CALIFORNIA PUBLIC UTILITITES COMMISSION

Preliminary Staff Analysis

Analysis of Los Angeles Basin's 2016 Energy Demand and the Role of Aliso Canyon Storage

Energy Division

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EXECUTIVE SUMMARY

RELIABILITY FOR CORE AND ALL CUSTOMERS (CORE PLUS NONCORE)

SoCalGas plans to meet the winter demand for *Core* customers based on the load on a 1-in-35-year peak day, which equals 3.1 Billion cubic feet per day (Bcf/day). It plans to meet the winter demand of *all* customers (core and non-core) based on a 1-in-10 year "cold February day," which equal 5.047 Bcf/day of storage *plus* flowing gas. The CPUC requires that SoCalGas maintain a storage withdrawal capacity of 2.25 Bcf/day.

During summer, the peak-day demand is 3.211 Bcf/day.[1] This 3.211 Bcf/day falls well within the 1-in-10 design standards for the system (5.047 Bcf/day); furthermore, the total system demand is typically well within the system capacity.

ALISO CANYON'S ROLE

Aliso Canyon storage is integral to meeting system-wide and more specifically to meeting the Los Angeles (LA) Basin peak demand and to supporting reliability at even more moderate demand levels. Over the period 2012-2015 withdrawals were needed from Aliso an average of 134 out of 151 winter days and 70 out of 214 summer days. *Aliso is the only source* able to provide the rapid response to increases in LA Basin gas fired electric generation demand that occurs on hot days when cooling demand increases.

RECOMMENDATION

To minimize risks of curtailments to noncore customers including electric generators and to minimize the possibility of curtailment to core customers, SoCalGas was ordered by the CPUC not to reduce inventory levels at Aliso Canyon below 15 Billion cubic feet (Bcf) other than to meet reliability requirements.

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[1] SoCalGas customers are categorized into two major groups:

- Core Customers: residential, small commercial and some large commercial customers.
- Noncore Customers: high volume consumers such as industrial customers, refineries, and electric power plants. Noncore customers are small in number about 1000 in total. However, these noncore customers consume roughly 60% of the gas delivered on the SoCalGas system.

The recommended inventory level considers several factors.

- A CPUC mandated level of 2.225 Bcf/day system wide withdrawal capacity for reliability necessitates an inventory of 5 Bcf at Aliso to provide the pressure necessary to meet the withdrawal capacity requirement.
- The 15 Bcf level recognizes that the operational performance of a storage field at very low levels of inventory is not known and that the amount leaked is not known with certainty.
- Based on an analysis maximizing withdrawals from non-Aliso storage fields and considering winter conditions experienced in February – March 2015 it is likely that 4.1 Bcf will need to be drawn from the field to reduce the chance of curtailments through the remainder of this winter.
- The same analysis applied to summer indicated that an additional 5 Bcf will be needed to limit curtailments during summer.

Analysis of the full impact on the electric system if storage from Aliso is not available is ongoing. However, initial studies indicate that even with 15 Bcf in storage now, as the 15 Bcf is drawn down over the course of the summer, it will be increasingly difficult for SoCalGas to respond to increases in electric generation demand and therefore likely that electric generation in the LA Basin relying on gas from Aliso Canyon will be curtailed.

BACKGROUND

Since October 25, 2015, no natural gas has been injected into the Aliso Canyon storage natural gas storage facility. The operator of this facility, Southern California Gas Company (SoCalGas), has been further directed not to inject gas into the storage facility until a safety review of the facility has been completed.

For several weeks during the gas leak, SoCalGas was directed to maximize daily withdrawals of gas at the Aliso Canyon facility to reduce gas pressure in the underground facility, which in turn reduced the rate of the gas leak.

On January 21, 2016, SoCalGas was ordered by the CPUC Executive Director to reduce the amount of working gas inventory levels at Aliso Canyon to 15 Billion cubic feet (Bcf) and then hold the gas inventory at this level in order to meet energy reliability requirements for customers in the Los Angeles Basin. If daily withdrawals of natural gas from Aliso Canyon had continued at their current pace below 15 Bcf, it was projected that reliability of service to

noncore customers would be impacted by the middle of February, and eventually, even core gas reliability could be affected.

