# Aliso Canyon Action Plan to Preserve Gas and Electric Reliability for the Los Angeles Basin

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




# Aliso Canyon Action Plan to Preserve Gas and Electric Reliability for the Los Angeles Basin

## Table of Contents

# Aliso Canyon Action Plan to Preserve Gas and Electric Reliability for the Los Angeles Basin

## Executive Summary

Several actions are underway to respond to the major natural gas leak that occurred at the Aliso Canyon Natural Gas Storage Facility on October 23, 2015. With the leak now stopped, there is a moratorium that prohibits the operator of the facility, Southern California Gas (SoCalGas), from injecting natural gas into the underground reservoir until a comprehensive safety review of the facility is completed. This safety review requires that all 114 wells in the facility are either thoroughly tested for safe operation or removed from operation and isolated from the underground reservoir.

The implementation of these safety measures means that the Aliso Canyon facility is not operating as it normally does to provide gas for the energy demands in the Greater Los Angeles area. Only 15 billion cubic feet of natural gas remains in the Aliso Canyon underground reservoir—less than one-fifth of the capacity of the facility—for use to maintain electrical and gas service in the region if it is needed.

The Aliso Canyon facility has operated for decades as a critical part of the natural gas transmission and distribution system in the Los Angeles region. Aliso Canyon provides gas supplies to 11 million customers for home heating, hot water and cooking fuel. The facility also provides gas supplies to natural gas-fired power plants that play a central role meeting regional electrical demand. Aliso Canyon is critical to meeting peak gas usage demands in winter months and helping to meet peak electrical demands during the summer months. Gas supply from Aliso Canyon has never before been constrained at current levels, which introduces uncertainty and concerns regarding energy reliability in the Greater Los Angeles area.

Four energy agencies came together to assess possible impacts to electrical service during the summer months recognizing that the current situation at Aliso Canyon threatens energy reliability. The California Energy Commission (Energy Commission), California Public Utilities Commission (CPUC), California Independent System Operator (California ISO) and the Los Angeles Department of Water and Power (LADWP) collaborated to develop a technical assessment of energy impacts stemming from the current gas supply limitations of Aliso Canyon. Technical staff from these four entities joined with staff from SoCalGas in a Technical Assessment Group to conduct an engineering analysis that details potential energy impacts in the coming summer months.

The Technical Assessment Group finds that Aliso Canyon plays an essential role in maintaining both natural gas and electric reliability in the greater Los Angeles area. As a result, the limited current operations of the facility create a distinct possibility of electricity service interruptions in the coming summer months. The engineering analysis, which applied complex industry standard hydraulic modeling to simulate operations on the SoCalGas system suggests that without any gas supply from Aliso Canyon, there are 14 days this coming summer during which gas curtailments could be high enough to cause electricity service interruptions to millions of utility customers. Factors leading to gas curtailments, even

on days with only moderately high demand, include differences between gas scheduled and received into the SoCalGas system (receipts) versus actual customer demand (sendout) as small as 0.15 Bcf; gas storage and pipeline maintenance work planned for this summer, and unplanned outages.

Using the 15 billion cubic feet of gas currently stored at Aliso Canyon as directed by the CPUC and taking several other actions described below can reduce – although not eliminate – the possibility of these electric interruptions. It is also important to note that, using most or all the gas remaining in Aliso Canyon during this summer would result in greater risk of shortages next winter if normal operations of the facility are not restored in time to store new gas there for winter use. The Technical Assessment Group will present in the near future an analysis of energy reliability challenges for the upcoming winter in the event of continued constrained operations at Aliso Canyon.

The technical assessment of potential energy impacts informed the development of a joint Draft Action Plan by the four energy agencies to preserve electrical reliability in the coming summer months in the greater Los Angeles area, which is described in this document. The Action Plan identifies actions to reduce the risks of gas curtailments this summer, including using the current supply of 15 billion cubic feet stored in Aliso Canyon during periods of peak demand to avoid electrical interruptions, directing all shippers to closely match their scheduled gas deliveries with their actual demand every day, and asking customers to use less energy. This Reliability Action Plan represents intense coordination among the state's utility regulator, energy planning agency, SoCalGas and the electric balancing authorities to develop plans trying to preserve reliability for electrical service over the coming several months.

This Draft Action Plan proposes implementation of 18 specific measures to reduce the possibility of electrical service interruptions this summer. These measures will reduce, but not eliminate, the risk of gas curtailments large enough to cause electricity interruptions. The measures themselves are not cost-free. Some require regulatory approval; including potentially by the Federal Energy Regulatory Commission. The measures fall into five major categories: efficient use of Aliso Canyon, noncore gas tariff changes, greater operational coordination, LADWP-specific measures, and measures aimed at reducing natural gas and electricity consumption. The detailed measures are listed below in order of relative importance in reducing risk and impact of curtailment.

Table ES-1: Summary List of Mitigation Measures

| Category | Mitigation Measure |
|---|---|
| Prudent Aliso Canyon Use | Utilize the 15 Bcf Currently Stored At Aliso Canyon to Prevent Summer Electricity Interruptions |
| | Efficiently Complete the Required Safety Review at Aliso Canyon to Allow Safe Use of the Field |
| Tariff Changes | Implement Tighter Gas Balancing Rules |
| | Modify Operational Flow Order Rule |
| | Call Operational Flow Orders Sooner in Gas Day |
| | Provide Market Information to Generators Before Cycle 1 Gas Scheduling |
| | Require California ISO Generators to Show Gas Lined UP before Bid into Day-Ahead Electricity Market |
| Operational Coordination | Increase Electric and Gas Operational Coordination |
| | Establish More Specific Gas Allocation among Electric Generators In Advance of Curtailment |
| | Determine if Any Gas Maintenance Tasks Can be Safely Deferred |
| LADWP Operational Flexibility | Curtail Physical Gas Hedging |
| | Stop Economic Dispatch |
| | Curtail Block Energy and Capacity Sales |
| Reduce Natural Gas and Electricity Use | Use New and Existing Programs s Asking Customers to Reduce Natural Gas and Electricity Energy Consumption |
| | Expand Gas and Electric Efficiency Programs Targeted at Low Income Customers |
| | Expand Demand Response Programs that Target Air Conditioning and Large Commercial Use |
| | Focus and Reprioritize Existing Energy Efficiency Towards Projects with Potential to Impact Usage this Summer and Coming Winter |
| | Reprioritize Spending in Existing Solar Thermal Program to Fund Projects Installable this Summer and by end of 2017 |

## Introduction

On October 23, 2015, a significant natural gas leak in well SS25 was detected at the Aliso Canyon natural gas storage facility owned by Southern California Gas Company (SoCalGas). The facility is near the community of Porter Ranch, in the north end of the San Fernando Valley. Numerous attempts to "kill" – plug up – the well and stop the leak in November and December 2015 failed. In the meantime, SoCalGas withdrew gas from the field in hopes of increasing the success of further kill and to reduce the rate of the leak. The California Energy Commission (Energy Commission), the California Public Utilities Commission (CPUC), and other state agencies including the Department of Conservation's Division of Oil, Gas and Geothermal Resources (DOGGR), and the Governor's Office of Emergency Services, as well as the California Independent System Operator (California ISO), worked to assess potential impacts to natural gas and electricity reliability, recognizing that the storage field could be out of service or available only at reduced capacity for some period.

Governor Edmund G. Brown Jr. issued an Emergency Proclamation[1] on January 6, 2016, acknowledging the significant and ongoing impacts of the well leak on the local community. The Proclamation noted the response had included "months of regulatory and oversight action from seven state agencies mobilized to protect public health, oversee Southern California Gas Company's actions to stop the Aliso Canyon leak, track methane emissions, ensure worker safety, safeguard energy reliability and address any other problems stemming from the leak." The proclamation specifically called on the Energy Commission, CPUC, and the California ISO to work together and "take all actions necessary to ensure the continued reliability of natural gas and electric supplies during the moratorium on gas injections into Aliso Canyon."

The Energy Commission, CPUC, and the California ISO replied to Governor Brown's Emergency Proclamation with a letter on February 1, 2016, in which they committed to work together with a sense of urgency to identify and address potential threats to reliability that might arise during the time that Aliso Canyon is unavailable or available at less than full capacity. This effort is similar to the effort undertaken by these same agencies when the San Onofre Nuclear Generating Station (San Onofre) unexpectedly closed. The two agencies and California ISO committed to completing an assessment by April 2016 of the reliability risks for summer 2016 and present a plan for addressing them. The agencies and California ISO were joined by the Los Angeles Department of Water and Power (LADWP). LADWP performs its own balancing of electricity loads and resources along with some other municipal utilities in the LA area, and as such is not a member of the California ISO.

The nexus between the gas and power systems in the Los Angeles Basin (L.A. Basin) is complex. A technical assessment must consider the constraints on gas deliveries, system operations features, rapid changes in electricity demand that occur every day, and electric transmission constraints that limit electricity imports into the area. Given these complexities, reliability planning for the two sectors combined requires an in-depth explanation into operational nuances and detail that even many experts do not have easily at hand using data that are often held confidentially, sometimes for business reasons and sometimes for critical infrastructure security reasons. SoCalGas has long used Aliso Canyon as a critical component of the natural gas transmission and distribution system it uses to provide gas service. This natural gas serves both "core" customers—homes and small businesses—and "non-core" customers – which includes large customers like hospitals, local governments, oil refineries and 17 large natural gas-fired power plants. With much of the necessary natural gas system data held solely by SoCalGas, the California ISO invited the gas company to join a task force to perform and review the required reliability analysis and help explore mitigation measures. The Technical Assessment Group worked over several weeks, developing the analysis assumptions, subjecting the results to hours of review, and assessing the ultimate impact on electricity operations for power plants within both the California ISO and LADWP balancing areas.

The action Plan begins with a background discussion about the natural gas system in southern California. A summary of the risk assessment follows, additional details of which are described in the Technical

1 For the Proclamation see https://www.gov.ca.gov/news.php?id=19264

Assessment Group's report accompanying this Action Plan. The Reliability Action Plan describes the mitigation measures and next steps for implementation of the mitigation measures and analyses that need to be launched for winter 2017 and beyond.

## Background

Understanding the rationale for the mitigation measures and the importance of Aliso Canyon requires providing some background about the natural gas system in southern California. It also requires knowledge of natural gas customer types and the associated tariff rules and operating procedures and planning that govern their service. This section also provides background information about LADWP's natural gas requirements and its alternatives to in-basin gas-fired generation in the short term.

### *Gas System Operating Characteristics*

SoCalGas bills 5.7 million accounts, translating to 22 million customers, 11 million of which are within the L.A. Basin. To serve those customers, SoCalGas owns and operates high-pressure gas pipelines (known as the "backbone transmission system") that can accept as much as 3.875 Billion Cubic Feet per day (Bcf per day) of natural gas from several pipelines that connect California to gas producing areas. Those gas producing areas are often hundreds of miles away, in New Mexico, Texas or the Rocky Mountains (primarily Wyoming).[2] The general configuration of SoCalGas' system is shown in Figure 1.

