. No other comments were received.

SoCalGas makes the following assertions in its comments:

Current pipeline outages are not unprecedented: SoCalGas states that a "combination of supply shortfalls and outages on the SoCalGas system, or upstream of SoCalGas' system, has in the past reduced system capacity to the levels we see today.
Natural gas storage provides resiliency: SoCalGas asserts that Aliso Canyon is safe to operate and that the storage facility would improve resiliency if it could be filled to the level allowed by DOGGR and operated without reference to the Aliso Withdrawal Protocol.
The 715 Report overstates the value of adding 1 Bcf: SoCalGas states that an additional 1 Bcf will add to inventory but will have only a minimal impact on Aliso's withdrawal capacity.
The 715 Report overstates the value of lowering the range minimum: SoCalGas states that it is uncertain how the storage field will perform at low inventories.
The 715 Report makes withdrawal capacity and inventory determinations based on minimum electric generation and an N-1 Contingency" levels: SoCalGas notes that the 715 Report uses 1-in-10 peak winter day gas demand with minimum electric generation and an N-1 contingency rather than the 1-in-10 peak winter gas demand forecasted in the 2016 California Gas Report.
The 715 Report potential conflicts with the Aliso Withdrawal Protocol: SoCalGas notes that the Aliso Withdrawal Protocol requires Aliso to be used as an asset of last resort and asserts that electric generation must be curtailed down to the minimum

generation levels determined in the 2017-18 Winter Supplement before Aliso can be used.

Discussion

Current pipeline outages are not unprecedented: While SoCalGas may be correct that a "*combination* [emphasis added] of supply shortfalls and outages on the SoCalGas system, or upstream of SoCalGas' system, has in the past reduced system capacity to the levels we see today," the current outages are entirely on the SoCalGas system.
Natural gas storage provides resiliency: While SoCalGas appears to want to return the field to historic operating parameters, there is significant uncertainty about the role of Aliso Canyon at this time, which will be addressed in I.17-02-002 and other venues.
The 715 Report overstates the value of adding 1 Bcf: The addition of 1 Bcf was intended to increase inventory so that the current withdrawal capacity could be maintained longer. This action comports with SoCalGas' own logic in its 2017-18 Winter Assessment:

…if SoCalGas is able to increase Aliso Canyon's inventory above 23.6 Bcf, it will increase gas supply in storage for subsequent high demand periods, increase withdrawal rates, extend the time high withdrawal rates can be maintained, better enable SoCalGas to meet reliability needs, and create an additional operating margin to support sufficient inventory at all fields throughout the winter season.[11]

The 715 Report overstates the value of lowering the range minimum: The lowering of the range minimum was a direct response to SoCalGas' suggestion in its 2017-18 Winter Assessment, in which the utility stated the following:
If SoCalGas is able to withdraw gas from Aliso Canyon below 14.8 Bcf, more natural gas supply will be available to respond to customer demand… To establish inventory levels that better support energy reliability, the CPUC should expeditiously issue its next 715 Report that either lifts inventory restrictions entirely or includes a greater range of inventory that SoCalGas can maintain at Aliso Canyon.[12]

Southern California Gas Company Winter 2017-18 Technical Assessment, October 30, 2017, p. 7.

Southern California Gas Company Winter 2017-18 Technical Assessment, October 30, 2017, p. 7.

In response to SoCalGas comments, the CPUC modified the 715 Report to allow SoCalGas to maintain Aliso Canyon's working gas inventory within a range of 0 Bcf to 24.6 Bcf instead of 5 Bcf to 24.6 Bcf.

The 715 Report makes withdrawal capacity and inventory determinations based on minimum electric generation and an N-1 Contingency" levels: SoCalGas' observation is correct. The 715 Report was based on the analysis in the 2017-18 Winter Supplement.
The 715 Report potential conflicts with the Aliso Withdrawal Protocol: No part of the 715 Report should be construed as conflicting with the Aliso Withdrawal Protocol [13], and should there be any conflict, the Aliso Withdrawal Protocol controls. It should also be noted that the Aliso Withdrawal Protocol *does not* require that electric generation be curtailed down to the minimum generation levels determined in the 2017-18 Winter Supplement before Aliso can be used. Should SoCalGas have questions regarding gaps, conflicts, or ambiguities regarding the 715 Report or the Aliso Withdrawal Protocol, SoCalGas should contact CPUC Energy Division staff for clarification.

The assumptions used to complete this report are likely to change based on a number of conditions. For example, SoCalGas recently completed a round of flow testing on in-service wells at Aliso Canyon. The results indicate that the withdrawal capacity is higher than the 675 MMcfd estimated for this report. This report also notes that warm November weather led to higher storage inventories than those assumed in the 2017-18 Winter Supplement. The weather, storage levels, well operational status, facility outages, and storage withdrawal capacity will continue to change throughout the winter. We remain open to issuing further updates to the Section 715 Report should changing circumstances make such action necessary.

The Aliso Withdrawal Protocol is available at http://www.cpuc.ca.gov/aliso/; the most recent version as of the time of this Supplemental Report is dated November 2, 2017.

(END OF ATTACHMENT 5)

ATTACHMENT 6

STA TE OF CA LIFORNIA EDMUND G. BROWN JR., *Governor*

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

December 1 I , 20 17

Rodger Schwecke
Se nior Vice President
Gas Transmissio n and Sto rage
Southern Ca lifo rnia Gas Company
505 West Fifth Stree t, GT21C3 Los
Angeles, Califo rnia 90013

Re: Directive to maintain a range of working gas in the Aliso Canyon gas storage facility that ensures safety and reliability for the region, and just and reasonable rates in California

Dear Mr. Sc hwecke:

Public Utili ties ("PU") Code Sectio n 715 requires that the Executive Director of the California Public Utili ties Co mmissio n ("C PUC") direct So uthern California Gas Company ("SoCa!Gas") to maintain a range of working gas in the Ali so Canyon gas sto rage facility neces sary to "ensure safety and relia bili ty for the regio n, and just and reasonab le rate s in Ca li fornia." Based on cu1Tent info rma tion and changed conditio ns, I am directing SoCa !Gas to maintain up to 24.6 billi on cubic feet (" Bcf") of workfog gas at the Aliso Canyo n gas storage faci li ty ("Facilit y"). SoCa!Gas must manage the Fac ility co ns is tent with the findings of the Aliso Canyon Working Gas Invento ry, Production Capacity, Injec ti on Capac ity, and Well Availabi lity for Relia bility Final S upple mental Report for Winter 2017-18 , as pub!ish ed on December 11, 2 017 at www.cpuc.ca.gov/aliso (" Report").

The Report conside red the unprecede nted le vel of o utages on the SoCalGas system tha t inc lude all of the major syste m elements: storage facilities, pipe lines , and compresso r stations.' CPUC staff consulted with the Califo rnia Energy Comm ission, the Ca li fornia Independent Systems Operator , and the Los Angeles Deprutm e nt of Water and Power, and responded to comm ents from SoCalGas before finaliz ing the Report. The Report finds that SoCalGas should maintain a working gas inventory between zero Bcf and 24.6 Bcf at the Facilit y in order to maintain safe and reliab le serv ice; [2] and that under all c irc ums tances the Facility may not be drawn down below zero Bcf of working gas *or* the level at whic h a prude nt operator would mainta in in o rder to preserve the integrity of the field.

[1] The ser ies of o utages and ma int e nance iss ues are described in detai l in th e Aliso Canyon Winter Ris k Assess ment Technica l Report 2017- 18 S upp lement ("2 017-2 0 18 Winter Supple ment") pr e p a re d by the sta ff of the Ca lifornia Pub lic Ut ilit ies Co mmissio n, the Cali fornia E nergy Comm iss ion, the Cali fornia Independent Sys tem Operator, and the Los Ange les Department of Water and Power on No vember 28 , 20 17. The report is a vailab le at:

http://docketpublic.energy.ca.gov/PublicDocuments/17-1E-PR-1L/TN222863_20171128T1034_11_Aliso_Canyon_Winter_Risk_Assessment_Technical_Report_2017_18_Supp.pdf[2]
The PUC Code Section 715 report was first published in summer 2016, updated in winter 2017, and then again on July 19, 2017. A draft supplement was published on November 30, 2017 for comment and finalized on December 11, 2017. The report is available at: http://www.cpuc.ca.gov/aliso/

SoCalGas must also make withdrawals of gas from the Facility consistent with the Aliso Withdrawal Protocol.[3] Should SoCalGas have questions regarding potential conflicts between the findings of the Report and the Aliso Withdrawal Protocol, SoCalGas should contact CPUC Energy Division staff for clarification. CPUC staff will resolve any potential conflicts in favor of the Aliso Withdrawal Protocol.

This directive will ultimately be superseded by the California Public Utilities Commission's determination in the formal investigation of this matter - "Order Instituting Investigation pursuant to Senate Bill 380 to determine the feasibility of minimizing or eliminating the use of the Aliso Canyon natural gas storage facility located in the County of Los Angeles while still maintaining energy and electric reliability for the region."[4] In the interim, CPUC staff will continue to evaluate the success of mitigation measures to reduce reliance on the Aliso Canyon gas storage facility as well as new information that may impact gas reliability in Southern California. If CPUC stafr s continuing evaluation leads them to amend their previous findings, I may amend this directive to reflect our most current conclusions.

Sincerely,

Timothy J. Sullivan
Executive Director
California Public Utilities Commission

[3] As of the date of the Final Supplemental Report, the most recent version of the Aliso Withdrawal Protocol is dated November 2, 2017 and is available at: http://www.cpuc.ca.gov/aliso/
[4] CPUC proceeding I.17-02-002

(END OF ATTACHMENT 6)

ATTACHMENT 7

California Public Utilities Commission

Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability

Summer 2018 Supplemental Report

Public Utilities Code Section 715 July 6, 2018

Energy Division

Executive Summary

In the aftermath of the 2015 gas leak at the Aliso Canyon natural gas storage facility (Aliso), Senate Bill 380 added Section 715 to the Public Utilities Code, which requires the California Public Utilities Commission (CPUC) to determine the range of Aliso inventory necessary to ensure safety, reliability, and just and reasonable rates. In this update to the 715 Report,[1] Energy Division recommends that the maximum allowable Aliso inventory be increased from 24.6 to 34 billion cubic feet (Bcf). Energy Division deems this increase to be necessary due to 1) continuing pipeline outages on the Southern California Gas Company (SoCalGas) system; 2) consideration of the impact that declines in inventory at the non-Aliso storage fields have on their withdrawal capacity; 3) an examination of whether monthly 1-in-10 peak day demand can be met with forecasted storage inventory levels; and 4) limited injection capacity at the non- Aliso fields, which makes it difficult to inject gas into storage.