Natural gas supplies delivered into the Los Angeles basin through transmission pipelines and gas supplies provided by Aliso Canyon storage facility are both necessary to meet energy demand for 11 million customers in the Los Angeles Basin. Currently, the Aliso Canyon storage facility is essential to the overall reliability of both the gas and electrical systems, and it is uniquely critical to meet peak summer demand for electricity through providing gas supplies to gas-fired power plants in the Los Angeles Basin.

The SoCalGas system consists of a pipeline system (Backbone Transmission System) and storage facilities. Most of SoCalGas' gas supply (90%) originates outside of California largely from production basins in Texas, New Mexico, and the Rocky Mountains. Gas from these regions is delivered via interstate pipelines into SoCalGas' Backbone Transmission System. This 'flowing supply' is moved throughout the system to serve current customer demand and/or moved into storage. Gas inventory in storage facilities is then used when demand exceeds the flowing supplies provided through the Backbone Transmission System. Gas from storage facilities is also used to provide rapid, hour-by-hour demand of gas-fired electric-generating plants or when pipeline maintenance or repair restricts the availability of flowing supply.

SoCalGas' system-wide demand for gas supplies is highest in the winter—reflecting gas needs for heating buildings, hot water and cooking. The current system is designed to standards that allow it to meet a defined level of peak demand that may occur on particularly cold or hot days. When these periods of peak demand occur, the weather driving this peak demand is usually not limited to Southern California but is generally regional. Consequently, competition for flowing gas supplies, which might otherwise flow into California, increases as gas is needed in other areas of the country. Additionally extreme cold weather in the producing basins triggers a reduction in gas production in those basins, so incremental supplies may not be available to Southern California. In these circumstances, storage is used to meet the peak demand in Southern California.

Aliso Canyon is an integral part of the SoCalGas system and is essential for meeting demand in the Los Angeles Basin. Limited use or loss of Aliso's storage capacity under normal conditions can be supplemented in the short term using increased flowing supply and, to a limited extent, the Honor Rancho storage facility. *However, Aliso Canyon storage is the only source available to meet the gas supply needed for gas-fired electric generators in Los Angeles Basin during summer hot days when electric demand increases to meet cooling needs (air conditioning, etc.).* These gas-fired electric plants require a rapid increase in gas supply when demand peaks. Because natural gas can flow through pipelines only at rates between 20 and 30 miles per hour, flowing supplies through pipelines into the Los Angeles Basin cannot respond in time to electric-

generation demands on peak days. Storage gas located close to the generating plants at Aliso Canyon is the only alternative. 18 gas-fired electric plants located in the Los Angeles Basin rely on Aliso Canyon storage during these periods. The plants' combined capacity is 9,838 megawatts.

Figure 1 Electric Generation Plants Served by Aliso Canyon

CORE VS. NONCORE GAS CUSTOMERS

The distinction between core and noncore customers can be characterized based on their type and on where the responsibility lies for the reliability of their supply. Core customers are residential homes, small commercial buildings and operations, and small industrial customers. Core customers represent over 80% of SoCalGas' customers. SoCalGas is responsible for the reliability of Core customers' gas supply; so SoCalGas must ensure that there is sufficient gas available to meet core customer needs as defined by reliability standards. Core customers are to be the last customers to be curtailed in the event that there is insufficient supply in the system. It is important to note, that it can take multiple days to restart gas service to core customers if their gas service is interrupted. For safety reasons, restarting gas service to

buildings requires relighting pilots and restarting gas appliances on building-by-building basis and this process can take several days.

Noncore customers consist of large industrial and commercial customers and non-industrial/commercial customers including hospitals, electric generators (power plants), and oil refineries. These businesses have the final responsibility for their own gas supply. When the curtailment of gas supplies becomes necessary because demand for gas exceeds available supplies, noncore customers, specifically electric generation facilities, are curtailed in rotation with other noncore customers including refineries.

On a peak demand day in winter, core customers are responsible for most of the gas demand in SoCalGas' service territory. Out of the 5.077 Bcf/day of forecasted demand on the peak 2016 winter day, 60% (3.050) of demand is expected come from core customers, 20% (1.031) of demand comes from electric generation facilities, and the remaining 20% (.996) will be driven by the remaining noncore customers such as refineries.