Some of the gas delivered via the backbone transmission system flows directly to customers. The remainder, however, is injected into one of SoCalGas' underground gas storage fields (Aliso Canyon, Honor Rancho, La Goleta or Playa del Rey) for later use. Before the situation at Aliso Canyon, the four storage fields could deliver as much as 3.8 Bcf per day, with Aliso Canyon alone being able to deliver 1.9 Bcf per day. Winter demand, can be as high as 5.1 Bcf per day on a peak day with several days more than 4 Bcf per day.[3] These winter demands are higher than the 3.875 Bcf per day that SoCalGas can take from the pipelines bringing gas into its system from gas producing areas.[4] Gas storage is therefore essential to meeting winter natural gas demand.

**Table 1: SoCalGas Underground Gas Storage Fields Key Operating Characteristics**

| Field | Location | Connects To | Working Gas Maximum Inventory (BCF) | Withdrawal (BCFD) | Injection (BCFD) |
|---|---|---|---|---|---|
| Aliso Canyon | San Fernando Valley | LA Loop | 86.2 | 1.9 | 0.4 |
| Playa del Rey | Marina del Rey | LA Loop | 1.8 | 0.4 | 0.2 |
| Honor Rancho | Santa Clarita | Backbone North | 27.0 | 1.0 | 0.07 |
| La Goleta | Santa Barbara | Coastal | 20.2 | 0.4 | 0.2 |
| TOTAL | | | 136.1 | 3.8 | 1.1 |

Source: Direct Testimony of Philip E. Baker on Behalf of SoCalGas in CPUC A.14-11-004, p. 5

2 Only 10 percent of the supply is produced in California. Some can also come from Canada.

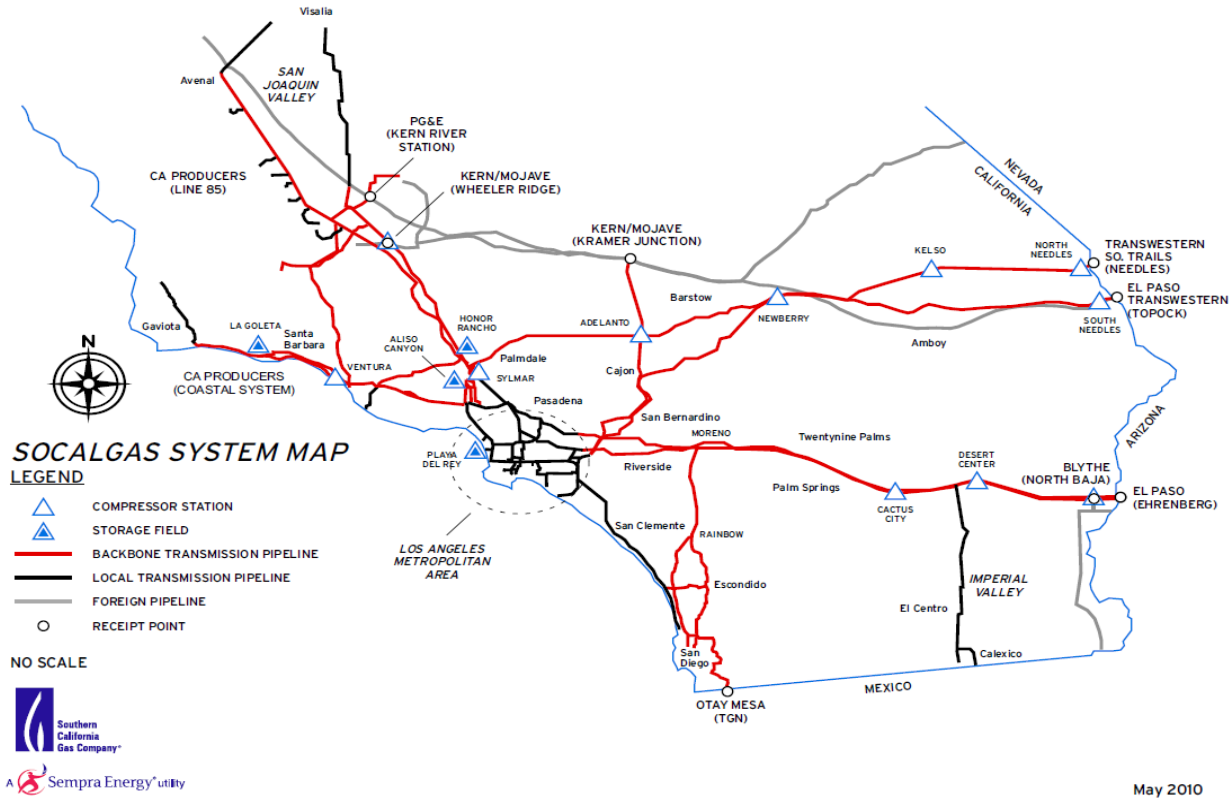
3 See 2014 *California Gas Report*, p. 90.

4 This is also true for the Pacific Gas and Electric system: both require use of gas in storage to meet winter gas requirements.

Gas storage, specifically gas from Aliso Canyon, is also essential to meeting summer demand. Aliso Canyon and Playa del Rey are the only two fields inside the L.A. Basin and are on the lower pressure local transmission system (sometimes referred to as the "L.A. Loop"). Gas can come into the Basin but cannot overcome the higher pressure of the Backbone Transmission System to leave the Basin. In addition, when there is not enough gas coming into SoCalGas' system to meet all demand, SoCalGas allows the flowing gas supply to stay on the Backbone Transmission System to meet demand there and pulls gas from Aliso to meet demand in the L.A. Loop.

SoCalGas particularly pulls from Aliso to meet hourly demand changes. Natural gas wells and long distance transmission pipelines flow natural gas at a constant hourly rate. Given the small size of Play del Rey, and the facts that Honor Rancho is several hours of flow farther away and La Goleta is too far away and only marginally connected to the L.A. Loop, Aliso Canyon is the only storage field available to support hourly operating changes within the LA Basin. This makes the Aliso Canyon storage facility essential to the overall reliability of both the gas and electrical systems (especially but not solely within the L.A. Basin), and uniquely critical to meet gas demand in the summer months. Summer gas demand is driven by demand for electricity and can display large and rapid swings in gas demand.

**Figure 1: Southern California Gas Company Natural Gas Transmission System**[5]




5 Source: Southern California Gas Company

Furthermore, there are many days that the full 3.875 Bcf of pipeline capacity is not available due to maintenance or unplanned outages.

Even on days when the 3.875 Bcf of pipeline capacity is available, less than 3.875 Bcf gas may flow into the system if weather patterns in regions east of California drive up gas demand in those regions and gas is diverted to meet their demand. Extreme cold weather in the producing basins can also trigger a reduction in gas production in those basins, as the liquids freeze in wellheads or gas gathering pipelines. Sometimes both these events occur together, with cold causing higher demand and reducing production. Either means that Southern California cannot count on 3.875 Bcf per day of gas supply flowing in from upstream sources and SoCalGas must withdraw gas from storage to meet demand.

It is also possible that even when the 3.875 Bcf of pipeline capacity is available and there are no weather issues to the east, the pipeline still will not be full. As will be explained fully later in this section, noncore customers who are responsible for purchasing and scheduling transportation of their own gas supply do not have to bring in enough supply each day to cover their usage.

Use of the storage capacity at Aliso under normal conditions can be supplemented, to a limited extent, using increased flowing supply delivered via pipelines or from the Honor Rancho storage facility. However natural gas flows through high pressure pipelines only at a rate of about 25 to 30 miles per hour, and closer to 20 miles per hour on lower pressure pipelines. This means that flowing gas supplies, that is, those that come into the LA Basin from the supply areas that are hundreds of miles away, cannot respond in time to hourly changes in electric-generation demand. But even more important to this equation is that on most days there are differences, known as "imbalances," between the quantities of gas that large customers schedule for delivery into SoCalGas' system versus what they actually use.[6] The lower pressure gas pipeline system within the L.A. Basin does not have enough of what is known as "pack and draft" capability to match supply with demand each hour.[7] Storage gas inside the L.A. Basin is the only way, today, to match supply with demand.[8]

Today, there are 17 major gas-fired electric plants in the LA Basin. As can be seen in Figure 2, many are near the southern end of the Basin. These plants have a combined capacity of 9,838 megawatts (MW). The Energy Commission has calculated that 1 MW serves about 1,000 homes. All 9,838 MW don't all operate every day, but most of this capacity operates on hot days, when electricity demand rises to

6 More about how the natural gas industry "schedules" gas deliveries the day ahead of use appears further below.
7 If supply exceeds demand, operating pressures could increase above acceptable and safe tolerances and ultimately could have to be vented to the atmosphere to prevent the line from failing. If supply is too far less than demand, there can be insufficient pressure to keep gas moving through the line. A customer could open a valve to use gas and find none. The gas system operator monitors line pressures and issues warnings or curtailment notices when safe operating limits cannot be achieved.
8 Playa del Rey is also located within the LA Basin. As the operating analysis will show, Playa del Rey is not sufficient to keep operating pressures at safe levels because of the small size and the length of time it takes to refill the facility once any gas is withdrawn. Early on, the CPUC and the Energy Commission considered whether compressed or liquefied natural gas tankers deployed near power plants would be helpful. The agencies concluded they would not be as those vehicles introduce safety concerns and deliver too little gas relative to power plant requirements to be useful.

support cooling needs met with air conditioning. SoCalGas relies on Aliso Canyon on these days to meet the hourly change in gas requirements as these gas-fired electric generators fire up and operate during peak hours. Moreover, some of the 17 gas-fired generating plants must be available to produce quickly, in case of outages on the electricity system.[9] Again, Aliso Canyon is the only source that can provide immediate gas supply in time to prevent collapse of operating pressures within the Basin.