This update to the 715 Report focuses on whether SoCalGas can meet all system demand on a 1-in-10-year peak day. Previous versions of the report calculated what system demand would be if electric generators were curtailed to the minimum generation level sustainable without a disruption in electric service. Curtailing electric generators to minimum generation is an emergency measure. As such, it was appropriate to consider when no Aliso injection was possible. However, the CPUC's established standard is that the SoCalGas system should be designed to meet both core and noncore demand on a peak day that is expected to occur once every 10 years. Deviating from that standard in the absence of an emergency puts an undue burden on electric generators and ratepayers. Furthermore, the California Independent System Operator (California ISO) has indicated that it faces "a much higher potential for challenging summer operating conditions" than in previous summers.[2] Requiring its electric generators to run at minimum generation would exacerbate an already difficult situation.

Another change in this update compared to previous versions is that it looks beyond the coming season to both summer 2018 and winter 2018-19. This change in strategy was prompted by the results of the Aliso Canyon Risk Assessment Technical Report Summer 2018 (Summer 2018 Technical Assessment), which found that in addition to the risks to energy reliability expected for summer 2018, extensive pipeline outages on the SoCalGas system may make it difficult for the utility to fill its gas storage fields to a level sufficient to ensure energy reliability this winter.

In addition to Summer 2018 Technical Assessment, the analysis in this report is based on the findings of the Aliso Canyon Winter Risk Assessment Technical Report (Winter 2016-17 Technical Assessment); the Aliso Canyon Winter Risk Assessment Technical Report 2017-18 Supplement (Winter 2017-18 Technical Assessment); the experience of

[1] The last 715 Report was published on December 11, 2017. All previous versions of the 715 Report can be found at: http://www.cpuc.ca.gov/General.aspx?id=6442457392.

[2] California Independent System Operator's 2018 Summer Loads & Resources Assessment, p.3.

winter 2017-18; and confidential withdrawal curves for the four SoCalGas storage fields provided by the utility.[3]

In this update, Energy Division examines two possible pipeline capacity scenarios, as shown in the table below. Each pipeline scenario is shown under two sets of weather conditions in order to determine the amount of Aliso inventory that is required to meet 1-in-10-year peak day demand in every month of winter 2018-19.

Table ES-1: Scenarios Examined (MMcfd)

	Pipeline Capacity	Weather
A-average	2,696	Avg. summer/avg. winter
A-cold	2,696	Avg. summer/cold winter
B-average	3,296	Avg. summer/avg. winter
B-cold	3,296	Avg. summer/cold winter

The first pipeline capacity scenario assumes that current outages, as detailed in the Summer 2018 Technical Assessment, continue and that an additional 180 MMcfd of pipeline capacity is lost in September.[4] Under the "A" Scenarios, peak demand cannot be met without curtailments, even if Aliso were filled to the maximum inventory the Division of Oil, Gas, and Geothermal Resources (DOGGR) has deemed to be safe. The pipeline outages assumed in the A Scenarios also make it difficult to fill Aliso to a level that provides winter-long support for system reliability. In the Gas Balances produced for this analysis, the maximum achievable Aliso inventory under the A Scenarios was 31 Bcf. In contrast, under the "B" Scenarios, which assume that Line 4000 returns to full capacity in September and there are no additional pipeline outages, the need to use Aliso to meet peak demand is greatly reduced and the ability to fill storage is enhanced.

Further complicating matters is the fact that early summer — when demand is still relatively low — is the key time for injecting gas into storage under the reduced pipeline capacity scenario. Therefore, Energy Division cannot wait for more information about which pipeline scenario is more likely — a recommendation must be made early in the summer. In reaching its recommendation, Energy Division has weighed the risks to Southern California reliability in winter 2018-19 with the uncertainty regarding the pipeline system and the practical limitations on injecting gas into Aliso.

Finally, it is important to emphasize that the 715 Report is intended to provide analysis of what is required to manage Southern California gas reliability over the short term. The determination of whether the storage facility will be used over the long term is the subject of CPUC proceeding I.17-02-002.

[3] The Technical Assessments were created by the Aliso Canyon Technical Assessment Group, which consists of the CPUC, the California Energy Commission, the California ISO, and the Los Angeles Department of Water and Power. All previous Technical Assessments can be found at: http://cpuc.ca.gov/alisoassessments/. [4] The loss of pipeline capacity is based on the assumptions SoCalGas used in Table 2 of its own Summer 2018 Technical Assessment, which can be found in Appendix B of Advice Letter 5275-A.

Background

A major gas leak was discovered at the Southern California Gas Company's Aliso Canyon natural gas storage facility on October 23, 2015. On January 6, 2016, the governor ordered SoCalGas to maximize withdrawals from Aliso Canyon to reduce the pressure in the facility. The California Public Utilities Commission subsequently required SoCalGas to leave 15 Bcf of working gas in the field that could be withdrawn in an emergency. On May 10, 2016, Senate Bill (SB) 380 was approved. Among other things, the bill:

1. Prohibited injection into Aliso until a safety review was completed and certified DOGGR with concurrence from the CPUC;
2. Ordered Aliso wells to be remediated so that gas flows only through the interior metal tubing and not through the annulus between the tubing and the well casing ("tubing-only flow");
3. Required DOGGR to set the maximum and minimum reservoir pressure; and
4. Charged the CPUC with determining the range of working gas necessary to ensure safety and reliability and just and reasonable rates; this statutory requirement may be found in Public Utilities Code Section 715.[5]

On July 19, 2017, DOGGR certified, and the Executive Director of the Commission concurred, that the required inspections and safety improvements had been completed and injections could resume. DOGGR found that the facility could be safely operated at pressures between a minimum of 1,080 pounds per square inch absolute (psia) and a maximum of 2,926 pounds psia.[6] These pressures translate into an inventory of working gas that ranges from 0 Bcf to approximately 68.6 Bcf.[7]

The CPUC has published four previous versions of this report — known informally as the "715 Report" — which determines the range of working gas needed to ensure safety, reliability, and reasonable rates as required by Section 715. The allowable range has changed with each iteration of the report due to changing system conditions and the CPUC's evolving understanding of the available information. Specifically, the statute requires the CPUC to determine:

1. The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates in California;
2. The amount of natural gas production at the facility needed to meet safety and reliability requirements;

[5] SB 380 added Section 715 to the Public Utilities Code. All statutory references in this report are to the Public Utilities Code unless otherwise noted.

[6] DOGGR Updated Comprehensive Safety Review Findings, Enclosure 1.

[7] This figure is based on an April 19, 2018, email from DOGGR to the CPUC.

3. The number of wells and associated injection and production capacity required; and
4. The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation.

Items 3 and 4 have become less critical as more wells have satisfactorily completed required testing and remediation. Therefore, this report focuses primarily on Items 1 and 2: the range of working gas necessary (inventory) and the amount of natural gas production needed (withdrawal capacity). Nonetheless, a brief update on Items 3 and 4 is provided at the end of this report.

This update incorporates information acquired since the last 715 Report was published on December 11, 2017, as well as the results of previous analyses. It is based on the findings of the Winter 2016-17 Technical Assessment; the Winter 2017-18 Technical Assessment; the Summer 2018 Technical Assessment; the experience of winter 2017-18; and confidential withdrawal curves for the four SoCalGas storage fields.

The 715 Report is intended to provide analysis of what is required to manage Southern California gas reliability over the short term. The determination of whether the storage facility will be used over the long term is the subject of CPUC proceeding I.17-02-002.

Lessons from Winter 2017-18

Winter 2017-18 started off under challenging circumstances due to the October 1, 2017, rupture on Line 235-2. After the rupture, SoCalGas took the adjacent Line 4000 out of service for inspection and repair.[8] With little time to inject additional gas into storage before the official start of the winter season on November 1, the CPUC allowed a modest expansion of the range of working gas at Aliso, from 14.8-23.6 Bcf[9] to 0-24.6 Bcf.[10]

With pipeline capacity reduced by outages, the gas balance forecasts performed in November for the 2017-18 Winter Technical Assessment[11] showed that storage inventory would be insufficient to meet peak demand in an average winter and that it would be woefully inadequate for a cold winter. Fortunately, most of winter 2017-18 was exceptionally warm, and SoCalGas withdrew very little gas from storage until the region experienced a sustained cold snap beginning in mid-February. Even with the cold snap, there was nearly as much gas in the non-Aliso fields at the end of March as the average forecast predicted for December. However, even with much higher storage inventory levels than anticipated, electric generators were curtailed between February 20 and March 6, 2018.

[8] These outages were in addition to an existing outage on Line 3000 and a reduction in capacity on Line 2000.
[9] July 19, 2017, 715 Report.
[10] December 11, 2017, 715 Report.
[11] 2017-18 Winter Technical Assessment, pp 22-23.

Table 1 below compares the forecasted month-end inventory at the non-Aliso fields from the November gas balances to actual month-end inventories in winter 2017-18.

Table 1: Forecasted vs. Actual Non-Aliso Month-End Inventory: Winter 2017-18 (Bcf)

	November	December	January	February	March
Average Winter	42	27	21	17	17
Cold Winter	36	21	5	1	1
Actual	46	41	35	29	26

Withdrawal capacity is directly related to storage inventory. At higher inventories, storage fields experience higher pressures, which allow the gas to be withdrawn at faster rates. Withdrawal rates decline rapidly as the amount of gas in inventory drops. Table 2 below calculates what the combined withdrawal rate for the non-Aliso fields would be at the inventory levels shown in Table 1. In all three scenarios, by March withdrawal capacity has fallen significantly. In the Cold Winter scenario, withdrawal capacity drops far below critical levels.