Table 1 Forecasted 2016 Winter Peak Demand

Customer	2016 Forecasted Peak Demand	% of Peak Demand
Core	3.050 Bcf	60%
Electric Generation	1.031 Bcf	20%
Noncore, not electric	.996 Bcf	20%
Winter Total	5.077 Bcf	100%

In the summer, the demand profile flips. Based on SoCalGas' 2016 peak summer forecasts, the peak demand in the summer for natural gas will be 3,211 Bcf/day. 61% of the peak demand comes from electric generation facilities.

Table 2 Forecasted 2016 Summer Peak Demand

Customer	2016 Forecasted Peak Demand	% of Peak Demand
Core	.634 Bcf	20%
Electric Generation	1.943 Bcf	60%
Noncore, not electric	.634 Bcf	20%
Summer Total	3.211 Bcf	100%

CURRENT ALISO CANYON OPERATIONS AND WITHDRAW

Under direction from the CPUC and the Division of Oil, Gas and Geothermal Resources (DOGGR), SoCalGas withdrew the maximum amount of gas technically feasible on a daily basis during the Aliso Canyon gas leak. From December 22, 2015, through January 18, 2016, daily withdrawals were at an average rate of 1.15 Bcf/day.

Table 3 Average daily SoCal gas Aliso withdrawals by week in billion cubic feet (Bcf)

	Week of:			
Measure	12/22-12/28/15	12/29-1/4-16	1/5-1/11/16	1/12-1/18/16
Avg. Daily Withdrawal	1.17 Bcf	1.29 Bcf	1.2 Bcf	.9 Bcf

According to SoCalGas, as of January 23, 2016, Aliso working gas inventory was at 15 Bcf. This number is based on the volume of gas that SoCalGas reported was withdrawn from the facility as of that date plus the approximately 5 Bcf that ARB estimates leaked by that period.

VOLUME OF GAS IN THE FIELD IMPACTS THE ABILITY TO WITHDRAW GAS

The amount of gas that can be withdrawn from the Aliso Canyon facility on a daily basis is impacted by the amount of gas inventory in the underground facility, as this inventory provides the pressure needed for withdrawals. As the inventory in the storage facility declines, less gas can be withdrawn on a daily basis. Based on SoCalGas' modeling of withdrawal capacity at Aliso Canyon, the maximum daily withdrawal rate of 1.5 Bcf/day begins to decline when working gas storage inventory reaches 37 Bcf and declines to a rate of .540 Bcf/day as the inventory approaches zero.

If the inventory level at Aliso Canyon falls too far and the daily withdrawal capacity correspondingly falls to very low levels, the ability of SoCalGas to deliver gas to its customers in periods of peak demand is threatened. Insufficient flowing supplies via pipelines, coupled with low daily withdrawal capacity from storage, could require SoCalGas to curtail service to its customers. As explained above, such curtailments would first be made to noncore customers and core customers would be curtailed as a last resort.

Because electric generators are noncore customers, the impact of such a curtailment on electric reliability must be considered as well.

CAPACITY OF "FLOWING GAS" THROUGH BACKBONE PIPELINES

On most days, the majority of the demand for natural gas is met through "flowing gas" that comes through SoCalGas' Backbone Transmission System. This system has the *design capacity* to import up to 3.875 Bcf/day. However, it is rare that flowing supplies can actually exceed 3 Bcf/day due to maintenance needs of the pipelines, insufficient gas being imported into California.

PLANNING FOR RELIABLITY

PLANNING FOR CORE CUSTOMERS

During the winter months of November through March, SoCalGas plans to meet its entire *core* load using a 1-in-35 standard.

Using a 1-in-35 peak day standard during the winter season (November through March), SoCalGas determines, based on historical data, the pipeline and storage infrastructure needed to meet core customer demand on the coldest day expected in a 35-year period. Because the peak day demand number is weather driven, the need varies by month. That is, in January the 1-in-35 year peak would occur when system-wide average temperatures are at 41 degrees; in warmer months the temperature is higher and the corresponding demand lower (Table 4).