This frequent use and reliance on Aliso Canyon is documented in Table 2. Over the 3-year period from 2012-2015, SoCalGas withdrew gas from Aliso Canyon an average of 134 out of 151 "winter" days and 70 out of 214 "summer" days.[10,11]

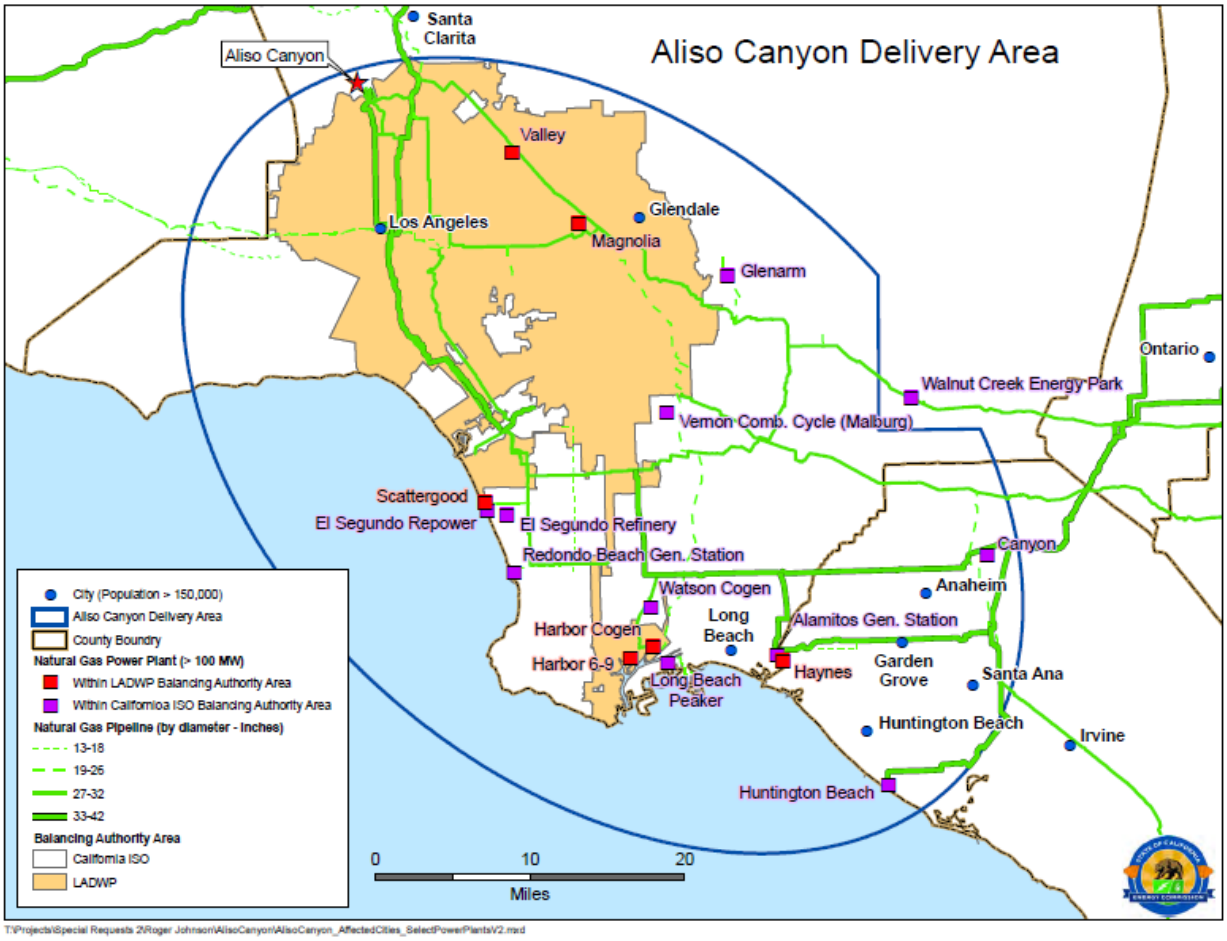
**Table2: Average Number of Days of Withdrawal from Aliso**

| | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average # of Days per Year Aliso Withdrawals | 31 | 21 | 18 | 7 | 3 | 6 | 13 | 18 | 12 | 12 | 26 | 31 |

Source: CPUC Energy Division *Preliminary Staff Analysis*, February 16, 2016

9 Electricity reliability planners refer to these outages as "contingency events."
10 Winter is defined as November 1 through March 31, and summer is April 1 to October 31. These dates coincide with the traditional underground gas storage withdrawal and injection seasons for the natural gas industry.
11 SoCalGas' *Envoy™* system reports withdrawals on a system accumulated basis and not by individual storage facility, thus, these data are not available except via data request to SoCalGas. This contributes to the inability of many members of the public to immediately understand why Aliso Canyon is so important to reliable gas operations.

**Figure 2: Electric Generation Plants Served by Aliso Canyon**




Source: Energy Commission Staff

### *Core Versus Noncore Customers*

In 1988, the CPUC separated gas supply (or, procurement) service from gas transportation service and split gas utility customers into two basic groups: core customers and noncore customers. The distinction between core and noncore customers is based on size; it determines where the responsibility lies for procurement of their gas supply, the reliability of that supply, and the rates each pays, for gas transportation service. Core customers are homes, small commercial operations, and small industrial customers, all of whom typically receive their gas-related services from the gas utility, all together in a single package, including procurement, transmission, storage, distribution, metering, and billing.[12] SoCalGas purchases the gas supply and then provides transportation, storage and balancing service for these customers. Ninety nine percent of SoCalGas' customers, representing roughly 80 percent of the annual load, are in the core category. Core customers are to be the last customers curtailed in the event

12 The core customer bill shows the commodity cost of the gas procured separately from the other services but the gas utility still buys the gas on their behalf. Noncore customers, in contrast, are required to buy their own gas.

that there is insufficient supply in the system.[13] This is not only because of the "human needs" nature of the service to core customers but because gas safety requires restarting gas service by purging lines of air and any water that might have invaded, then relighting pilot lights on gas appliances building-by-building and distribution feeder-by-distribution feeder sequentially. This process can take several days, depending on the number of customers involved. Customers must be present to provide building access and numerous gas company employees are required. This is not to ignore the significant safety and economic risks should electricity service be interrupted and rotating or other electricity outages ensue, or that many gas appliances cannot operate without electricity.

Noncore customers consist mainly of large industrial and commercial customers, including hospitals, electric generators (power plants), and oil refineries. These customers procure their own natural gas supplies. They use SoCalGas' transmission and distribution system to transport, or ship, the gas supply they purchase elsewhere.[14] They also can purchase gas storage service. These customers pay lower rates recognizing their lower order in the priority of service and that there is not enough capacity to serve them under peak winter conditions. A subsequent section of this Reliability Action Plan explains in detail the relative contributions of core and noncore customers to winter peak gas demand.

### *Gas Scheduling and Balancing*

Today's gas market structure with noncore customers purchasing their own gas supply means there are many entities who need to communicate and confirm operations up and down the gas supply chain to keep track of whose gas is coming from where and make sure it gets delivered. Shippers, therefore, have to notify the gas company of how much gas they plan to transport onto the system and subsequently use at their facility.[15] In doing so, shippers are not required to, and often do not, bring in each day exactly the amount of gas they will use. Noncore customers are not required to balance their demand and delivery of gas each day; instead, SoCalGas requires that noncore customers total demand for the month must match up with the gas they deliver in that month within a tolerance band of plus or minus 10 percent. That difference does not have to be made up until the next month. In other words, a shipper can be out of balance by up to 10 percent of its monthly gas use and make up that difference next month at no penalty.

These balancing provisions have been in place for a long time and have provided great benefits to all shippers on the SoCalGas system. The flexibility balancing shippers enjoy were made possible by the

13 Priority rules for order of service in case of curtailment still generally reflect those adopted in the 1970's gas shortages when little natural gas was used for electricity generation. For a time, the Fuel Use Act actually prohibited use of natural gas in non-cogeneration baseload electric generating plants; many gas-fired generators also had the ability to burn an alternate fuel. Today, many gas appliances require electricity to ignite meaning that many will not work if electricity service is out.

14 This is why noncore customers are sometimes referred to as "shippers." In addition, gas marketers can ship gas over the SoCalGas system and inject it into storage for later sale to noncore customers, also in this context as a "shipper."

15 This notification is called, variously, "scheduling" or "nominating" their gas.

large amount of gas storage available in southern California.[16] The work by the Technical Assessment Group, discussed in the subsequent Risk Assessment section of the Aliso Action Plan, demonstrates that imbalances cannot be sustained without being able to use Aliso Canyon routinely. This is an unfortunate reality that is a result of removing the Aliso Canyon gas storage field from service due to the well leak and safety inspections required prior to restoring any wells service..

The only exception to the current balancing rules occurs when SoCalGas has to call an Operational Flow Order (OFO). An OFO is a specific warning to customers that the SoCalGas system is so far out of balance that gas from storage alone cannot balance the system. Thus, the OFO notifies customers, after initial scheduling requests are received and processed, that they must match their deliveries with their use more closely. Those who do not or cannot comply are charged a penalty that varies with the severity of the system imbalance. OFOs occur somewhat unpredictably and the notices are issued late in day, after a problem is discovered. At that point shippers have few tools available to respond. OFOs are intended to be the exception rather than the rule.

As explained above, storage was key to the broad tolerance allowed in the gas balancing rules: when customers did not bring enough flowing supply to the receipt points, SoCalGas used storage to provide make-up supply. In operating its system, SoCalGas often used flowing supply to meet demand outside the Basin and withdrew from Aliso Canyon to meet demand inside the Basin. SoCalGas also used Aliso to follow hourly load changes within the Basin. It has no other tool that can perform this role inside the Basin: Honor Rancho is too far away, and Playa Del Rey is small, with limited injection capability that keeps it from being quickly refilled. The L.A. Loop also operates at a lower pressure than the higher pressure pipelines coming in from the border receipt points and often uses Aliso Canyon to meet hourly changes in demand that are often larger than its limited pack and draft can address.[17]

Another complexity to scheduling gas deliveries is the timing in which this scheduling occurs. Figure 3 depicts gas scheduling alongside electricity scheduling to make apparent the timing mismatches. Shippers, including electric generators, schedule their gas at 9:30 a.m. Those generators don't bid into the California ISO's day-ahead electricity market until 10:00 a.m. They then won't learn which of them are dispatched by the California ISO until the California ISO announces awards at 1:00 pm.[18] The fact that generators must schedule gas supply before they receive their awards forces generators to guess

16 Electric utilities have pointed out that this flexibility is of particular comfort as California adds more renewables and needs to ramp up and down more frequently use of gas-fired generating facilities. Other noncore customers may use it to facilitate price arbitrage or for other reasons.