Table 2: Estimated Non-Aliso Withdrawal Capacity at Winter 2017-18 Forecasted and Actual Month-End Inventory Levels (MMcfd)[12,13]

	November	December	January	February	March
Average Winter	1,048	878	786	666	666
Cold Winter	1,033	806	487	225	225
Actual	1,065	1,060	1,021	809	762

These declines in withdrawal capacity have a significant impact on the SoCalGas system's ability to meet 1-in-10 peak day demand. However, previous versions of the 715 Report mentioned, but did not explicitly calculate, these impacts. In part this was because, prior to the pipeline outages, the drawdown in storage was not as extreme since a greater portion of daily demand could be met with flowing gas supplies. Similarly, both the Winter 2016-17 and the Winter 2017-18 Technical Assessments use a

[12] Withdrawal rates for individual fields are confidential. These estimates combine the differing withdrawal rates at the three non-Aliso fields at estimated levels of inventory and are for illustrative purposes only. Assumptions have been made about how inventory would be allocated between storage fields. Aggregate withdrawal capacity may differ at similar combined inventory levels because of different assumptions about how the inventory is allocated. For example, if more inventory is assumed to be at Honor Rancho in Estimate A compared to Estimate B, combined withdrawal capacity will be different, even if combined inventory is the same. The withdrawal rates used in the calculations underlying these estimates are based on confidential withdrawal curves provided by SoCalGas in fall 2017 for Honor Rancho and La Goleta. SoCalGas did not provide a withdrawal curve for Playa del Rey at that time, so the estimated withdrawal capacity for that field is based on weekly reliability reports provided to Energy Division by SoCalGas.

[13] Honor Rancho is limited to a maximum of 541 MMcfd of withdrawal capacity based on the hydraulic modeling found on page 19 of the 2016 Aliso Canyon Winter Risk Assessment Technical Report. Modeling found that Honor Rancho would operate at a higher withdrawal capacity on an hourly basis but that it wouldn't be used every hour of the day. This limitation only has an impact early in winter.

static number — 1,181 MMcfd — in their calculations of non-Aliso withdrawal capacity on a peak day.[14] Although the gas balances included in the Technical Assessments forecast how storage inventory declines throughout the season, the impact of the decline on withdrawal capacity is not explicitly calculated. This report seeks to make the connection between inventory and withdrawal capacity explicit and to consider whether drawdowns in storage inventory impact the system's ability to meet peak-day demand late in the winter.

Table 3: Ability to Meet 2017-18 Winter Monthly 1-in-10 Peak Day Forecast[15] with Estimated Month-End Non-Aliso Withdrawal Capacity (MMcfd)

	(a) 1-in-10 Peak Day Demand	(b) Total Pipeline Capacity	(c) Estimated Withdrawal Capacity	(d) Total System Capacity (d=b+c)	(e) Surplus/ Shortfall (e=d-a)
November					
Average Forecast	4,263	2,476	1,048	3,524	-739
Cold Forecast	4,263	2,476	1,033	3,509	-754
Actual	4,263	2,476	1,065	3,541	-722
December					
Average Forecast	4,955	2,736	878	3,614	-1,341
Cold Forecast	4,955	2,736	806	3,542	-1,413
Actual	4,955	2,736	1,142	3,878	-1,077
January					
Average Forecast	4,955	2,906	786	3,692	-1,263
Cold Forecast	4,955	2,906	487	3,393	-1,562
Actual	4,955	2,906	1,021	3,927	-1,028
February					
Average Forecast	4,639	2,906	666	3,572	-1,067
Cold Forecast	4,639	2,906	225	3,131	-1,508
Actual	4,639	2,906	809	3,715	-924
March					
Average Forecast	4,428	2,906	666	3,572	-856
Cold Forecast	4,428	2,906	225	3,131	-1,297
Actual	4,428	2,906	762	3,668	-760

Table 3 above shows in column (b) the pipeline capacity assumed in the Winter 2017-18 Technical Assessment[16] and then in column (c) substitutes the estimated withdrawal

[14] This estimate came out of the hydraulic modeling done for the Winter 2016 Technical Assessment (p. 19). The hydraulic modeling found that the withdrawal capacity of the fields was as follows: La Goleta: 340 MMcfd; Playa del Rey: 300 MMcfd; and Honor Rancho: 541 MMcfd.

[15] Winter 2017-18 peak day forecasts were created for the 2016 California Gas Report.

capacities from Table 2 above for the static number (1,181 MMcfd) used in the Winter 2016-17 and Winter 2017-18 Technical Assessments. As withdrawal capacity declines, it becomes more difficult to meet the 1-in-10-year peak day design standard. The shortfalls displayed in column (e) represent the amount of gas from Aliso and/or curtailments that would have been required if a peak day had occurred. Given the existing pipeline outages, the SoCalGas system could not have supported 1-in-10 peak demand in any month, under any scenario without using Aliso Canyon and/or resorting to curtailments. Furthermore, in some scenarios, 1-in-10 peak demand could not have been met even with the 869 MMcfd in withdrawal capacity available at Aliso Canyon at the 24.6 Bcfd inventory cap.[17] If electric generators were curtailed to minimum generation on peak days, these shortfalls could be reduced but not eliminated. Under the Cold Forecast assumptions, the shortfall would have been roughly 900 MMcfd in February, even with electric generators curtailed to minimum generation.

Given the precarious state of the SoCalGas system, Southern California was fortunate to have experienced extremely mild temperatures for most of winter 2017-18, with sustained cold weather hitting only late in the season. However, hoping for continued mild weather is not a prudent strategy for ensuring future energy reliability. Pipeline capacity has not improved appreciably since winter 2017-18, and there is a chance that it could deteriorate further. When Line 235-2 ruptured in October 2017, there was insufficient time to substantially increase storage inventory before the high-demand winter season began. However, there is time now to boost storage inventory in advance of the 2018-19 winter season. Doing so requires increasing the cap on Aliso inventory while there is still time to inject gas into storage.

Public Utilities Code Section 715 also requires the CPUC to consider the impact of Aliso inventory on rates. While the CPUC has not completed its planned analysis of winter 2017-18, it is clear that the combination of pipeline outages and limits on Aliso storage led to continuing pressure on SoCalGas citygate commodity prices. Natural gas prices spiked repeatedly on cold days in the SoCalGas service territory, while PG&E citygate prices remained flat *(see Figure 1, below)*.

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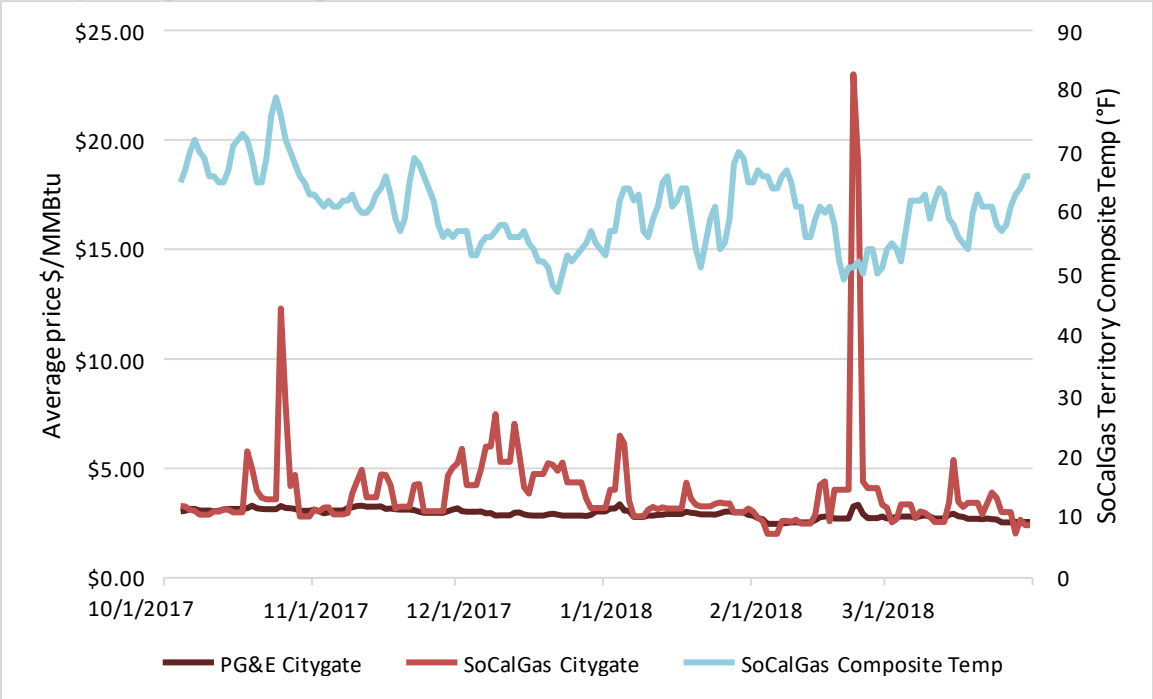
[16] The assumptions used in the Winter 2017-18Technical Assessment (Table 2, page 9) were based on hydraulic modeling done for the Winter 2016 Technical Assessment (Table 1, p. 19). The additional pipeline outages were subtracted from the total supported demand on a one-for-one basis. In Table 3, Total Pipeline Capacity for January-March was revised downward by 30 MMcfd compared to the 2017-18 Winter Technical Assessment due to events that occurred after the Technical Assessment was published. Line 4000 was expected to return to service at a capacity of 350 MMcfd. However, it actually returned to service at 270 MMcfd. That 80 MMcfd loss was somewhat offset by the resultant ability to bring in 50 MMcfd of interruptible supply at Kramer Junction.

[17] Advice Letter 5275-A (April 20, 2018) states that at 24.6 Bcf in inventory, Aliso Canyon has a projected withdrawal rate of 869 MMcfd.