Table 4 1-in-35 Day Standard: Temperatures and Core Loads

Month	Temperature	Core Load (Bcf/day)
January	41	3.353
February	43	3.102
March	46	2.863

PLANNING FOR ALL CUSTOMERS (CORE AND NONCORE)

During the winter months, SoCalGas designs its pipeline and storage infrastructure to meet all customers' demand, including noncore demand, using a 1-in-10 year cold day peak demand standard. However, the utility does not have the obligation to procure any gas on behalf of noncore customers.

This standard determines the amount of pipeline and storage infrastructure capacity needed to serve all customers' gas requirements on the coldest day expected in ten years. The standard is

calculated in a manner similar to that used to calculate the 1-in-35 year standard. Table 5 presents the 1-in-10 year temperatures and loads.

Table 5 1-in-10 Year Peak Demand Temperatures and Peak Load

Month	Temperature	Total Load: Noncore plus Core Load (Bcf/day)
January	43	5.293
February	46	5.047
March	48	4.829

Using these standards, SoCalGas makes plans necessary to meet demand in the using a combination of flowing gas and storage gas.

SUMMER PLANNING

Summer demand for natural gas is somewhat less than winter demand, since less gas is needed for heating purposes. SoCalGas projects summer "high sendout" demand (analogous to winter "peak day" demand) in 2016 for all customers, core and noncore, to be 3.211 Bcf/day. This 3.211 Bcf/day falls well within the 1-in-10 design standards for the system; furthermore, the total system demand is typically well within the system capacity.

While daily peak demand in summer is less than in winter, electric generation needs in the Los Angeles Basin creates rapid localized peaks in demand. The electric generation demand in the Los Angeles basin frequently results in peak hourly demand over portions of the day that are substantially higher than the rate reported for the entire day. These hour-by-hour spikes in demand require a rapid supply of gas to power plants that is able to be provided only through withdrawals from Aliso Canyon. As discussed previously, since natural gas moves through the pipelines between 20 and 30 miles per hour, it is not possible to import gas by pipeline from outside the Los Angeles basin to the electric plants in time to meet the electricity system's needs for quick ramping of these electrical generation facilities.

HOW STORAGE HELPS WITH RELIABILITY

Gas stored at Aliso Canyon helps to meet gas system demand when overall demand exceeds the capacity of interstate pipelines to bring gas into the Los Angeles Basin. Storage can also be critical when capacity of the gas Backbone Transmission System is limited due to maintenance or reduced interstate gas flows. In the summer of 2015, backbone capacity to deliver gas into

the Los Angeles Basin was severally limited due to planned repairs, which are often required for safety reasons. Similar repairs are planned for this summer, and delaying these repairs could create other safety and operational risks.

As previously discussed, storage can also be critical to meeting sudden spikes in local demand such as when a large electric generator begins operation to meet local electrical demand. The close proximity of Aliso Canyon storage to gas-fired power plants in the Los Angeles Basin allows use of Aliso Canyon storage gas to respond quickly to the short-term spikes in demand that often cannot be met on a timely basis by flowing supplies.

STORAGE HELPS MITIGATE FLUCTUATIONS IN GAS PRICES

The utility and noncore customers can also use gas storage to purchase gas at times when spot markets for gas are low and then withdraw gas from storage when spot market prices increase. Large inventories of gas in storage also create diversity and supply that helps reduce spot market prices when there is increased national demand for gas. Because Aliso Canyon is the largest storage facility in Southern California, changes in operation at the facility could have long-term impacts on spot market prices for natural gas and gas and electric rates for retail customers.

CONSEQUENCES OF REDUCED STORAGE OPERATIONS

Historical data demonstrates that withdrawals from Aliso Canyon have been regularly used to meet Los Angeles basin demand—particularly when flowing supplies through pipelines are constrained and when electric demand peaks and triggers the need for rapid dispatch of gas supply to electrical generators within the Los Angeles Basin.

As Table 6 shows, from 2012 to 2015, SoCalGas withdrew gas from Aliso Canyon to meet demands on most days in the winter and on almost half of the days during summer. If SoCalGas had continued to withdraw gas from Aliso Canyon at continued withdraw rates below 15 Bcf, there would be no capacity to withdraw gas during the late winter into the summer. Without that withdraw capacity, significant risk exists that noncore customers will be curtailed if severe weather occurs.