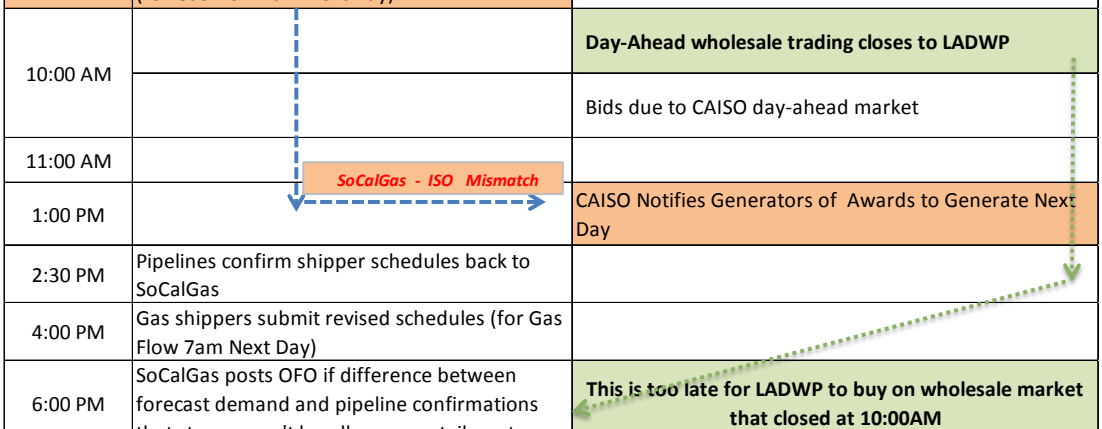
17 Pack and draft describes the ability within a pipeline to operate at a slightly higher operating pressure and effectively compress more natural gas molecules into the same space. It occurs when more gas is flowing in than customers are using. Conversely, draft occurs when the pressure drops and the molecules spread out. This occurs when customers are using more gas than is flowing into the system.

18 Effective April 1, 2016, the nomination times shown above changed. For example, 9:30 a.m. will change to 11:00 a.m., and 2:30 p.m. will change to 4:00 p.m. A fifth intraday (ID) window will be added. Figure 3 shows the old format for simplicity.

how much gas they will use.[19] This situation leads to variances between nominations and actual burn. If large enough, the variances contribute to the need for SoCalGas to call OFOs or, worse, curtail gas service.

Figure 3: Simplified Timeline Illustrating Gas and Electricity Scheduling

| Time | Natural Gas | Electricity |
|---|---|---|
| | | |
| 9:30 AM | Gas shippers submit Initial Scheduling Requests (for Gas Flow 7am Next Day) | |
| 10:00 AM | | **Day-Ahead wholesale trading closes to LADWP** |
| | | Bids due to CAISO day-ahead market |
| 11:00 AM | | |
| 1:00 PM | | CAISO Notifies Generators of Awards to Generate Next Day |
| 2:30 PM | Pipelines confirm shipper schedules back to SoCalGas | |
| 4:00 PM | Gas shippers submit revised schedules (for Gas Flow 7am Next Day) | |
| 6:00 PM | SoCalGas posts OFO if difference between forecast demand and pipeline confirmations that storage can't handle -- or curtailment | **This is too late for LADWP to buy on wholesale market that closed at 10:00AM** |
| 8:00 PM | | Deadline for LADWP to start pumping at Castaic* |
| MIDNIGHT | | Electricity Day Begins |
| 7:00 AM | Gas Day Begins | |
| 8:00 AM | Gas shippers correct schedules in IntraDay window 3 (ID 3); change effective x pm | |
| 3:00 PM | Gas shippers correct schedules in IntraDay window 4 (ID 4); change effective x pm | |




* Castaic is a pumped storage hydro-electric facility owned by LADWP.

Source: California Energy Commission

Compounding these timing complexities, the interstate pipelines that bring gas from producing areas in Texas, New Mexico, Colorado, Wyoming or even Canada, must also confirm to SoCalGas that they will meet the scheduling requests submitted by SoCalGas' shippers. The pipelines do not deliver these "confirmations" to SoCalGas until 2:30 pm. This is the first indication SoCalGas gets of whether deliveries from the pipelines will match customer demand for the next gas day. By the time SoCalGas receives those pipeline confirmations and determines whether they need to call an OFO (or worse, a curtailment), the day-ahead wholesale power market is closed. This is especially problematic for LADWP, which has fewer options to replace any gas-fired generation that might be curtailed. LADWP's system and options are discussed more fully in the next subsection of this Reliability Action Plan.

19 Generators often guess very well owing to their experience watching weather and market conditions. Generators' use can also vary, as their efficiency changes with ambient air temperature changes. Generators can also end up being dispatched in real time differently than from the day-ahead market awards should, for example, real-time demand differ from the day-ahead forecast.

### *Gas Demand, Capacity and Reserve Margin*

On a peak demand day in winter, core customers account for more than half 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 percent (3.050 Bcf) of demand comes from core customers, 20 percent (1.031 Bcf) of demand comes from electric generation plants, and another 20 percent (0.996 Bcf) comes from other noncore customers. Table 3 shows the forecast of winter peak demand for 2016.

**Table 3: Forecasted 2016 Winter Peak Day Demand[20]**

| Customer | 2016 Forecasted Peak Demand | Percent of Peak Demand |
|---|---|---|
| Core | 3.050 Bcf | 60 |
| Electric Generation | 1.031 Bcf | 20 |
| Noncore, not electric generation[21] | 0.996 Bcf | 20 |
| Winter Total | 5.077 Bcf | 100 |

Source: CPUC Energy Division *Preliminary Staff Analysis*, February 16, 2016; initially taken from 2014 *California Gas Report, p. 90*

In the summer, the demand profile flips. Noncore customers consume more during these periods as core loads that are sensitive to heating degree days fall off and electric generation increases due to air conditioning load. Table 4 illustrates this occurrence. Based on SoCalGas' 2016 peak summer forecast, the peak demand for natural gas will be 3.211 Bcf perday. Sixty-one percent of that peak demand comes from electric generation plants. Another sixteen percent comes from refineries with combined heat and power facilities that often provide electricity into the market after meeting their own requirements. Most of the refinery load is inside the Basin and much of it cogenerates electricity using waste heat at the refinery.

**Table 4 Forecasted 2016 Summer Peak Day Demand[22]**

| Customer | 2016 Forecasted Peak Demand | Percent of Peak Demand |
|---|---|---|
| Core | 0.634 Bcf | 20 t |
| Electric Generation | 1.943 Bcf | 60 |
| Noncore, not electric generation[23] | 0.634 Bcf | 20 |
| Summer Total | 3.211 Bcf | 100 t |

Source: CPUC Energy Division *Preliminary Staff Analysis*, February 16, 2016; initially taken from 2014 *California Gas Report, p. 90*

When SoCalGas' system is short of either gas supply or the capacity needed to deliver that gas supply, procedures call for SoCalGas to curtail service first to noncore customers. This is aligned with the goal, as explained previously, to preserve service to core customers. The current tariff specifies that electric

20 Winter peak demand is calculated by SoCalGas as demand at 1-in -35 year conditions for core customers plus 1-in-10 year conditions for heating degree day-sensitive noncore customers. See 2014 *California Gas Report,* p. 90.
21 This includes approximately 0.5 Bcf of use by oil refineries.
22 The summer peak day reflects dry hydro-electric conditions observed to occur once every ten years. See 2014 *California Gas Report,* p. 90.
23 This includes about 0.5 Bcf of use by oil refineries.

generation plants are to be curtailed in rotation with other noncore customers. Some of these noncore customers are oil refineries, which are also key to California's economy. In practice, however, SoCalGas has found curtailment circumstances to arise so quickly that they have been deemed gas emergencies. In those circumstances, SoCalGas has turned to electric generation to reduce that load first, before involving other noncore customers.[24] This is because electric generation loads are large, allowing more load to be shed with fewer phone calls.[25]

Table 5 shows the gas reserve margin under design conditions versus recent experience. At 15 Bcf in storage, pressure within Aliso Canyon allows a withdrawal capacity of Aliso Canyon of about 0.88 Bcf/day.[26] The combined withdrawal capacity from the other SoCalGas storage fields (Honor Rancho, La Goleta, and Playa del Ray) is 1.7 Bcf/day. Adding the storage withdrawal ability to SoCalGas' pipeline design capacity of 3.875 Bcf SoCalGas appears able to meet its winter peak demand of 5.077 Bcf/day, with a reserve margin of 0.5 Bcf.

However, there are several reasons that the system does not normally flow at 3.875 Bcf of supply or capacity. SoCalGas's daily operating data show, that 3.4 Bcf per day has been the highest flowing supply coming into its system at any time in the last five years, and, most often, it is 3.0 Bcf per day or less.[27] Using this experience, SoCalGas would not be able to serve all the forecasted winter peak day demand without some contribution of withdrawals from Aliso Canyon. The gas reserve margin calculation contained in Table 3 shows that SoCalGas would be 1.0 Bcf/day short without Aliso Canyon withdraws. This calculation will become important when Aliso Canyon Action Plan Entities start work to protect reliability in winter 2017.

**Table 5: Illustrative Gas Reserve Margin Under Design Versus Experience if Winter Demand Exceeds Historical Supply/Capacity without Aliso Canyon**

| Supply/Demand | Design (Bcf/day) | Recent Experience (Bcf/day) |
|---|---|---|
| Pipeline Capacity Supply | 3.8 | 3.0 |
| Other Storage Supply (*excluding* Aliso) | 1.7 | 1.0 |
| Peak Winter Gas Demand | (5.0) | (5.0) |
| Reserve Margin | 0.5 | (1.0) |

Source: CPUC Energy Division *Preliminary Staff Analysis*
Note 1: Typical outages can reduce capacity 0.5-1.0 Bcf/day
Note 2: Electric generation typically requires 1.0-2.0 Bcf/day

24 SoCalGas has Application No. 15-06-020 pending before the CPUC to change the curtailment rule in its tariff to be more consistent with its operating practice.
25 The gas curtailments of the 1970's led to requirements that every state to adopt priority of service rules. In nearly every instance, states, (including California) approved making electric generation the lowest priority for natural gas service.
26 This 0.888 Bcf may not be achievable if fewer wells or available or with changed withdrawal characteristics using tubing only instead of operations using both tubing and well casing, consistent with DOGGR's March 4 emergency rules.
27 As calculated from data posted on SoCalGas' Envoy™ system. The 3.4 Bcf occurred on October 16, 2014. Envoy™ also shows maximum gas sendout to customers of 5.2 Bcf on January 14, 2013.

### *Los Angeles Department of Water and Power*

LADWP is the nation's largest municipal electric utility and the third largest electric utility in California. It serves a 465 square mile area in Los Angeles and much of the Owens Valley, which is in the south eastern Sierra Nevada. LADWP provides electricity to the city of Los Angeles and serves a population of more than 4 million people with 1.4 million residential and business retail customers. LADWP owns and operates its own generation, transmission and distribution system, making it a vertically integrated utility delivering power from its generation sources to its customers. LADWP has 7,957 MW of generation capacity from a diverse mix of energy sources, including gas, coal, nuclear, hydroelectric, and renewable sources. [28] LADWP's electric transmission system network spans five states, including Oregon, Nevada, Utah, Arizona, and California. The LADWP electric system was designed and evolved to rely upon L.A. Basin gas-fired generation to assure reliability of the system, while importing additional power supplies from outside the LA Basin. LADWP operates its transmission facilities and balances loads and resources within them, serving as its own balancing authority.[29] Thus, it is separate from the California ISO balancing authority.