Figure 1: Comparison of SoCalGas and PG&E Citygate Prices and SoCalGas Service Territory Composite Temperature: 10/3/17-3/31/18[18]



Findings

This report recommends that the maximum allowable working gas at the Aliso Canyon gas storage field should be increased to 34 Bcf. The minimum should remain 0 Bcf or the level that a prudent operator would maintain in order to preserve the integrity of the field. This minimum level is in keeping with the minimum established by DOGGR and the language of the previous version of the 715 Report.[19]

Several factors have led to the recommendation to increase the cap on Aliso inventory. First, significant pipeline outages have made it more difficult for customers to deliver enough gas to meet their demand, increasing reliance on storage. Second, experience this past winter caused Energy Division to explicitly consider the impact that declines in inventory at the non-Aliso storage fields have on their withdrawal capacity. Third, the experience of winter 2017-18 also caused Energy Division to examine whether the SoCalGas system has the ability to support monthly 1-in-10 peak day demand throughout the winter rather than determining the amount of Aliso inventory needed to meet one peak day. Finally, without Aliso, systemwide injection capacity is limited, which makes it difficult to inject gas into all the storage fields.

It is important to note that the pipeline outages currently in effect are not expected to be permanent. Additional mitigation measures proposed in the Summer 2018 Technical Assessment, such as deliveries of liquefied natural gas and changes to the gas tariffs,

[18] Based on weighted average spot prices reported by PointLogic; composite temperature data from Envoy.
[19] December 11, 2017, 715 Report, p. 2.

could also change the reliability equation in the future. However, the impact of the proposed additional mitigation measures is uncertain and will likely be insufficient to fully eliminate the identified shortfalls. Energy Division will revisit the recommendations of this report as the impact of these measures becomes more certain.

Pipeline Outages

Energy Division created four gas balances for this report to estimate inventory levels under different pipeline capacity and weather scenarios.[20] Gas balances look at average daily demand by month rather than peak demand and provide a means of forecasting how storage may be drawn down throughout the winter. Gas Balances A-average and A-cold assume that Line 4000 remains at its current reduced capacity all winter and that an additional 180 MMcfd of pipeline capacity is lost in September. In contrast, Gas Balances B-average and B-cold assume that Line 4000 returns to its maximum capacity of 740 MMcfd in September and there are no additional pipeline outages. Gas Balances A-average and B-average are based on demand assumptions for an average temperature year, while A-cold and B-cold assume an average summer and a cold winter.[21]

Table 4 below forecasts the amount of pipeline capacity that may be available this winter. It is modeled on Table 2 in the Winter 2017-18 Technical Assessment. It differs from that table in that it includes the 30 MMcfd of incremental pipeline capacity on Line 2000 that was lost in March 2018 due the expiration of a right-of-way agreement between SoCalGas and the Morongo Band of Mission Indians. It has also been modified to include the assumptions about pipeline capacity used in Gas Balances A and B.

Table 4: Forecasted Pipeline Capacity Under Scenarios A and B

(MMcfd)	Scenario A	Scenario B
Supported Gas Demand from Table 1 of the 2016 Winter Assessment (Includes both pipeline and withdrawal capacity)	4,567	4,567
Static Withdrawal Capacity	(1,181)	(1,181)
Combined Outages Lines 4000/235-2	(530)	(60)
Reductions at Ehrenberg (Lines 2000 and 5000)	(410)	(230)
Total Pipeline Capacity: No Mitigation	2,446	3,096
Mitigation 1: Otay Mesa	200	200
Mitigation 2: Kramer Junction (Interruptible)	50	0
Total Pipeline Capacity	2,696	3,296

[20] The gas balances and a summary of the assumptions used are provided in Appendix A.

[21] Demand assumptions are from SoCalGas' workpapers for the 2016 California Gas Report, pp. 12-13 and 25-26.

Impact of the Decline in Inventory on Withdrawal Capacity

The Gas Balances in Appendix A use the assumptions about pipeline capacity shown in Table 4 above to determine whether average monthly demand can be supported all winter long. They also provide a forecast of how much inventory will be left in the non-Aliso fields at the end of every month.[22] The resulting month-end inventory levels for the non-Aliso fields are used in Tables 5 and 6 below to provide a range of possible inventory and withdrawal capacity scenarios.

Table 5: Non-Aliso Month-End Inventory in 2018-19 Gas Balances (Bcf)

Gas Balance	November	December	January	February	March
A-average	37	29	20	15	13
A-cold	38	25	13	5	3
B-average	50	44	36	31	38
B-cold	50	38	29	25	26

Table 6: Estimated Non-Aliso Withdrawal Capacity at Month-End Inventory Levels in 2018-19 Gas Balances (MMcfd)[23]

	November	December	January	February	March
A-average	1,064	1,040	914	813	761
A-cold	1,064	996	803	584	532
B-average	1,113	1,097	1,064	1,048	1,080
B-cold	1,113	1,080	1,040	1,032	1,032

Table 5 shows that inventory at the non-Aliso fields declines precipitously in the A Scenarios, falling to 3 Bcf in March of the A-cold Scenario. Table 6 shows the impact that declining inventory has on withdrawal capacity. In the A Scenarios, there is little non-Aliso withdrawal capacity left in February and March, leaving the gas system very vulnerable to cold weather, outages, or any disruption in flowing supply.[24]

Ability to Support Monthly 1-in-10 Year Peak Day Demand throughout the Winter Table 7 below combines the forecasted pipeline capacity from Table 4 with the estimated withdrawal capacities from Table 6 to evaluate whether monthly 1-in-10 peak day demand can be met under the different scenarios.

[22] See the row labeled "OTF Month-End Storage Inventory (Bcf)." OTF stands for "other three fields."

[23] The combined withdrawal capacities were calculated using estimated withdrawal curves as of June 1, 2018. The withdrawal curves were provided to Energy Division by SoCalGas on May 14, 2018.

[24] SoCalGas is unlikely to let inventories fall as low as shown in the A Scenarios. Noncore customers would likely experience preemptive curtailments long before inventories reached such low levels.

Table 7: Ability to Meet 2018-19 Winter Monthly 1-in-10 Peak Day Forecast[25] with Estimated Month-End Non-Aliso Withdrawal Capacity (MMcfd)

Gas Balance	(a) 1-in-10 Peak Day Demand	(b) Total Pipeline Capacity	(c) Estimated Withdrawal Capacity	(d) Total System Capacity (d=b+c)	(e) Surplus/ Shortfall (e=d-a)
November					
A-average	4,247	2,696	1,064	3,760	-487
A-cold	4,247	2,696	1,064	3,760	-487
B-average	4,247	3,296	1,113	4,409	162
B-cold	4,247	3,296	1,113	4,409	162
December					
A-average	4,936	2,696	1,040	3,736	-1,200
A-cold	4,936	2,696	996	3,692	-1,244
B-average	4,936	3,296	1,097	4,393	-543
B-cold	4,936	3,296	1,080	4,376	-560
January					
A-average	4,936	2,696	914	3,610	-1,326
A-cold	4,936	2,696	803	3,499	-1,437
B-average	4,936	3,296	1,064	4,360	-576
B-cold	4,936	3,296	1,040	4,336	-600
February					
A-average	4,622	2,696	813	3,509	-1,113
A-cold	4,622	2,696	584	3,280	-1,342
B-average	4,622	3,296	1,048	4,344	-278
B-cold	4,622	3,296	1,032	4,328	-294
March					
A-average	4,410	2,696	761	3,457	-953
A-cold	4,410	2,696	532	3,228	-1,182
B-average	4,410	3,296	1,080	4,376	-34
B-cold	4,410	3,296	1,032	4,328	-82

In Table 7, the shortfalls displayed in column (e) represent the amount of gas from Aliso and/or curtailments that would be required if a 1-in-10 day occurs and the pipeline capacity and weather scenarios assumed in the Gas Balances come to fruition. The need for Aliso's withdrawal capacity is greatest under Scenarios A-average and A-cold. The greatest shortfall is seen in January under Scenario A-cold, when an additional 1,437 MMcfd is required to meet peak demand. In this scenario, the potential for large

[25] Winter 2017-18 peak day forecasts were created for the 2016 California Gas Report. The 2018 California Gas Report is expected to be published in July and will include updated forecasts.

shortfalls continues through March, when an additional 1,182 MMcfd would be required on a 1-in-10 peak day. Aliso's maximum withdrawal capacity when filled to the maximum safe inventory of 68.6 Bcf determined by DOGGR is estimated to be 1,092 MMcfd.[26] Therefore, these shortfalls could not be met without curtailments at any authorized level of Aliso inventory. However, the depth of the curtailments could be reduced if Aliso inventory was higher than the 24.6 Bcf authorized in the December 11, 2017, version of the 715 Report.[27]

The situation is much less dire in Scenarios B-average and B-cold. The largest shortfall is seen in January in Scenario B-cold, when an additional 600 MMcfd is required. The shortfalls drop significantly in February and March — in Scenario B-cold the March shortfall is only 82 MMcfd.

To further complicate matters, it is very difficult to fill Aliso under the A Scenarios because of the critical lack of pipeline capacity. In Gas Balances A-average and A-cold, the maximum achievable Aliso inventory is 31 Bcf, a level of inventory that provides under 1,000 MMcfd of withdrawal capacity.[28] In short, under conditions when Aliso inventory would be most needed, it is least likely to be available.

Unfortunately, there is not time to wait and see which set of assumptions most closely matches reality because of the need to inject gas into storage early in the summer. In the A Gas Balances, the largest build in storage inventory takes place in early in summer, when demand is relatively low and there are no additional pipeline outages. Waiting until late summer to determine the maximum Aliso inventory would mean missing this window for injection.

In the A Scenarios, Aliso withdrawals would be needed over multiple months, reducing the field's inventory level and withdrawal capacity. In the A-average scenario, there is 10 Bcf left at Aliso in March; in A-cold there is only 1 Bcf. Confidentiality concerns preclude Energy Division from revealing Aliso withdrawal capacity at all the inventory levels of concern in this report. However, Table 8 includes information that SoCalGas has stated publicly to provide a rough idea of how declines in Aliso inventory impact withdrawal capacity.