Table 6 Average Number of Days per Month (winter months shaded) with Withdrawal from Aliso Canyon, 2012-2015

Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg.	31	28	18	7	3	5	13	18	12	12	26	31

No. of Days												

Further, if abnormally hot weather occurs in Southern California, the further reduction of gas supplies from Aliso Canyon below 15 Bcf further jeopardizes SoCalGas' capability to respond, even in a limited manner, to peaks in electric demand met by gas-fired electric generation this summer. Table 7 provides a list of electric generators who are served by the storage supply at Aliso.

Table 7 Los Angeles Basin Gas Fired Electric Generation Plants

	Electric Generation Station
1	LADWP Haynes Generation Station
2	LADWP Scattergood Generation Station
3	LADWP Valley Generation Station
4	LADWP Harbor
5	SCE Alamitos Toll
6	SCE Huntington Beach Generating Station
7	SCE Redondo Beach
8	SCE Barre Peaker
9	SCE Center Peaker
10	El Segundo Energy Center, LLC
11	El Segundo Power, LLC
12	Long Beach Generation, LLC
13	City of Glendale
14	City of Burbank
15	City of Pasadena
16	City of Anaheim - Canyon Power
17	City of Vernon - Malburg
18	Southern California Public Power Authority – Magnolia

RECOMMENDATION

A minimum working gas inventory level of 15 Bcf should be maintained at Aliso Canyon.

This inventory level provides the withdrawal capacity needed to maintain the core reliability standard and should help avoid or limit the potential for curtailments to noncore customers over the remainder of the winter period and through the summer season; i.e., April through October of 2016.

SoCalGas has *design capacity* sufficient to bring a maximum of 3.875 Bcf/day into its system through pipelines into the LA Basin when all of that capacity is available. However, as previously discussed, in recent years this full capacity has not been available. At 15 Bcf in storage, the withdrawal capacity of Aliso Canyon is approximately 0.888 Bcf/day and the withdrawal capacity from the other fields (Honor Rancho, La Golita, and Playa del Ray) is 1.700 Bcf/day. This means, in the *best of circumstances***,** SoCalGas could meet a demand of 5.580 Bcf/day. That corresponds to 5.047 Bcf/day peak demand on a 1-in-10 day in February and a 4.829 Bcf/day peak demand in March.

During summer months under ideal conditions, there is sufficient capacity to meet demand with the 15 Bcf remaining in Aliso *except* on these days when gas-fired electric generation in the LA Basin requires withdrawals at a rate in excess of .888 Bcf/day. On those days, a requirement for any part of the day that gas be withdrawn from Aliso at a rate greater than a withdrawal capacity of .888 Bcf/day will not be met. Furthermore, this .888 Bcf/day capacity level will decrease as withdrawals lower the 15 Bcf working inventory in Aliso. Historically, peak electric generation demand in the LA Basin during the summer has required as much as a 1.5 Bcf/day capacity rate over multiple days.

IMPACT ON CORE CUSTOMERS

SoCalGas' first responsibility is to provide service to its core customers.

Storage withdrawal capacity of 2.225 Bcf/day has been allocated and determined by the Commission (D.07-12-019) to be needed to meet the 1-in-35-year standard for core customers in the combined SoCalGas/SDG&E system. SoCalGas' wholesale customers, Southwest Gas, and the City of Long Beach also have core customers. Serving these customers requires an additional amount of withdrawal capacity of .067 Bcf/day. This brings the total core requirement to 2.292 Bcf/ day to provide all core customers reliably at the 1-in-35 year standard. Of this amount, only 1.650 Bcf is available through non-Aliso SoCalGas storage

facilities in the LA Basin. Thus, a withdrawal amount of .642 Bcf is needed from Aliso Canyon to meet a 1-in-35 event.

Table 8 Withdrawal Capacity Needed at Aliso to meet 1-in-35 Core Reliability Standard

Core Customer Need	Bcf/**Day**
SoCalGas/SDG&E	2.225
Other Core Customers	0.067
System Total	2.292
Sources	
Non Aliso Storage	1.65
Needed from Aliso	0.642

CPUC Energy Divisions' calculated level of inventory needed to provide for the withdrawal capacity from Aliso to meet the 1- in-35 winter standard is 5 Bcf. SoCalGas calculated approximately 4 Bcf. SoCalGas notes that it rarely operates at this low an inventory level and is concerned that leak mitigation efforts may have degraded the performance of the field. Based on this, SoCalGas indicated that it would be prudent that an additional 5 Bcf remain in storage (for a total of 10 Bcf).