As its own balancing authority, LADWP 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 in basin generation this voltage support LADWP becomes unable to accept into its system the portion of its generation that is imported. Gas-fired generation plays a key role in meeting these metrics with specific generation minimums required, which vary based on system load and conditions. Some 40 percent of the gas-fired generation capacity in the LA Basin is owned by LADWP. 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. [30]

LADWP forecasts its gas-fired generation requirement to meet its load and reliability requirements and schedules the necessary gas to meet this generation requirement. This gas requirement forecast is based on expected system demand, weather, and system conditions. LADWP's gas consumption typically ranges between 0.2 Bcf and 0.4 Bcf; during the 2015 summer, it averaged 0.141 Bcf with a maximum usage of 0.336 Bcf. 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 suddenly or with littlewarning.

28 Source: CEC Form S-1, Capacity Resource Accounting Table (issued 12/2014).
29 The North American Electricity Reliability Council defines a Balancing Authority Area as the collection of generation, transmission, and loads within the metered boundaries of the Balancing Authority. The Balancing Authority maintains load-resource balance within the respective area.
30 Source: CEC Form S-2, Energy Balance Table (issued 12/2014)

At its 2016 summer peak load forecast of 5,787 MWh, roughly 72 percent of LADWP's import capability is used to import electricity generated outside LADWP's system.[31] That electricity may come from generating resources owned by LADWP or purchased from others. On these high demand days, LADWP has only 1,000 MW of electric transmission capacity remaining unused and available to import replacement electricity from outside its system. This remaining import capability is useful, however, only if energy is available for purchase. LADWP also has a relatively small amount of additional generation capacity it may be able to obtain from its Castaic hydroelectric pumped storage facility. This pumped hydro resource can be used only if LADWP has advance notice so that it can pump water up to use for generation the following day. Last, LADWP has some additional transfer capability with the California ISO that may be able to replace a portion of LADWP's 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. In sum, LADWP has limited capability to shift load away from its gas-fired resources. The closing hour for day-ahead wholesale electricity markets and the time needed to pump water into Castaic mean that the shorter the notice it receives from SoCalGas that it needs to reduce its gas demand, the fewer these options become.

## Risk Assessment

The Aliso Canyon Action Plan Entities[32] began in December to discuss the threats to gas and electric reliability that could arise without the ability to withdraw from Aliso Canyon. The technical analysis revealed that Aliso Canyon is needed to meet high core gas demands that occur in the winter months, along with high electric generation demand in the summer months. Moreover, SoCalGas uses Aliso Canyon to balance its system on a daily and hourly basis, throughout the year. Aliso Canyon is critical is due to location within the L.A. Basin, where it is close to SoCalGas' key loads and is connected to the lower pressure local transmission system in the Basin.

The initial assessment focused on winter 2016 and how much gas might be needed from Aliso Canyon during cold weather events, reflecting the critical need to protect gas service reliability for core customers. As the Aliso Canyon Action Plan Entities understood how frequently and precisely how SoCalGas uses Aliso Canyon, reliability risks in both winter and summer became clear. It is likely that using the gas remaining at Aliso would reduce those risks, but as yet it remains unknown how the reconfigured field, as safety inspections are completed, will perform. The winter 2016 and summer 2016 analyses are described below. Winter 2017 is discussed only at a cursory level and requires additional analysis before conclusions can be reached.

31 See p. ES-5 of LADWP's 2014 Integrated Resource Plan. The Energy Commission's 2016 Integrated Energy Policy Report showed a 1-in-10 day summer peak load forecast for LADWP of 6,712 MW. See California Energy Demand Revised/Final Forecast, 2016 - 2026, Mid Demand Baseline Case, Mid-AAEE Savings, Form 1.5d.

32 The detailed Risk Assessment compiled by the Technical Assessment Group (consisting of the Aliso Canyon Action Plan Entities staff members plus SoCalGas) Aliso Canyon Action Plan Entities is contained in the detailed technical report include in the Appendix to this Reliability Action Plan.

***Winter 2016*** (With Some Overlap Into Summer)

SoCalGas began withdrawing gas from Aliso Canyon in November 2015, after the leak was detected at well SS-25. SoCalGas increased those withdrawals in December, with the onset of colder weather and with the goal of pulling as much natural gas as possible out of the storage field to reduce the operating pressure of the field.[33] DOGGR directed SoCalGas not to inject any gas into the storage field until a safety review of the facility is completed. With the inability to inject and the field inventory declining, the agencies looked carefully at how much gas was needed – specifically from Aliso Canyon - to prevent gas service curtailments with the onset of cold weather. The February 16 preliminary analysis noted that, if withdrawals were to continue at the late-December pace, the field would be empty by mid-February. This would have left no gas in the field for withdrawal in late winter. With no ability to inject, there would be no gas in the field for the upcoming summer.

Winter reliability requirements focus on making sure the utility has enough capacity and supply to meet projected demand on extreme cold days. As discussed, SoCalGas forecasts gas demand under 1-in- 10 and 1-in-35 year conditions and plans to meet those extreme condition demands with a combination of supply flowing through the backbone transmission system and gas from storage.[34] Core customers receive the highest level of protection due to the criticality of home heating, along with the cost of restoring service after an outage. SoCalGas projects that demand on an extreme winter peak day will be 5.3 Bcf. As explained, the expectation is that about 3 Bcf of flowing supply will be available from the interstate pipelines into SoCalGas' backbone transmission system. That means that all the remaining supply needed to serve demand above 3 Bcf must be met by storage.

CPUC Decision 07-12-019 determined that SoCalGas would need a total storage withdrawal of 2.292 Bcf to meet the 1-in-35 demand for core customers served by SoCalGas, SDG&E, plus Southwest Gas and City of Long Beach. Of that, 1.65 Bcf could come from the combination of SoCalGas' other three storage facilities (that is, Honor Rancho, La Goleta and Playa de Rey). This leaves 0.642 Bcf as the remaining supply needed to reach the total required from gas in storage under these system design conditions.[35] This gas can come only from Aliso Canyon.

Gas is withdrawn from storage under natural pressure. The withdrawal capability from the gas field declines as inventory declines, because lower volume in the field results in lower pressure. The preliminary analysis acknowledged SoCalGas' estimate of the relationship between inventory and withdrawal pressures. From this estimated relationship, the Aliso Canyon Action Plan Entities agreed that 5 Bcf of inventory was needed to assure the ability to pull 0.642 Bcf from Aliso Canyon on any given day. SoCalGas further indicated it was concerned that the leak mitigation efforts (that is, the attempts

33 This was to reduce the rate at which gas was leaking from the field and to reduce the field pressure that attempts to kill the well from the top needed to overcome.
34 The term 1-in-10 represents the coldest condition expected to occur once in 10 years and is used for planning capacity needed to serve noncore customers. Similarly, 1-in-35 represents the coldest condition expected to occur once every 35 years and is used for planning capacity needed to serve core customers.
35 In 2007 when this withdrawal capability was adopted, peak winter demand was forecast to total 5.58 Bcf, higher than the current forecast. This forecast is due to a general decline in peak natural gas demand.

to “kill” the well from the top) could have degraded the performance of the field. This possibility reinforces the need to keep 5 Bcf in the field.

The Aliso Canyon Action Plan Entities added 10 Bcf, for a total of 15 Bcf to be retained in the field. This additional 10 Bcf was based the amount of gas needed from Aliso during the remainder of the winter if the weather and demand experienced in 2015 was repeated in 2016 and all other facilities were operated at their maximum. It was determined that about 4.1 Bcf would be needed. The same approach was used to determine the requirement from Aliso for June through October 2016 that maximum use of all facilities and a repeat of 2015 summer weather. An estimated 4.9 Bcf was indicated. While 2016 weather will not be identical to that of 2015, this additional volume was left in the field to account for the fact that some gas would be withdrawn on peak days but volume and pressure must be maintained for future high demand days.

These findings culminated in an order from CPUC Executive Director Timothy Sullivan that directed SoCalGas to withdraw natural gas from Aliso Canyon down to an “actual working gas inventory” of 15 Bcf. This translates to a 20 Bcf volume reported on *Envoy™,* less the 5 Bcf estimated to have leaked. Sullivan further directed SoCalGas to hold the gas inventory at this level to meet “energy reliability requirements.” As discussed in the CPUC’s February 16 “Preliminary Analysis,” three general risks are addressed by holding this level in inventory: a) the inability to rely solely on flowing supplies to meet peak demand; b) the operational uncertainty about how the field will perform at such a low inventory level; and c) the need to use some gas from storage during the summer.

### *Summer 2016*

With the 15 Bcf reserved, the Technical Assessment Group conducted a more detailed look at reliability planning for summer 2016. The preliminary analyses behind the recommendation to hold inventory at 15 Bcf allowed for SoCalGas to withdraw as much gas to support electricity generation demand this coming summer as it did during summer 2015. Granted, summer 2016 weather may not be the same as that of summer 2015’s, but it offers some protection. In addition, those analyses, were based on a straightforward comparison of daily demand to daily supply. In preparing the subsequent more detailed risk assessment for summer, the Technical Assessment Group looked beyond the daily balance of supply and demand to perform an engineering analysis simulating operating pressures on the system and communication time schedules between the gas and electric industries.

The engineering analysis used the industry standard hydraulic model that simulates gas system operations, measuring flows and pressures within key pipelines, from an engineering perspective. [36] The model simulation estimates operating pressures on the SoCalGas system continuously using a series of differential equations for compressible fluids that calculate actual flows through a pipeline given design parameters such as size of the line, maximum operating pressure, and minimum acceptable operating pressure. It takes into account where gas comes into the system, where load is located, the pressure limiting stations, and other operating characteristics. The output tells the modeler when any of the key

36 The model is now owned and supported by international consultancy DNV-GL. It is used by most gas utilities and pipelines and remains known to many in the natural gas industry as the Stoner pipeline simulation model.

operating parameters are violated. Such modeling is routinely used for system design. It is also used to determine if a large, new load can be accommodated successfully at a given location.