[26] This estimate is untested since the field has not been filled to 68.6 Bcf since the switch to tubing-only flow. [27] The California ISO and LADWP have not yet calculated what their minimum generation requirements will be for winter 2018-19. Using their estimates for February 2018 as a proxy, peak day demand can be reduced by roughly 592 MMcfd if electric generators are curtailed to minimum generation. See Table 7 on p. 15 of the Winter 2017-18 Technical Assessment.

[28] SoCalGas has stated that withdrawal capacity for individual fields is market sensitive and therefore confidential. This report only includes specific withdrawal capacities that have been previously made public or that SoCalGas has agreed to disclose

Table 8: Estimated Aliso Withdrawal Capacity at Four Inventory Levels[29]

Inventory (Bcf)	Withdrawal Capacity (MMcfd)
12.3	574
21.9	815
24.6	869
68.6	1,092

Injection Capacity

With the Aliso Canyon Turbine Replacement Project fully operational, Aliso injection capacity is estimated to be 545 MMcfd. In contrast, non-Aliso injection capacity in mid-May was roughly 230 MMcfd.[30] The injection capacity at Aliso therefore represents over 70 percent of effectively available systemwide injection capacity.[31]

Injection capacity serves two important purposes, and the total available injection capacity must be divided between these two purposes. First, it provides firm injection rights that customers can purchase in order to inject gas into storage. Second, a portion of total injection capacity is set aside to help the gas system stay in balance. On days when customers schedule more gas onto the system than is burned, something must be done with the excess gas to keep the pipelines from exceeding their maximum allowable operating pressure. If injection capacity is available, the SoCalGas System Operator can balance the system by injecting the extra gas into storage. If there is not enough injection capacity available, the System Operator must either call a High Operational Flow Order (OFO)[32] or turn away gas at the border to avoid over-pressurization. Both of these measures increase customer costs and create disincentives for customers seeking to take advantage of unpredictable releases of injection capacity late in the day.

[29] Estimates for the first three rows are taken from Table 2 of Advice Letter 5275-A and p. 7 of Attachment C to AL 5275-A. SoCalGas authorized the CPUC to disclose the withdrawal capacity at 68.6 Bcf in a June 6, 2018, email. All estimates are based on the number of wells expected to be in service at the beginning of summer 2018.

[30] On May 11, 2018, Envoy reported injection capacity of 236,000 dekatherms (Dth): https://scgenvoy.sempra.com/#nav=/Public/ViewExternalOFO.getOFO%3Frand%3D40. Using the conversion factor of 1027.348 Dth/MMcf provided by SoCalGas, that is equivalent to 229.7 MMcf (236,000 Dth/1,027.348 Dth/MMcf = 229.7 MMcf).

[31] In a May 15, 2018, announcement regarding the Aliso Canyon Turbine Replacement Project, SoCalGas states that it has 995 MMcfd in total injection capacity. The effectively available total is much lower, however, due to long-term reductions in injection capacity at Honor Rancho and La Goleta that are not expected to be remedied in the timeframe covered by this report.

[32] A High OFO is called when too much gas is scheduled onto the system and there is a danger that pipelines could exceed their maximum allowable operating pressure. On a High OFO day, gas customers face a financial penalty if they deliver more than 105 percent of their gas burn. The System Operator will not allow more gas onto the system than the pipelines are designed to handle. If there is still too much gas scheduled after a High OFO is called, the System Operator will simply refuse to accept additional gas from the interstate pipelines.

When Aliso reaches its maximum inventory, its injection capacity is no longer available. This leads to a significant drop in the injection capacity available for both firm injection rights and balancing. The end result of having less injection capacity for balancing services is that less gas will be scheduled into the system to fill the non-Aliso storage facilities since the injection capacity in those facilities may need to be held in reserve to mitigate overdeliveries. Limits on firm injection rights mean customers cannot enter into long-term contracts to purchase the extra gas they need to inject into storage. The reduction in storage set aside for balancing leads to an increase in OFOs and incidences of gas being turned away, which make customers wary of overscheduling. Therefore, one of the factors in the recommendation to increase the maximum Aliso inventory is the need to extend the period during which Aliso's injection capacity is available.

Recommendations

Given the uncertainty regarding the pipeline capacity that will be available this winter along with concerns about maintaining injection and withdrawal capacity, this report recommends a maximum Aliso inventory of 34 Bcf. While this level of inventory does not provide a substantially higher withdrawal capacity than the 31 Bcf that is shown as the maximum achievable inventory in the A Gas Balances, it does allow the system to maintain relatively high injection and withdrawal capacity over a longer period. This is important even if pipeline capacity increases to the level forecasted in the B Scenarios.

Aliso is not needed to meet average daily demand in Gas Balance B-average. However, in Gas Balance B-cold, 22 Bcf from Aliso is used.[33] Table 9 below compares how Aliso inventory would be impacted if the Aliso draw-down followed the pattern shown in Gas Balances A-cold and B-cold but Aliso was capped at either 24.6 or 34 Bcf.[34]

Table 9: Comparison of Aliso Draw-Down under Scenarios A-cold and B-cold at Caps of 24.6 and 34 Bcf

	November	December	January	February	March
A-cold					
24.6 Cap	24.6	12.6	0.6	0.0	0.0
34 Cap	34	22	10	4	4
B-cold					
24.6 Cap	24.6	19.6	11.6	2.6	2.6
34 Cap	34	29	21	12	12

At the 24.6 Bcf cap, there is not enough gas in Aliso to meet January peak demand under either the A-cold or the B-cold Scenario. With a cap of 34 Bcf, the January peak cannot be met in the A-cold Scenario, but it can be met under B-cold assumptions. Raising the cap

[33] Usage to meet average demand is in addition to the gas from Aliso needed to meet peak day demand. [34] As noted in Appendix A, the Gas Balances do not impose a cap on Aliso inventory. Only physical constraints on storage injections were considered.

thus provides an additional margin of reliability should either the more pessimistic pipeline or weather scenarios come to pass.

If pipeline outages continue, it may not be possible to fill Aliso to 34 Bcf. However, under certain weather and pipeline conditions it may be achievable. Given the potential for reliability problems this winter, this report finds it prudent to recommend a maximum level that would bring Southern California closer to being able to meet 1-in-10 peak day demand over a longer period. It is important to emphasize, however, that even with 34 Bcf at Aliso, the SoCalGas system would not meet the 1-in-10 design standard with the pipeline outages assumed in the A Scenarios. Southern California would remain vulnerable to disruptions in energy supply that could lead to curtailments of noncore customers, including electric generators.

Statutorily Required Determinations
Consistent with SB 380, the CPUC has a statutory requirement to make four determinations concerning the Aliso Canyon storage facility prior to the approval of injections. These determinations are presented below.

1. *The range of working gas necessary at the Aliso Canyon storage facility to ensure safety and reliability at just and reasonable rates in California.*

This report finds that 34 Bcf of inventory at the Aliso Canyon natural gas storage field is necessary to maintain reliability given forecasted demand and supply constraints and may be practically achievable before the start of the 2018-19 winter season. If Line 4000 returns to full capacity before winter and no additional outages are sustained, this level of inventory should be sufficient. If Line 4000 remains at reduced capacity and additional pipeline capacity is lost, Southern California will face risks to reliability even with the increased inventory at Aliso. Despite these risks, Energy Division does not recommend authorizing a higher level of Aliso inventory because it is unlikely that the storage field could be filled above 34 Bcf under the more pessimistic pipeline scenarios.

Minimum Aliso inventory remains at 0 Bcf or the level that a prudent operator would maintain in order to preserve the integrity of the field This minimum determination is in keeping with the minimum established by DOGGR and the language of the previous version of the 715 Report.

2. *The amount of natural gas production at the facility needed to meet safety and reliability requirements.*

To meet peak day demand in a scenario where Line 4000 remains at reduced capacity and an additional 180 MMcfd of pipeline capacity is lost, 1,437 MMcfd of Aliso natural gas production is required. This is not achievable at any inventory with the number of wells that are expected to be in service by June 1, 2018.

To meet peak day demand in a scenario where Line 4000 returns to service and there are no additional pipeline outages, 600 MMcfd in Aliso withdrawal capacity is required.

3. *The number of wells and associated injection and production capacity required.*

As of May 31, 2018, 46 wells had completed all testing and remediation requirements and were operational. Up to eight more wells may be in service before the end of summer, which will provide a modest increase in Aliso's production capacity. These wells are sufficient to meet peak demand in the more optimistic pipeline capacity scenario but not in the more pessimistic scenario.

SoCalGas has provided a range of historical withdrawal capacities for the 22 wells that have not yet returned to service but are not slated to be plugged and abandoned. If all the wells were to perform at the minimum of the range, there still would not be enough withdrawal capacity to meet peak demand in the pessimistic pipeline scenario. If all the wells were to perform at the maximum of that range, it is possible that peak demand of 1,437 MMcfd could be met, depending on the pressure in the field. It should be noted that this finding is based on simple addition using historical data and does not take into account factors such as the switch to tubing-only flow. In the event that a significant number of new wells return to service, a new Aliso withdrawal curve should be created to better estimate maximum withdrawal capacity.

The Aliso Canyon Turbine Replacement project is currently being brought online and should soon be fully operational. When the new electric compressors are operating at full capacity, Aliso is expected to have a maximum injection capacity of 545 MMcfd. This represents over 70 percent of effectively available systemwide injection capacity.[35]

4. *The availability of sufficient natural gas production wells that have satisfactorily completed required testing and remediation.*

As of May 31, 2018, 46 wells had completed all testing and remediation requirements and were operational. Up to eight more wells may be in service before the end of summer, which will provide a modest increase in Aliso's production capacity.

[35] In a May 15, 2018, announcement regarding the Aliso Canyon Turbine Replacement Project, SoCalGas states that it has 995 MMcfd in total injection capacity. The effectively available total is much lower, however, due to long-term reductions in injection capacity at Honor Rancho and La Goleta that are not expected to be remedied in the timeframe covered by this report.

Comments and Responses

The Draft 715 Report was posted on the Commission's website on June 18, 2018. The Commission accepted informal comments on the draft through June 27, 2018. Below we describe the comments and our response to them.