Further, while 5 Bcf in working inventory is needed to provide the withdrawal capacity to meet the 1-in-35 standard this amount does not consider impact of potential drawdowns through the winter months nor does it consider potential needs for working gas inventory beyond March; i.e., during the Summer months.

A further analysis of winter and summer inventory needs was conducted considering what levels would be needed if the demand and pipeline gas receipts patterns of 2015 were repeated in 2016. The analysis maximized the use of other SoCalGas system storage facilities to substitute for the loss of capacity at Aliso Canyon. The results indicate that approximately 4.1 Bcf would need to be drawn from Aliso for the remainder of January through March, the end of the winter season, and undermined amounts of gas would continue to leak from the field. The analysis also indicates that approximately 4.9 Bcf additional supply would need to remain in inventory to meet summer demand.

Table 9 Aliso Withdrawals Needed based on 2015 Demand and Maximum Withdrawal from Non-Aliso Storage

Season	Month	Withdrawal (Bcf)
Winter	January (22 - 31)	1.061
	February	0.415
	March	2.569
Total		4.045
Summer	April	0.000
	May	0.000
	June	0.913
	July	1.638
	August	2.165
	September	0.000
	October	0.257
Total		4.973
Total 1/22/16 - 10/31/16		9.018

IMPACT ON NONCORE CUSTOMERS

While SoCalGas' first responsibility is to provide service to its core customers, it is critical to support the noncore customers who include electric generation, refineries, hospitals, large industrial customers, etc.

Based on current conditions throughout the system and considering supplies, it is reasonable to expect that 3 Bcf/day will be the upper limit of what can be delivered into the SoCalGas basic pipeline system. Given this expectation, it would be necessary to rely on storage withdrawal from Aliso Canyon in the amount of 2.3 Bcf/day in order to meet the 1-in-10 winter demand. In the summer, it would be necessary to rely on storage withdrawal in order to meet the 1-in-10 peak electricity demand. During summer months, the key role of storage withdrawal is to be able to respond quickly to electric generation demand and to provide high levels of supply over the relatively-short, hourly periods needed to meet peaks in demand.

As Aliso Canyon inventory declines and gas ceases to be available from Aliso as a readily-available source, it becomes increasingly difficult to guarantee that SoCalGas can meet reliability standards. As a result, there is a greater likelihood that curtailments of noncore customers will occur. This likelihood increases during very cold winter events when supplies

may not be available to ship to California or in hot summer months when there is increased electric demand.

Thus, reliability of supply for core and noncore customer needs to be addressed. Considering both the winter inventory needed to maintain withdrawal capacity and the supply needed to maintain reliability for core customers and to limit the probability of deep curtailments through the summer, a working gas inventory at Aliso Canyon of 10 Bcf is indicated. However, we agree with SoCalGas, without reservation, that an additional 5 Bcf is prudent and indeed necessary to assure core customer reliability**.** Based on this, we recommend maintaining a working gas inventory level of 15 Bcf. This 15 Bcf level accommodates the operational uncertainty, the high level of uncertainty concerning the amount of leaked gas, and the risk associated with increased reliance solely on flowing supplies.

Further, we recommend that this inventory level not be reduced, other than to meet needs that cannot be met through flowing supply through October, the end of the summer season. This level will reasonably provide for core reliability and moderate the risk of curtailments to noncore customers. It should be noted however that summer noncore curtailments remain a risk. In particular, there is a risk of curtailments to electric generators in the LA Basin who require the rapid supply response available only from Aliso. Other storage facilities cannot be used to meet quick ramp ups in demand caused by electric generation demand in the LA Basin. As the 15 Bcf inventory level gets drawn down, the ability of Aliso Canyon to meet this demand will be reduced. The state's energy agencies (CPUC, CEC and CAISO) are working closely with LADPW, SoCalGas, and SCE to develop a reliability action plan to address any summer reliability risks.