The Technical Assessment Group selected four specific days to simulate.[37] These were days that were expected to stress the system and included days, particularly in the summer, when SoCalGas often relied upon stored gas from Aliso Canyon to follow hourly changes in electric generation gas demand that, left unmitigated, could create operating problems. The four were relatively high demand days, including days on which recorded demand for the California ISO and LADWP was high (September 16, 2014 and September 9, 2015), a day that reflected the largest change in hourly gas demand from electric generators (July 30, 2015) and a winter day on which electric generator gas demand was high (December 15, 2015). Demand on the summer days was close to what would be expected under SoCalGas' forecast of summer high sendout days, but none were particularly extreme relative to SoCalGas' peak demand for natural gas, which occurs in the winter.[38]

Operating assumptions included hourly demand, including hourly electric generation demand provided by California ISO and LADWP. The simulation limited flowing gas receipts from the pipelines to 3.5 Bcf per day, consistent with historical experience. The simulation assumed that no gas was injected or withdrawn at Aliso Canyon. The Technical Assessment Group agreed this assumption was reasonable because it remains unknown when the well inspections will be complete or what the ultimate withdrawal capability of the field will be. The analysis allowed 1 Bcf per day withdrawn from Honor Rancho. Playa del Rey withdrawals were held back and used as the sole tool left in reserve to fix any disruptions that might occur on the system within a given gas day. The initial simulation also allowed no planned or unplanned outages of any gas system equipment, such as compressors, valves, or wells. Last, the simulation required restoration to normal operating pressures overnight. This assures that the gas system is not in a worse position the next day, which could lead to worsening outages on successive days.

The two higher demand days in the simulation showed that all demand could be met with no operating pressures or other conditions out of acceptable and safe tolerance; the simulation for the two lower demand days, however, did not. Under these simulated conditions, real-time operators, seeing the pressures falling toward unsustainable operating levels, would trigger calls to curtail gas use. When the simulation failed to maintain operating pressure within tolerances it was for a single reason: gas flows into the system on those days did not match demand.[39] In fact, day 3 (September 9, 2015) showed operating pressure problems when the difference between receipts and demand was only 0.25 Bcf per day. The pressures were lowest at the southern end of the LA Basin system, farthest from Aliso Canyon

37 The focus at this point is on reliability planning for summer 2016; planning for winter 2017 will introduce additional issues and will be addressed in the coming months.
38 More detail about the four days, the simulations and results can be found in the report of the Technical Assessment Group. Demand on the four days ranged from 3.19 Bcf to 4.02 Bcf. The biggest distinguishing feature was the relative difference between scheduled gas and actual gas demand across the four days.
39 The technical report explains how, with pressures dropping, particularly at Yerba Station, SoCalGas would be forced to choose between letting more gas into the LA Basin to preserve its operating pressures versus sending it south to San Diego.

and even farther from Honor Rancho. Moreover, withdrawals from Honor Rancho were already at maximum in the scenario. Increased gas deliveries, if more gas were available, from the high pressure transmission pipelines could not reach the LA Basin system quickly enough to restore operating pressures. The result would require SoCalGas' to call on customers to curtail load.

This result turns out to be down to about 0.15 Bcf per day.[40] In other words, the biggest contributor to gas curtailments (assuming first that capacity is sufficient to meet daily demand) is a difference between what customers deliver into the SoCalGas system versus what they consume. As highlighted previously in this Reliability Action Plan, that difference can occur because customers are using the flexibility they are allowed between what they deliver into the system and what they use.

With these results in hand, the next questions are a) how often could there be a difference of 0.15 Bcf per day between flowing supplies and demand when total demand - demand in general, under any temperature or weather condition -- exceeds 3.2 Bcf; and b) how would planned and unplanned gas facility outages modify this calculation (including potential days of overlap). Last is the most complex question to answer: How big does the gas curtailment have to be before LADWP and the California ISO would need to interrupt electric service to consumers?

The Technical Assessment Group used SoCalGas operating data to answer these questions, combined with SoCalGas' analysis of capacity outage impacts under its 2016 maintenance schedule. The operating data are publicly available. The number of days which the difference between flowing supply receipts and demand was greater than 0.15 Bcf was 121. SoCalGas then estimated that planned outages to perform maintenance on gas storage facilities (other than Aliso Canyon) that would take more than 0.4 Bcf out of service over 97 days. Another 158 days are planned for maintenance that would reduce pipeline capacity by more than 0.5 Bcf. The number of days in a year on which all of these things could occur coincidently is 23. In other words, there are 23 days in the year where a supply/demand imbalance plus the combination of planned work on storage or pipelines would have a large enough impact to cause a gas load curtailment. The magnitude of the curtailment varies according to the exact conditions. Most of the planned outages would occur in summer, since summer is when gas utilities conduct most of their maintenance.

Unplanned outages, however, could occur at any time of the year. . Here the Technical Assessment Group looked at unplanned outages over the three years between 2013 and 2015. There were an average 21 days per year on which storage withdrawal capacity was reduced by more than 0.4 Bcf and 117 that reduced pipeline capacity by more than 0.5 Bcf. Some of these days overlap such that the average number of coincident days of unplanned outages is 9.

Layering the planned and unplanned outages on top of days with demand greater than 3.2 Bcf and assuming customers match their deliveries to within 0.15 Bcf of their actual demand, yields an estimate

40 The technical report describes in greater detail that the 0.25 Bcf translated to 0.15 Bcf after taking into better account the cut-off at which the operators in Gas Control would institute curtailments to prevent the pressure from reaching minimum

of 16 days this summer to expect gas curtailments, assuming no withdrawals of any of the 15 Bcf held at Aliso. Unless gas is withdrawn from Aliso, 14 of these days are likely be large enough to interrupt much of the generation located in the LA Basin, affecting both the California ISO and LADWP. In sum, the risk of curtailment exists when combinations of following occur:

- Scheduled gas does not match actual gas demand.
- Pipeline outages reduce delivery capacity.
- Outages at the SoCalGas' other storage facilities reduce remaining storage capacity.

For ease of reference, the number of curtailment days and related causes are summarized in Table 6.

**Table 6: Identifying Risk of Natural Gas Curtailment and Electricity Service Interruption (Using None of the 15 Bcf from Aliso)**

| Description | Number of Days in Summer |
|---|---|
| Mismatch between scheduled gas receipts and actual gas demand of 0.15 Bcf | 2 |
| Mismatch of 0.15 Bcf plus Planned Outages at Non-Aliso Storage Facilities with impact greater than 0.4 Bcf | 2 |
| Mismatch of 0.15 Bcf plus Planned Outages of pipeline capacity with impact greater than 0.5 Bcf | 9 |
| Days the storage and pipeline work could occur coincidently (for total impact of 0.9 Bcf) | 3 |
| Total | 16 |
| Number of days in which gas curtailments are too large for California ISO and LADWP to remedy (aka days of risk of electric service interruption) | 14 |

Source: Technical Assessment Group Analysis

### *Winter 2017 and Longer-Term*

Planning for winter 2016 and summer 2016 have been the top priorities. With those analyses completed, the Aliso Canyon Action Plan will turn to longer-term analyses involving winter 2017 and beyond. Much of the impact beyond this summer will depend on the well inspection results, the possible return to injection capability as wells are found to be safe, and other regulations that might be adopted by DOGGR.

At this point, the team anticipates the analysis above, which combines hydraulic gas flow modeling with days of outage impact, will raise similar concerns about gas curtailments and electricity service interruptions as raised above. Other issues to consider include uncertainty about if reinjection at Aliso Canyon will be allowed and what the injection and withdrawal volumes allowed will be. There should be no doubt that winter reliability will be threatened if all or part of the 15 Bcf now held at Aliso is withdrawn and cannot be replaced before winter. The degree to which it will be threatened, however, is yet to be determined and will require the Aliso Canyon Action Plan Entities to perform additional assessments to determine how much gas SoCalGas will have available to deliver to customers throughout the winter and particularly on a cold day. Honor Rancho will provide some incremental gas

supply, but the fundamental issue of too little gas being available to follow load in the LA Basin will remain as long as Aliso Canyon operations are uncertain.

## Mitigation Measures

The Aliso Canyon Action Plan Entities have identified and propose implementation of 18 measures to reduce the need for and magnitude of natural gas curtailments. Some of these mitigation measures have already been implemented; for others implementation is still under consideration, while several more are held on "standby" for later implementation, if needed. The measures can be grouped into five general categories: Prudent Use of Aliso Canyon; Tariff Changes (both state and federal); Coordination; LADWP Operations; and Reducing Natural Gas and Electricity Use. Each of these is discussed below.

### *Prudent Aliso Canyon Use*

**Use the 15 Bcf at Aliso Canyon to Prevent Summer Electricity Interruptions:** Of the roughly 15 Bcf of gas stored at Aliso Canyon under CPUC Executive Director Sullivan's January 21 direction, 10 Bcf was designated for withdrawals to maintain reliability for core customers and limit curtailments to noncore customers (some of whom are gas-fired electric generators). The 10 Bcf designation assumed that as much as 5 Bcf would be needed to maintain reliability should 1-in-35 conditions occur through the remainder of the 2015/16 winter season (at the time, the last of January and the months of February through March). Five Bcf was reserved for use during the summer. Due to favorable weather conditions this winter, no withdrawals have been made since the Executive Director's order and the 10 Bcf remains available for reliability-based withdrawals. 10 Bcf is more gas than was withdrawn from Aliso Canyon for reliability purposes in the summer of 2015. If noncore customers and SoCalGas can closely match their scheduled gas with actual demand, there are no prolonged heat waves, and there are no prolonged unexpected outages of the backbone pipeline transmission system, the 10 Bcf could be enough to meet demand this summer. SoCalGas needs to provide the CPUC with detailed plans and procedures detailing how it will use the 15 Bcf to prevent summer electricity interruptions.

The Aliso Canyon Action Plan Entities have not yet focused on detailed planning for next winter. However, it appears based on the summer analysis, the winter demand forecast, and the gas reserve margin analysis in Table 3, maintaining reliability next winter with only 15 Bcf at Aliso Canyon could pose a significant challenge. What is known now about the well inspection plan suggests some ability to reinject is likely to occur at some point this summer but it remains unclear how much SoCalGas would be able to reinject or how the operating characteristics of the field may change the maximum daily withdrawal capability. Because of the uncertainty about reinjection for winter and what exact withdrawal capability might exist as the inspections progress, SoCalGas has not committed to using any of the gas at Aliso Canyon this summer.

The Aliso Canyon Plan Entities therefore propose clear direction be given to SoCalGas to use the 15 Bcf this summer to the extent needed to prevent electricity interruptions. By planning to use that gas when curtailments of gas service to electricity generators would be large enough to cause electricity service interruptions, the entities can prolong the benefit of the gas held in storage and help prevent the

economic damage and public safety risk associated with electricity interruptions. Implementing this measure may require developing rules for triggering events.

**Efficiently Complete the Required Safety Review at Aliso Canyon to Allow Safe Use of the Field:** Governor Brown's emergency proclamation states that SoCalGas may not inject any gas into the Aliso Canyon Storage Facility until a comprehensive review, using independent experts, of the safety of the storage wells and the air quality of the surrounding community is completed. This safety review, developed in consultation with independent experts from Lawrence Berkeley, Lawrence Livermore, and Sandia National Laboratories requires each of the 114 wells of the facility to undergo a battery of tests to confirm the safety and integrity of the well or to remove the well from service and isolate it from the underground reservoir. No new gas injections will be allowed until all 114 wells have either passed a comprehensive set of tests or been taken out of service and isolated from the underground reservoir.