SoCalGas

- Supports an increase in inventory at Aliso Canyon.
- Recommends modifying the Aliso Canyon Withdrawal Protocol to allow SoCalGas to withdraw gas from Aliso Canyon, without curtailing customers or requiring the balancing authorities to voluntarily reduce demand.
- Stresses the importance of injection capacity, noting that if Aliso reaches its inventory limit, it has other effects on the system, which tends to limit the overall injection capacity of the system.
- Agrees with the approach taken in this latest 715 Report to look beyond the summer season to winter, when demand for gas by the core customers is greatest.
- Asks that the Commission consider more than just costs and prices at the SoCalGas and PG&E citygates, but take a more holistic view of how restrictions on the use of Aliso Canyon gas storage affect the entire region, including not just Southern California, but all of California and neighboring states.

Energy Division Response to SoCalGas

- Energy Division is reviewing the Aliso Canyon Withdrawal Protocol. Any proposed changes to the Protocol would be circulated for comment at a later date.

Southern California Publically Owned Utilities (SCPOU)

- SCPOU supports changes in the 2018 Report over previous reports.
- Asks the Commission to investigate the reduction in capacity on Line 4000.
- Notes differences in the number of operational wells discussed in the 715 Report (46 wells tested and operational) and the DOGGR website (56 wells that have passed all tests).
- Seeks clarification if changes to the Aliso Canyon withdrawal protocol will be addressed.

Energy Division Response to SCPOU

- Energy Division shares SCPOU's concern about the reliability impacts of the reduction in capacity on Line 4000.

- SCPOU is correct that 56 wells have passed all DOGGR inspections. However, to date, not all of the wells that have passed inspections are operational.
- Energy Division is reviewing the Aliso Canyon Withdrawal Protocol. Any proposed changes to the Protocol would be circulated for comment at a later date.

Porter Ranch Neighborhood Council (PRNC)

- Opposes the inventory increase in the 715 Report because the proposed increase appears based on pipeline outages on the SoCalGas system. Contends SoCalGas should be held to its promise to fix pipeline outages by September, rather than pressuring the Commission to increase inventory.
- Disagrees with relying on use of storage to balance the system and suggests instead the potential curtailment of noncore customers.
- Maintains that increasing inventory levels at Aliso increases the risk of leakage, which has significant health and safety effects on the neighboring communities.
- Recalculates the gas balancing tables that are included in the Appendix to the 715 Report, and concludes that in the event that the pipelines are not fixed by September, the system can be balanced by curtailing up to 500 MMcf/day of deliveries to noncore, wholesale and/or international customers. In its analysis, PRNC also increased deliveries of California Producers to 100 MMcf/day from the 60 MMcf/day assumed by the 715 Report.
- Notes that 100 MMcf/day is what the ENVOY system shows as California Producers' deliveries since March of this year.
- Contends inventory levels at Aliso can be increased at a later date, such as the start of the fall season, which is a season of low demand like spring.

Energy Division Response to PRNC

- Energy Division shares PRNC's concern about the reliability impacts of outages on the SoCalGas system and continues to monitor the situation.
- Season-long curtailments of noncore customers are not a reasonable solution to the problem posed by SoCalGas' pipeline outages. This proposed solution would harm SoCalGas' customers more than SoCalGas itself. Noncore customers include electric generators, manufacturers, hospitals, and oil refineries. The extensive curtailments proposed by the Porter Ranch Neighborhood Council would likely decrease electric reliability, drive up costs for electric ratepayers, and harm the Southern California economy.
- PRNC is correct that 100 MMcfd has been delivered from California Producers in recent months. However, Energy Division is reluctant to count on continued deliveries at that level in its analysis because under the Pipeline Safety

Enhancement Plan enacted in the aftermath of San Bruno, Line 85 must either be pressure tested, replaced, or derated. It is therefore unclear how long Line 85 will continue to operate at its current capacity. Nevertheless, in response to PRNC's concerns, Energy Division re-ran the Gas Balances from the draft 715 Report for its own internal analysis, using 100 MMcfd from the California Producers.
Increasing deliveries from the California Producers led to marginal improvements but did not significantly change the outcome of the analysis.

- PRNC is correct that fall is a shoulder season when storage injections can be made. However, it is a relatively short period since September is usually hot and November is the official start of the winter season. Furthermore, the Summer Technical Assessment warned that storage withdrawals may be needed to support electric demand this summer. If storage is depleted this summer and the pipelines remain out of service, waiting until fall could mean there is not enough time to bring storage inventories to a level to provide reliability over the winter of 2018-19.

Porter Ranch residents

- In addition to PRNC, eight individual residents of the Porter Ranch community commented on the 715 Report. The residents oppose an increase in the inventory of Aliso Canyon, expressing health concerns as well as questions about the monitoring and safety of the facility, including seismic concerns.
- Several express concern that SoCalGas is manipulating its pipeline outages to justify use of Aliso Canyon and state that the company has not worked diligently to repair its pipelines.
- They request the root-cause analysis of the leak be finalized.
- Several ask for increased conservation of natural gas rather than an increase in Aliso Canyon inventory levels.

Energy Division Response to Community Members' Concerns

- On July 19, 2017, Division of Oil, Gas, and Geothermal Resources (DOGGR) certified, and the Executive Director of the Commission concurred, that the required inspections and safety improvements had been completed and injections could resume. DOGGR has found that the facility can be safely operated up to an inventory of approximately 68.6 Bcf. The 715 Report proposes an inventory level of 34 Bcf, or roughly half that capacity.
- DOGGR is monitoring Aliso Canyon's wells, and the CPUC's Safety and Enforcement Division continues to coordinate with DOGGR consistent with our shared responsibility to ensure that the facility is operated safely.

- DOGGR approved SoCalGas' Storage Risk Management Plan on January 17, 2017, "conditioned upon further study as recommended by subject matter experts at Lawrence Berkeley, Lawrence Livermore, and Sandia National Laboratories." That seismic study is being conducted by a consortium of experts in conjunction with the National Laboratories to determine whether any additional safety measures should be put in place. It is scheduled to be released November 1, 2018.
- The Commission will continue to investigate the pipeline outages and to consider an appropriate regulatory response.
- The root-cause analysis is expected to be completed by November 20, 2018.[36]
- Although California and the CPUC are working diligently toward a low-carbon future, at this time, intermittent renewable electricity still needs to be backed up by fossil fuel generation. Winter heating demand is also still supplied in large part by natural gas. The Commission has authorized several mitigation measures to reduce gas usage including energy efficiency and demand response programs that provide rebates for smart thermostats. To date, energy efficiency and demand response programs have led to more significant demand reductions in the summer than the winter.[37]

BizFed

- Represents an alliance of over 170 business organizations and represents 390,000 employers with 3.5 million employees in L.A. County.
- Supports the inventory increase.
- Suggests changes are needed to the Withdrawal Protocol. Concerned with continuing curtailments of electric generators before withdrawals from Aliso Canyon are allowed.

Energy Division Response to BizFed

- Energy Division is reviewing the Aliso Canyon Withdrawal Protocol. Any proposed changes to the Protocol would be circulated for comment at a later date.

[36] Root-cause analysis schedule: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Safety/Natural_Gas_Pipeline/Blade%20RCA%202-15-18%20%20Estimated%20Timeline.pdf. For more information about the root-cause analysis, see: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Safety/Natural_Gas_Pipeline/Blade%20RCA%20SS-25%20Metallurgical%20Protocol%20-Phase%204%20RCA.pdf.

[37] For more information, see the May 2018 Update to the Aliso Canyon Mitigation Measures Impact Report.

RWE Supply and Trading (RWE)

- Supports the Commission's efforts to ask SoCalGas for a detailed update on the status of Lines 3000 and 235-2.
- Contends there is a lack of transparency and communication from SoCalGas, in contrast to other North American pipeline operators after similar incidents. In the two weeks after a June 7, 2018, explosion on Transcanada's Columbia gas pipeline, Columbia Gas Transmission posted six updates, created an FAQ page on the rupture, and gave an estimated date of "early July" for the line's return to service.

Energy Division Response to RWE

- The Commission shares RWE's concerns about pipeline outages and the transparency surrounding them and is working to obtain further information from SoCalGas about its pipeline outages.

Environmental Defense Fund (EDF)

- The Commission should perform a formal inquiry of SoCalGas' actions on pipeline repairs. Notes the response of Columbia Gas Transmission to a pipeline explosion on a 1.2 Bcf/day line in a "densely forested region away from easily accessible roads" where an 80 foot long rupture and fire affecting multiple pipeline joints has taken less than a month to restore partial service, while the rupture of Line 235-2 has taken eight months with still no date for return to service.
- Agrees with SCPOU that the Commission should include Line 4000 in its investigation.

Energy Division Response to EDF

- The Commission will continue to investigate the pipeline outages and to consider an appropriate regulatory response.

Protect Our Communities Foundation (POC)

- Opposes increasing inventory at Aliso Canyon. Contends that current storage levels are adequate.
- Asks for a more transparent and formal process before approval of inventory changes at Aliso Canyon. Asks that comments on the 715 Report be folded into the Administrative Record of I.17-02-002.
- States that a root-cause analysis must be completed before inventory is increased.
- Requests evidentiary hearings on the alleged lack of progress of pipeline repairs, particularly on Line 235-2, and on Aliso Canyon inventory levels. Contends that

SoCalGas should be required to turn over information regarding the pipeline outages.

Energy Division Response to POC

- Winter storage usage is largely dependent on the weather. Southern California was fortunate to have experienced mild weather for most of last winter. If the February cold snap had happened in December, there would have been very little gas left in storage to get through the rest of the winter.
- The 715 Report is focused on short-term reliability while I.17-02-002 will look at the long term.
- The Commission will continue to investigate the pipeline outages and to consider an appropriate regulatory response.

Food and Water Watch

- Opposes increasing inventory at Aliso Canyon and states that the Commission should demand faster response times on pipeline repairs.
- Concerned about reported 8.1 methane spikes from SoCalGas' fence-line monitors on June 21 and 22, 2018 and reports of over 500 health impacts from the Environmental Health Tracker app.

Energy Division Response to Food and Water Watch

- The Commission will continue to investigate the pipeline outages and to consider an appropriate regulatory response.
- Energy Division contacted SoCalGas regarding readings from fence-line methane monitors on June 21 and 22, 2018. SoCalGas stated that no injections had been made since the 715 Report was not final at that time. With regard to the heightened readings of methane, the following notification and explanation was posted on the SoCalGas Aliso Canyon Community Notifications Page: "Around 8:20 a.m., one of the Fence-Line methane monitoring points at Aliso Canyon registered a reading of 8.1 ppm. The reading was caused by fog and humidity. Following normal procedures, SoCalGas crews performed an infrared survey of the Aliso Canyon facility and did not find any elevated concentrations of methane. No other Fence-Line monitors recorded elevated methane levels at that time. There are no indications of elevated methane levels at the fence line."

County of Los Angeles

- Pipeline outages on Lines 3000 and 235-2 significantly contribute to energy reliability concerns in the L.A. Basin. SoCalGas "appears to be slow-walking repairs," which has had a dramatic effect on the price of natural gas. Urges thorough investigation of the pace of repairs and delays and consideration of other penalties in addition to removing unused pipeline capacity from rate-base.

- Requests results from internal investigation that the Commission said it was conducting as to the cause of the "unusual circumstances" surrounding withdrawals in January 2017.
- Concerned that a focus on 1-in-10 peak day gas demand, rather than gas demand after curtailing electric generators to minimum generation, avoids curtailments but ignores health and safety impacts to customers.
- Notes differing numbers of remediated wells in the 715 Report from those certified by DOGGR. Asks that SoCalGas provide a status update of its tests and conclusions as well as a timeline of when forthcoming tests of wells not yet remediated are expected to be concluded.

Energy Division Response to County of Los Angeles

- The Commission will continue to investigate the pipeline outages and to consider an appropriate regulatory response.
- The Commission's analyses of withdrawals from Aliso in winter 2017 and winter 2018 are still pending.
- As stated in the Technical Assessments, curtailing electric generators to minimum generation is an emergency response. Relying on minimum generation increases electricity costs and strains reliability. It is not reasonable to curtail electric generators to minimum generation on a regular basis or for an extended period. The Commission's established design standard is the ability to meet demand on a 1-in-10 year peak day.
- Regarding differences in well counts, not all wells certified by DOGGR have yet become operational.

Appendix A

Gas Balances

Energy Division created four gas balances for this report to estimate inventory levels under different weather and pipeline scenarios. These gas balances do not project what will actually happen but rather show what would happen if the supply, demand, and storage assumptions shown come to pass. These gas balances are similar to those created for the 2018 Summer Technical Assessment but contain some updates based on what has actually happened in April and May. For example, actual storage inventory at the end of April was lower than projected in the Technical Assessment, and low demand caused SoCalGas to reduce Southern System pipeline capacity to 700 MMcfd for most of May.

The four gas balances also combine some of the assumptions in the different gas balances created for the 2018 Summer Technical Assessment. In the case of Otay Mesa, 30 MMcfd is assumed through October, while 200 MMcfd is assumed throughout the November-March winter season. In all cases, no limits are put on Aliso inventory beyond the physical limits imposed by DOGGR and the existing constraints on injecting gas into storage. This was done in order to understand what is physically possible under different assumptions. However, withdrawals were made from the non-Aliso fields first where possible.

Gas Balances A-average and A-cold share the same pipeline assumptions but look at different weather scenarios. Gas Balance A-average estimates what would happen in an average temperature year, while Gas Balance A-cold assumes an average summer and a cold winter. Both gas balances assume that Line 4000 remains at its current capacity of 270 MMcfd all winter long and that Kramer Junction is able to deliver 600 MMcfd. They also assume that an additional 180 MMcfd of pipeline capacity is lost in September. In Gas Balance A-cold, by the end of the winter season there is insufficient gas in storage to maintain a positive deliverability balance, even on an average day. Furthermore, in both A Gas Balances, the maximum level of achievable Aliso inventory is 31 Bcf.

Gas Balances B-average and B-cold also look at an average temperature year and an average summer/cold winter year respectively. These gas balances assume that Line 4000 returns to full capacity of 740 MMcfd in September, which reduces Kramer Junction's capacity to 550 MMcfd. Both gas balances assume that there are no additional pipeline outages throughout the winter.

Ideally, a gas balance would result in a reserve margin of 15 percent. In these gas balances, a 15 percent reserve margin was only possible for a few months in the more optimistic B-average and B-cold scenarios.

Gas Balance A-average

SoCalGas Month-End Gas Balance, May 2018-March 2019: Average Temperature Year												
CGR Demand (MMcfd)		**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Core		751	692	630	608	628	714	1,072	1,483	1,420	1,379	1,143
Noncore including EG		1,063	1,089	1,362	1,408	1,526	1,270	1,100	1,136	1,151	1,112	1,031
Whole sale & Inte rnational Co.		358	377	374	374	392	391	422	521	501	486	414
Use and LUAF		27	27	30	30	32	30	33	40	39	38	33
Subtotal Demand		2,199	2,185	2,396	2,420	2,578	2,405	2,627	3,180	3,111	3,015	2,621
Storage Inje ction (Othe r Thre e Fields)		130	220	85	60	0	0	0	0	0	0	0
Storage Inje ction (Aliso)		0	140	85	60	0	0	0	0	0	0	0
Storage Inje ction Total		130	360	170	120	0	0	0	0	0	0	0
System Total Throughput		2,329	2,545	2,566	2,540	2,578	2,405	2,627	3,180	3,111	3,015	2,621
Supply (MMcfd)												
California Line 85 Zone Whe		60	60	60	60	60	60	60	60	60	60	60
eler Ridge Zone		765	765	765	765	765	765	765	765	765	765	765
Blythe (Ehre nbe rg) into Southe rn Zone Otay		700	980	980	980	800	800	800	800	800	800	800
Mesa into Southe rn Zone		0	30	30	30	30	30	200	200	200	200	200
Kramer Junction into Northe rn Zone North		600	600	600	600	600	600	600	600	600	600	600
Needles into Northe rn Zone Topock into		270	270	270	270	270	270	270	270	270	270	270
Northe rn Zone		0	0	0	0	0	0	0	0	0	0	0
Sub Total Pipeline Receipts		2,395	2,705	2,705	2,705	2,525	2,525	2,695	2,695	2,695	2,695	2,695
Storage Withdrawal (Othe r Thre e Fields)		0	0	0	0	100	0	110	275	275	200	50
Storage Withdrawal (Aliso)		0	0	0	0	0	0	0	275	250	150	0
Total Supply		2,395	2,705	2,705	2,705	2,625	2,525	2,805	3,245	3,220	3,045	2,745
DELIVERABILITY BALANCE (MMcfd)		66	160	139	165	47	120	178	65	109	30	124
Reserve Margin		3%	6%	5%	6%	2%	5%	7%	2%	4%	1%	5%
OTF Month-End Storage Inventory (Bcf)	28.4	32	39	42	44	41	41	37	29	20	15	13
Aliso Month-End Storage Inventory (Bcf)	22.2	22	26	29	31	31	31	31	22	15	10	10
Total Storage Inventory	50.6	55	65	71	74	71	71	68	51	35	25	23

Gas Balance A-cold

SoCalGas Month-End Gas Balance, May 2018-March 2019: Average Summer / Cold Winter												
CGR Demand (MMcfd)		**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Core		751	692	630	608	628	714	1,183	1,696	1,619	1,559	1,274
Noncore including EG		1,063	1,089	1,362	1,408	1,526	1,270	1,150	1,188	1,218	1,159	1,061
Whole sale & Inte rnational Co.		358	377	374	374	392	391	453	577	560	551	451
Use and LUAF		27	27	30	30	32	30	35	44	43	41	35
Subtotal Demand		2,199	2,185	2,396	2,420	2,578	2,405	2,821	3,505	3,440	3,310	2,821
Storage Inje ction (Othe r Thre e Fields)		130	230	85	80	0	0	0	0	0	0	0
Storage Inje ction (Aliso)		0	150	85	70	0	0	0	0	0	0	0
Storage Inje ction Total		130	380	170	150	0	0	0	0	0	0	0
System Total Throughput		2,329	2,565	2,566	2,570	2,578	2,405	2,821	3,505	3,440	3,310	2,821
Supply (MMcfd)												
California Line 85 Zone		60	60	60	60	60	60	60	60	60	60	60
Whe eler Ridge Zone		765	765	765	765	765	765	765	765	765	765	765
Blythe (Ehre nbe rg) into Southe rn Zone		700	980	980	980	800	800	800	800	800	800	800
Otay Mesa into Southe rn Zone		0	30	30	30	30	30	200	200	200	200	200
Kramer Junction into Northe rn Zone		600	600	600	600	600	600	600	600	600	600	600
North Needles into Northe rn Zone		270	270	270	270	270	270	270	270	270	270	270
Topock into Northe rn Zone		0	0	0	0	0	0	0	0	0	0	0
Sub Total Pipeline Receipts		2,395	2,705	2,705	2,705	2,525	2,525	2,695	2,695	2,695	2,695	2,695
Storage Withdrawal (Othe r Thre e Fields) Storage		0	0	0	0	100	0	125	410	375	300	75
Withdrawal (Aliso)		0	0	0	0	0	0	15	400	375	200	20
Total Supply		2,395	2,705	2,705	2,705	2,625	2,525	2,835	3,505	3,445	3,195	2,790
DELIVERABILITY BALANCE (MMcfd)		66	140	139	135	47	120	14	0	5	-115	-31
Reserve Margin		3%	5%	5%	5%	2%	5%	0%	0%	0%	-3%	-1%
OTF Month-End Storage Inventory (Bcf)	28.4	32	39	42	44	41	41	38	25	13	5	3
Aliso Month-End Storage Inventory (Bcf)	22.2	22	27	29	31	31	31	31	19	7	1	1
Total Storage Inventory	50.6	55	66	71	76	73	73	69	44	20	6	3