SoCalGas, in consultation with DOGGR and its independent experts, plans to take all wells out of service and isolating groups of them from the underground reservoir. Then, as SoCalGas completes the well inspections, it can bring a small group of wells that have passed the safety and integrity inspection back in service. This approach would allow Aliso Canyon to return to service in a limited capacity sooner than if all 114 wells were inspected before any are returned to service. The Aliso Canyon Action Plan Entities eagerly await information about which wells will be able to withdraw, how much natural gas can be withdrawn, and when so that the entities can incorporate that information into the Reliability Action Plan as it is revised and updated.

### *Tariff Changes*

**Implement Tighter Gas Balancing Rules:** The current balancing rules for gas transportation service allow shippers (that is, noncore customers and marketers) a tolerance band on the difference between what they delivery into the L.A. Basin and what they actual use so that they don't have to balance delivery and usage on a daily basis. Instead they are allowed to balance supply and demand on monthly basis with a 10 percent margin of error on their monthly demand, with the difference made up the following month at zero penalty. These monthly balance rules mean SoCalGas must with draw or inject gas into storage on days when the noncore customers do not match their supply and demand. With Aliso Canyon unavailable (except for withdrawals to maintain system reliability), the gas system has much more limited ability to balance differences between shipper deliveries and actual customer load. The Technical Assessment Group's hydraulic models found that even relatively small imbalances can reduce operating pressures during the gas day sufficient for Gas Control to call for curtailments.

The Aliso Canyon Action Plan Entities therefore recommend moving away from the monthly balancing with the 10 percent tolerance and replace it with something tighter [41]

The hydraulic modeling by the Technical Assessment Group shows that SoCalGas does not have the ability to support 10 percent monthly balancing while it cannot routinely use Aliso Canyon. It is essential

41 SoCalGas, with its affiliate San Diego Gas & Electric Company (SDG&E), filed a motion with the CPUC in an application they already had pending (Application No. 15-0-020), to implement this mitigation measure.

to get help from all shippers – who have not created the problem at Aliso Canyon - by asking them to match their actual usage very closelywith their scheduled delivery quantities so that the gas system can avoid curtailments. The Technical Assessment Group estimates there still will be some days where even a 5 percent difference between deliveries and burn will result in gas service curtailment. If shippers, in aggregate, cannot successfully balance deliveries with their consumption, the number of days of estimated gas curtailment and/or the need to withdraw gas from Aliso Canyon would increase.

**Modify Operational Flow Order Calculation:** On December 1, 2015 SoCalGas implemented a new rule, approved by the CPUC in D.15-06-004 to call a "low" OFO. An OFO directs shippers to get into balance; low OFOs occur when customers have scheduled too little gas to meet their requirements. SoCalGas normally pulls from storage the gas needed to cover customer imbalances, when the imbalance is larger than the storage withdrawal capability available, however, SoCalGas calls an OFO, which requires customers to step in, use a subsequent scheduling window to correct their nomination and thereby remedy their imbalances themselves

The quantity of storage provided by Aliso Canyon is zeroed out in the calculation, reflecting the fact that Aliso Canyon is not available to help provide balancing service. The Aliso Canyon Action Plan Entities are concerned, that the current tariff rule and related storage-based calculation apply system-wide, taking into account all of SoCalGas' storage. As discussed in this Action Plan, the storage on the rest of SoCalGas' system is mostly irrelevant to providing balancing service within the L.A. Basin. Thus, the current calculation could trigger or not trigger an OFO but might not capture all instances in which an imbalance causes low operating line pressures within the L.A. Basin that could trigger curtailment. . Until the gas and electric utilities have operating experience with the daily balancing rule, the Aliso Canyon Action Plan Entities suggest placing this mitigation measure on a "stand by" list and watch for conditions that might call for re-opening the discussion.

**Call OFOs Sooner in the Gas Day:** This is another measure the Aliso Canyon Action Plan Entities suggest holding on the stand by list as daily balancing may make it unnecessary. SoCalGas does not know how much difference there might be between supply into its system versus deliveries to customers (that is, receipts versus sendout) until late in the afternoon before the next gas day. If other indicators could be developed, SoCalGas could use those indicators to trigger OFOs sooner. The earlier that notice can be given, the more the options that LADWP and California ISO will have to modify gas-fired generation. The difficulty in implementing this measure, however, is that it is not clear SoCalGas would have the information actually needed to call an OFO sooner in the gas day. OFOs are called once there is a problem, while daily balancing is aimed at preventing a problem. The Technical Assessment Group thought daily balancing was easier to implement and more certain.

**Provide E Dispatch Information Prior to Cycle 1:** Today, generators must nominate and schedule their natural gas before the California ISO releases its day-ahead market awards. This requires gas-fired generators to essentially guess what their gas use will be. California cannot change the gas schedule; the gas nomination windows are set on a nation-wide basis and are passed up the natural gas supply chain, across pipelines and time zones. But the Aliso Canyon Action Plan Entities believe that giving

generators guidance about likely dispatch before they schedule their natural gas with the gas utility, pipeline, and supplier can help reduce some of the guessing and ease compliance with daily balancing.

The California ISO is therefore considering how it could provide dispatch information to inform the generators prior to the "timely," or first, window to nominate gas for the next day.[42] This information will give generators a better idea of whether they will be dispatched, which allows them to predict their gas use with less error. This mitigation measure should help reduce the variance between nominations and actual burn. This information is in "Beta status" and is being tested with the gas utilities. The report is being fine-tuned through modifications to the forecasting process and it is expected to take a couple months to achieve a level of consistent quality. Expansion of this new process will require ISO tariff and Business Practice Manual changes that must be approved by the Federal Energy Regulatory Commission.

**Consider CAISO market changes that increase gas-electric coordination in response to Aliso Canyon[43]:** The CAISO has initiated a stakeholder process to consider market changes that may be necessary in response to the Aliso Canyon issue and to reduce the risk to reliability. This expedited initiative is considering if timing of the day-ahead market or other information prior to the gas nomination cycle could better align gas procurement with electric generation needs. Also being considered are change to the real-time market that may be necessary to constraint the real-time dispatch around day-ahead results to minimize gas use changes from day-ahead expected levels. Lastly, compensation and bidding rules changes that may be necessary to could improve ISO's ability to better model and compensate resources for the higher costs associated with committing or dispatching resources subject to proposed gas balancing rules.

### *Operational Coordination*

**Increase Electric and Gas Operational Coordination:** Recognizing the increasing interdependence between the gas and electric systems, the California ISO and SoCalGas have, over the past five years, made significant strides to improve the quantity, content and timing of communication to coordinate between electricity and gas operations. For example, SoCalGas is using the California ISO's notifications that restrict maintenance on the electric system to help inform SoCalGas of areas where maintenance may be limited or modified. Furthermore, the California ISO receives notice of operational flow orders from Pacific Gas and Electric Company (PG&E), Kern River and SoCalGas, thereby enabling the California ISO to assess grid conditions during times of gas system strain and to take measures to ensure reliable operation of the electric system. With this information, the California ISO can compare pipeline operators' operational flow orders with outages and constraints on transmission lines and generation locations to assess whether the operational flow order could adversely impact grid reliability. The California ISO also presents SoCalGas operators with daily forecasted gas burn information, based on Day Ahead Market awards. This lets SoCalGas know what level of electric generation gas use to expect and allows it to compare what it sees happening on its system with what the day-ahead awards led it to

42 Known as "Cycle 1," among the four traditional gas day scheduling windows. A fifth window, or cycle, is added at the end of the day beginning April 1.
43 http://www.caiso.com/informed/Pages/StakeholderProcesses/AlisoCanyonGasElectricCoordination.aspx

expect. SoCalGas and the California ISO communicate in real time when significant challenges are anticipated, when weather changes occur, or when changes are seen in gas consumption patterns. The California ISO will also develop a forward-looking report that reflects gas burn rates two days in advance of operating day, enabling the gas companies to anticipate upcoming changes in gas flows and best prepare for them.

Further, the California ISO implemented an Operating Procedure for Gas Transmission Pipeline Outages or De-rates, which formalizes the communication between the California ISO and SoCalGas during challenging events, as well as examines how each entity proactively addresses changing conditions. This procedure was a key component in a table top exercise held between thee California ISO and SoCalGas on March 2, 2016, in anticipation of summer challenges made evident by the Aliso Canyon constraints. The California ISO will hold a follow up table top exercise that includes LADWP before the summer. Moreover, the California ISO will regularly monitor both SoCalGas' *Envoy™* and PG&E's *Pipe Ranger* gas pipeline notification systems as well as the interstate pipelines for operating condition information that could be relevant to system conditions in California.

LADWP also monitors gas supply conditions and has responded to SoCalGas operational flow orders. Starting last summer during a period of gas curtailments, LADWP interacted with SoCalGas and the California ISO and is working cooperatively with them to better coordinate gas fuel usage and system planning. Armed with this information, LADWP can better forecast and plan its resource utilization for the upcoming day. LADWP now provides to SoCalGas a day-ahead forecast of the gas it expects to burn each hour at its in-basin generators for high load days. It is looking to automate this process and provide it every day and potentially expand it to a two-day-ahead forecast. These forecasts are presented in an hourly usage format. LADWP will also monitor the SoCalGas *Envoy™* notification system. LADWP and California ISO will continue and expand their joint emergency training to improve operator knowledge and improve coordination under normal and emergency conditions. LADWP and SoCalGas plan additional table-top exercises as well.

For summer 2016, California ISO and LADWP will also look at how they can coordinate during gas curtailment events as well as electricity contingency events. There must be clearly defined rules of the order of curtailments. In an electricity contingency event, gas-fired contingency reserves may need to be called upon to meet demand. Natural gas will need to be available for these gas-fired contingency reserves or other reserves or sharing will be needed. The California ISO and LADWP are still discussing whether alternatives need to be found to relying on gas-fired generation to satisfy electric contingency events. One alternative might be to rely more on in-basin generation and hold out-of-basin generation in reserve.

**Establish More Specific Gas Allocation among Electric Generators In Advance of Curtailment:** The Reliability Aliso Canyon Action Plan Entities propose that SoCalGas work with the California ISO and LADWP to develop a more specific and clear procedure for allocating a gas curtailment among generators so that they are agreed upon and known in advance Both prefer that the procedure be worked out in advance rather than working them out on the day of curtailment, while SoCalGas prefers

to leave as much flexibility as possible to tailor the allocation to exact system operating conditions.[44] The June 30, 2015 gas curtailment left many parties, including the, CPUC, the Energy Commission, the California ISO and LADWP with questions about how the determination was made that day about which generators should cut usage, by how much they should do so, and whether their minimum generation reliability requirements were taken into account.[45] A procedure needs to be created to clarify how a gas curtailment would be spread among electric balancing authorities and/or generators so that minimum generation requirements are satisfied and so that the balancing authorities can plan for how much gas-fired generation to replace. This more specific set of curtailment procedures may require CPUC approval.