Gas Balance B-average

SoCalGas Month-End Gas Balance, May 2018-March 2019: Average Temperature Year												
CGR Demand (MMcfd)		**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Core		751	692	630	608	628	714	1,072	1,483	1,420	1,379	1,143
Noncore including EG		1,063	1,089	1,362	1,408	1,526	1,270	1,100	1,136	1,151	1,112	1,031
Whole sale & Inte rnational Co.		358	377	374	374	392	391	422	521	501	486	414
Use and LUAF		27	27	30	30	32	30	33	40	39	38	33
Subtotal Demand		2,199	2,185	2,396	2,420	2,578	2,405	2,627	3,180	3,111	3,015	2,621
Storage Inje ction (Othe r Thre e Fields)		130	220	85	60	150	75	0	0	0	0	230
Storage Inje ction (Aliso)		0	140	85	60	150	400	400	0	0	0	0
Storage Inje ction Total		130	360	170	120	300	475	400	0	0	0	230
System Total Throughput		2,329	2,545	2,566	2,540	2,878	2,880	3,027	3,180	3,111	3,015	2,851
Supply (MMcfd)												
California Line 85 Zone Whe		60	60	60	60	60	60	60	60	60	60	60
eler Ridge Zone		765	765	765	765	765	765	765	765	765	765	765
Blythe (Ehre nbe rg) into Southe rn Zone		700	980	980	980	980	980	980	980	980	980	980
Otay Mesa into Southe rn Zone		0	30	30	30	30	30	200	200	200	200	200
Kramer Junction into Northe rn Zone		600	600	600	600	550	550	550	550	550	550	550
North Needles into Northe rn Zone		270	270	270	270	740	740	740	740	740	740	740
Topock into Northe rn Zone		0	0	0	0	0	0	0	0	0	0	0
Sub Total Pipeline Receipts		2,395	2,705	2,705	2,705	3,125	3,125	3,295	3,295	3,295	3,295	3,295
Storage Withdrawal (Othe r Thre e Fields) Storage		0	0	0	0	0	0	0	200	275	175	0
Withdrawal (Aliso)		0	0	0	0	0	0	0	0	0	0	0
Total Supply		2,395	2,705	2,705	2,705	3,125	3,125	3,295	3,495	3,570	3,470	3,295
DELIVERABILITY BALANCE (MMcfd)		66	160	139	165	247	245	268	315	459	455	444
Reserve Margin		3%	6%	5%	6%	9%	9%	9%	10%	15%	15%	16%
OTF Month-End Storage Inventory (Bcf)	28.4	32	39	42	44	48	50	50	44	36	31	38
Aliso Month-End Storage Inventory (Bcf)	22.2	22	26	29	31	35	48	60	60	60	60	60
Total Storage Inventory	50.6	55	65	71	74	83	98	110	104	95	90	98

Gas Balance B-cold

SoCalGas Month-End Gas Balance, May 2018-March 2019: Average Summer / Cold Winter												
CGR Demand (MMcfd)		**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Core		751	692	630	608	628	714	1,183	1,696	1,619	1,559	1,274
Noncore including EG		1,063	1,089	1,362	1,408	1,526	1,270	1,150	1,188	1,218	1,159	1,061
Whole sale & Inte rnational		358	377	374	374	392	391	453	577	560	551	451
Co. Use and LUAF		27	27	30	30	32	30	35	44	43	41	35
Subtotal Demand		2,199	2,185	2,396	2,420	2,578	2,405	2,821	3,505	3,440	3,310	2,821
Storage Inje ction (Othe r Thre e Fields)		130	230	85	80	160	40	0	0	0	0	50
Storage Inje ction (Aliso)		0	150	85	70	50	300	50	0	0	0	0
Storage Inje ction Total		130	380	170	150	210	340	50	0	0	0	50
System Total Throughput		2,329	2,565	2,566	2,570	2,788	2,745	2,871	3,505	3,440	3,310	2,871
Supply (MMcfd)												
California Line 85 Zone		60	60	60	60	60	60	60	60	60	60	60
Whe eler Ridge Zone		765	765	765	765	765	765	765	765	765	765	765
Blythe (Ehre nbe rg) into Southe rn Zone		700	980	980	980	980	980	980	980	980	980	980
Otay Mesa into Southe rn Zone		0	30	30	30	30	30	200	200	200	200	200
Kramer Junction into Northe rn Zone		600	600	600	600	550	550	550	550	550	550	550
North Needles into Northe rn Zone		270	270	270	270	740	740	740	740	740	740	740
Topock into Northe rn Zone		0	0	0	0	0	0	0	0	0	0	0
Sub Total Pipeline Receipts		2,395	2,705	2,705	2,705	3,125	3,125	3,295	3,295	3,295	3,295	3,295
Storage Withdrawal (Othe r Thre e Fields)		0	0	0	0	0	0	0	400	300	150	0
Storage Withdrawal (Aliso)		0	0	0	0	0	0	0	150	250	350	0
Total Supply		2,395	2,705	2,705	2,705	3,125	3,125	3,295	3,845	3,845	3,795	3,295
DELIVERABILITY BALANCE (MMcfd)		66	140	139	135	337	380	424	340	405	485	424
Reserve Margin		3%	5%	5%	5%	12%	14%	15%	10%	12%	15%	15%
OTF Month-End Storage Inventory (Bcf)	28.4	32	39	42	44	49	50	50	38	29	25	26
Aliso Month-End Storage Inventory (Bcf)	22.2	22	27	29	31	33	42	44	39	31	22	22
Total Storage Inventory	50.6	55	66	71	76	82	93	94	77	60	46	48

(END OF ATTACHMENT 7)

ATTACHMENT 8

STATE OF CALIFORNIA EDMUND G. **BROWN** JR., *Governor*

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

July 2, 2018

Rodger Schwecke
Senior Vice President
Gas Transmission and Storage
Southern California Gas Company
505 West Fifth Street, GT21C3
Los Angeles, California 90013

Re: Directive to maintain a range of working gas in the Aliso Canyon gas storage facility that ensures safety and reliability for the region and just and reasonable rates in California

Dear Mr. Schwecke:

Public Utilities (PU) Code Section 715 requires that the Executive Director of the California Public Utilities Commission (CPUC) direct Southern California Gas Company (SoCalGas) to maintain a range of working gas in the Aliso Canyon gas storage facility necessary to "ensure safety and reliability for the region, and just and reasonable rates in California." Based on current information and changed conditions, I am directing SoCalGas to maintain up to 34 billion cubic feet (Bet) of working gas at the Aliso Canyon gas storage facility (Facility). SoCalGas must manage the Facility consistent with the findings of the Aliso Canyon Working Gas Inventory, Production Capacity, Injection Capacity, and Well Availability for Reliability Final Supplemental Report for Summer 2018, as published on July 2, 2018, at www.cpuc.ca.gov/aliso (Report).

There are several points about the Report worth highlighting in this letter. First, the Report considered the unprecedented level of outages on the SoCalGas system.[1] Second, the Report's analysis arrives at a maximum allowable Facility inventory by assessing the ability of the SoCalGas system to meet the gas demand of both core and noncore customers on a 1-in-10 year peak day, which is the design standard set by the CPUC.[2] Lastly, the Report's timeframe was updated to look beyond summer 2018 to winter 2018-19 due to the outages on the SoCalGas pipeline system and corresponding uncertainties around energy reliability this coming winter. CPUC staff consulted with the California Energy Commission, the California Independent

[1] The series of outages and maintenance issues are described in detail in the Aliso Canyon Risk Assessment Technical Report Summer 2018 ("Summer 2018 Technical Assessment") prepared by the staff of the California Public Utilities Commission, the California Energy Commission, the California Independent System Operator, and the Los Angeles Department of Water and Power on May 7, 2018. The report is available at:

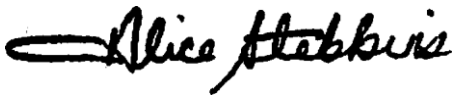
hnp://cpuc.ca.gov/uploadedFiles/CPUC_Website/Content/About_Us/Organization/Divisions/News_and Outreach Office/Aliso%20Canyon%20Summer%2020l8%20Technical%20Assessment.pdf

[2] D.18-06-028, Finding of Pact 14, p. 132; D.16-07-008, p. 7.

Systems Operator, and the Los Angeles Department of Water and Power, and responded to comments from 17 parties before finalizing the Report.3 The Report finds that SoCalGas should maintain a working gas inventory between zero Bcf and 34 Bcf at the Facility in order to maintain safe and reliable service and that under all circumstances the Facility may not be drawn down below zero Bcf of working gas *or* the level at which a prudent operator would maintain in order to preserve the integrity of the field. Any withdrawals of gas from the Facility by SoCalGas must be consistent with the Aliso Canyon Withdrawal Protocol.[4]

This directive will ultimately be superseded by the California Public Utilities Commission's determination in the formal investigation of this matter: "Order Instituting Investigation pursuant to Senate Bill 380 to determine the feasibility of minimizing or eliminating the use of the Aliso Canyon natural gas storage facility located in the County of Los Angeles while still maintaining energy and electric reliability for the region."[5] In the interim, CPUC staff will continue to evaluate the success of mitigation measures to reduce reliance on the Facility as well as new information that may impact gas reliability in Southern California. If CPUC staffs continuing evaluation leads them to amend their previous findings, I may amend this directive to reflect our most current conclusions.

Sincerely,



Alice Stebbins
Executive Director
California Public Utilities Commission

cc: President Michael Picker
Maryam Ebke, Deputy Executive Director
Edward Randolph, Energy Division Director Brian Prusnek, Sempra Utilities

[3] The PU Code Section 71*S* report was first published in summer 2016. It was updated for winter 2016-17, summer 2017, and winter 2017-18. The most recent draft supplement was published on June 18, 2018, for comment and finalized on July 2, 2018. The report is available at: http://www.cpuc.ca.gov/aliso/

[4] The most recent version of the Aliso Withdrawal Protocol is dated November 2, 2017, and is available at: http://www.cpuc.ca.gov/aliso/

s CPUC proceeding 1.17-02-002

(END OF ATTACHMENT 8)