**Determine if Any Gas Maintenance Tasks Can Be Safely Deferred:** The 2010 gas pipeline explosion at San Bruno that killed eight people resulted in requirements from both state and federal regulators (i.e., the CPUC and the U.S. Pipeline and Hazardous Materials Safety Administration) to enhance the safety of the natural gas system. Pursuant to these requirements, SoCalGas has several programs to perform maintenance, testing and pipeline and valve replacement work. The main two programs are Pipeline Safety Enhancement Plan (PSEP) and Transmission Integrity Management Program (TIMP). Projects under PSEP and TIMP are performed throughout the year, but the most busy months are in the summer when the weather permits to perform construction work and the gas demand is typically at its lowest.

Last year, a key pipeline was out of service for PSEP maintenance during a summer heat wave that reduced electricity imports. SoCalGas was unable to supply enough gas and therefore electric generation was curtailed, while both LADWP and California ISO scrambled to find replacement power. In this instance, curtailment was necessary even though Aliso Canyon storage facility was in service. Without Aliso Canyon, these types of situations may become frequent in the summer if major pipelines are taken out of service as well.

SoCalGas has been directed to file the list of projects that SoCalGas believes it needs to defer in order to ensure reliability. The CPUC will evaluate, through a public process, the deferred projects to understand safety risks and mitigate them as necessary.

### *Maximize LADWP Operational Flexibility*

LADWP has implemented three actions designed to maximize its operational flexibility this summer. These measures will position LADWP to respond quickly and without encumbrance should gas curtailments to its electric generation facilities be required. These actions impose significant cost on LADWP and its customers.

**Curtail Physical Gas Hedging**: LADWP would normally have purchased physical gas hedges, which consist of commitments to take a given quantity of gas supply at a price that is fixed and agreed upon in advance. LADWP instead will not enter into agreements to take any fixed quantity of gas and will not

44 The Aliso Canyon Action Plan Entities appreciate the tension between implementation flexibility and locking down the detailed procedures in advance.

45 An Appendix to the Technical Report describes the June 30-July 1 curtailment in greater detail.

receive the benefit of the price being locked down in advance. This will enable LADWP to vary its gas burn without worrying about needing to take some gas each day or risk violating a physical gas purchase agreement.

**Stop Economic Dispatch**: this action halts economy dispatch sales of energy to other market participants. These sales typically occur when LADWP is able to generate electricity at a lower cost than others; the sale represents an economic benefit to both LADWP and the electricity buyer. Those buyers will now have to buy more costly electricity instead of buying from LADWP and LADWP will no longer benefit from a sale.

**Curtail Block Energy and Capacity Sales**: Agreements to sell blocks of energy or capacity would have been entered into as commitments to use LADWP's power plant capacity to generate electricity and sell energy or capacity to others. A simple example would be LADWP agreeing to sell 10 MW of output to some buyer in December at some price negotiated between LADWP and the buyer. Again, such agreements would have been used where LADWP had capacity and ability to generate at a price that would have produced benefits to both parties. LADWP is foregoing these block energy and forward capacity sales so that it will retain flexibility to reduce its generation when it needs to curtail gas use.

### *Reduce Natural Gas and Electricity Use*

**Use New and Existing Programs Asking Customers to Reduce Natural Gas and Electricity Consumption:** The Flex Alert program has been used to encourage consumers to reduce electricity usage. It played a key role in reliability planning after the San Onofre closure and prior to that, in the 2000-2001 energy crisis. Because any reduction in energy consumption can help reduce the need for or magnitude of service interruptions that might otherwise be needed, the Aliso Canyon Action Plan Entities recommend deploying the Flex Alert program as long as Aliso Canyon is not fully available.

The California ISO took over administering and funding the program beginning in 2016. It owns and operates the Flex Alert call list, the program brand, and the website. To deploy the program now, the CPUC issued a proposed decision on March 14 directing SoCalGas to provide $15 million to fund energy conservation advertising including Flex Alert. The CPUC aims to issue a final ruling on this matter by May.

Using less natural gas is also important. There is no program analogous to Flex Alert for natural gas conservation, so a portion of the funding provided by SoCalGas will be for natural gas conservation messaging. Care will be needed in determining how to message electric and gas conservation efforts to minimize customer confusion. Other marketing campaigns need to be developed to stress to customers that the issues at the gas storage facility are the driving the requests for energy conservation. The campaign should be a joint effort of SoCalGas, LADWP, other local utilities, local governments, and state agencies. The campaign should be focused not just on paid media but must make use of community based organizations and social media.

**Expand Gas and Electric Efficiency Programs Targeted at Low Income Customers**: An Assigned Commissioner's Ruling issued on March 14, 2016 directs SoCalGas and Southern California Edison (SCE)

to prioritize near-term natural gas and electric savings through their Energy Savings Assistance (ESA) Program efforts in low-income communities affected by the Aliso Canyon Gas Storage Facility leak. The ruling also contemplates several potential changes to the existing ESA program activities to increase energy savings in the impacted communities. In Los Angeles, LADWP offers electric savings in combination with SoCalGas' mandated ESA program to reach low-income customers.

**Expand Demand Response programs that Target Air Conditioning and Large Commercial Use:** A number of the demand response (DR) efforts instituted with the loss of San Onofre in 2012 continue to be in place today. New demand response reporting templates have been developed to allow the California ISO to better plan for grid requirements in the summer, the demand response offerings in the region have been enhanced with new DR programs including SDG&E's US Navy Demand Bidding Programs, and SCE instituted improvements to its air conditioner cycling program. Finally, demand response was included as a preferred resource in a Commission Decision that authorized SCE to solicit procurement of electric capacity in the areas impacted by San Onofre. Beyond these efforts the DR program administrators and the CPUC should and are pursing the following program changes focused on the LA Basin.

- Encouraging increased customer participation and potentially providing addition funding for SCE's Base Interruptible, residential and non-residential AC Cycling and Agricultural Pumping Interruptible programs ;
- Conducting a custom Demand Response Auction targeted at the areas most impacted by the gas leak, or adjusting the scope of the current 2017 Demand Response Auction and
- Accelerating implementation of Assembly Bill 793 (Quirk, Chapter 589, Statutes of 2015) in affected areas by offering rebates to customers for the purchase and installation of smart programmable thermostats, combined with enrollment in an SCE DR tariff or load control program.

**Focus and Reprioritize Existing Energy Efficiency Toward Projects with the Potential to Affect Usage this Summer and Coming Winter:** Given the number of changes that are already underway with energy efficiency programs and the time it takes for program implementers to develop the infrastructure needed to roll out new efficiency measures it is unlikely that major program changes beyond what is already in the pipeline will have major impacts on gas or electric demand this summer. However, there are likely some benefit and little risk to accelerating programs that are under development and projects that are in the pipeline such that they will have more savings impact by this summer or by the winter of 2016. CPUC staff is coordinating with SCE and SoCalGas energy efficiency staffs to identify large projects that could be expedited to come on line to reduce peak electric demand for SCE by this summer and end use gas demand for SoCalGas by next winter. These efforts should include providing more staff with the program administrators, and the CPUC to speed approval of projects under development, provide increased incentives to efficiency providers who can install new measures before the end of 2016, and work with local governments to prioritize any necessary permitting.

In Los Angeles, LADWP is adding new components to its existing portfolio of energy conservation programs, incentives and rebates that reach all customer groups, including residential, commercial,

industrial and institutional. Its 2016-2017 fiscal year budget for energy efficiency programs is $178 million. These existing programs target commercial lighting, HVAC and industrial process load, rebates for and replacement of appliances for residential customers, including the popular pool pump rebate program and replacement of old refrigerators for low-income customers. New programs that will be available by the summer include residential and commercial air-conditioning tune-ups, residential light emitting diode (LED) lamp replacement and rebates to reduce home lighting load, and behavior-based energy conservation programs. LADWP is also working with the Los Angeles Unified School District (LAUSD) to implement energy savings measures at schools under a three-year memorandum of understanding with LAUSD.

**Reprioritize Spending in Existing Solar Thermal Program to Fund Projects Installable This Summer and by the End of 2017:** The CPUC oversees a solar thermal program that provides rebates for solar water heating that generally replace gas heaters. The CPUC is working with solar thermal (solar water heating) rebate program administrators for rule changes to the solar thermal program that will focus immediate efforts on installations in the L.A. Basin that will result in fuel switch/gas savings. The CPUC's Energy Division has already approved additional funding of the low-income program incentive budget, which was exhausted, with funds from the general market program. Likely additional changes include: increasing early-stage incentive rates and moving additional funding from late-stage incentive steps to early-stage incentive steps. The CPUC aims to have these program changes in place by June.

In Los Angeles, LADWP offers financial incentives for solar PV for both residential and commercial customers and has taken steps to reduce approval times for solar system installations.

## Next Steps

Implementing the Aliso Canyon Action Plan requires several follow-up steps besides those noted above. Those additional steps include:

- Developing and tracking the milestones to continue implementation of the Action Plan.
- Updating reliability risk assessments and adjusting the action plan as well testing plan unfolds and results potentially allow changes to injection and withdrawal capability.
- Preparing risk assessment analysis for Winter 2017 Reliability.
- Preparing analyses on long-term storage viability, including reliability impacts if DOGGR adopts statewide a rule limiting injections and withdrawals to tubing.

## Conclusion

The Aliso Canyon Action Plan Entities developed an action plan to address risks to natural gas and electricity service during the time that Aliso Canyon operations are constrained. The plan entities found a need first, to maintain inventory at 15 Bcf through the end of winter and into summer, withdrawing only as needed to augment flowing supply coming into the SoCalGas system via pipeline during critical times.

A more detailed analysis consisting of an engineering assessment confirmed Aliso Canyon to be an integral part of the southern California energy system, both for reliable natural gas service and reliable electricity service. The limited current operations of the facility create a possibility of electricity service interruptions in the coming summer months. Without any gas supply from Aliso Canyon, there are 14 days this coming summer during which gas curtailments could be high enough to cause electricity service interruptions to millions of utility customers. Factors leading to gas curtailments, even on days with only moderately high demand, include differences between gas scheduled and received into the SoCalGas system (receipts) versus actual customer demand (sendouts) as small as 0.15 Bcf; gas storage and pipeline maintenance work planned for this summer, and unplanned outages.

The Aliso Canyon Action Plan Entities have developed 18 mitigation measures, grouped into five categories. Some measures are for implementation as soon as possible; a few are to hold in case they are needed later. The sooner the facility can safely be brought back online, the lower the risk to gas and electric reliability. Until then, the actions described above will reduce the risk to reliability, though they will not eliminate it.