DOCKETED

Docket Number:	15-IEPR-01
Project Title:	General/Scope
TN #:	208938
Document Title:	Gene Nelson, Ph.D. Comments: Fast-acting methane from Aliso Canyon leak is boosting global warming - LA Times 01 24 16
Description:	N/A
Filer:	System
Organization:	Gene Nelson, Ph.D.
Submitter Role:	Public
Submission Date:	1/25/2016 12:22:49 AM
Docketed Date:	1/25/2016

Comment Received From: Gene Nelson, Ph.D.
Submitted On: 1/25/2016
Docket Number: 15-IEPR-01

Fast-acting methane from Aliso Canyon leak is boosting global warming - LA Times 01 24 16

This 24 January 2016 article from the Los Angeles Times
http://www.latimes.com/science/la-me-porter-ranch-greenhouse-20160124-story.html
about the Aliso Canyon Storage Facility (ACSF) natural gas storage facility from well "Standard Seson 25" (SS-25) contains some important updates regarding the global warming capability of the methane leaking from the ACSF.

The 2.1 MMT estimate of the CO2 equivalent contained in the article text is substantially smaller than the EDF estimate of 7.51 MMT CO2equivalent shown at https://www.edf.org/climate/aliso-canyon-leak-sheds-light-national-problem.

The revelation that the when the EDF had attempted to have UC Davis methane researcher Stephen Conley, Ph.D. measure the methane concentration above well SS-25 via his specially-equipped aircraft on 05 November 2015, he was ordered to return to the airport. Quoting from the article, "During the two-hour flight to the site at the northern edge of the Los Angeles metro area, EDF was dissuaded from the measurement by personnel from SoCal Gas, citing extreme danger," Note that per Matheson Gas company, the lower explosive limit for methane is 5% by volume in air. See: https://www.mathesongas.com/pdfs/products/Lower-(LEL)-&-Upper-(UEL)-Explosive-Limits-.pdf

Quoting further from the article, ...Conley returned two days later, under contract with the state, to complete the first successful emissions measurements. "That's when we discovered this absurd level," Conley said..... On page 2 of the article note the following, ...On the first flight, in November, methane levels above the community jumped to 50 parts per million, so high that Conley double-checked his instruments in disbelief. "This is probably 20 times bigger than anything else we've measured," Conley said.....

I believe that the important statistic relates to fugitive methane releases (curiously exempt from the California cap and trade program despite the huge GHG impact) between the wellhead and the point of use, estimated at between 2% and 4% of the total volume of natural gas used in the United States. Per the CEC Energy Almanac Natural Gas Overview at http://www.energyalmanac.ca.gov/naturalgas/overview.html, Table 1 on the web page shows a total California demand in 2012 of 2,313 billion cubic feet (BCF.) This total occurred with the premature shutdown of San Onofre Nuclear Generating Station (SONGS) in January, 2012 increasing the California demand for natural gas, as is noted on this CEC Energy Almanac page.

The annual fugitive methane emissions associated with the 2012 California natural gas usage would be between 46.26 BCF and 92.52 BCF of methane.

As has been noted in earlier postings, the most cost-effective means for Sempra to mitigate the harmful effects of this natural gas leak would be to restart SONGS. There would be ongoing global warming mitigation effects associated with each year of operation of SONGS after it was restarted. (Sempra is a part-owner of SONGS.)

Additional submitted attachment is included below.

Los Angeles Times

Science

Science

Fast-acting methane from Aliso Canyon leak is boosting global warming

Pilot and UC Davis scientist Stephen Conley points out the air intakes on his pollution-detecting plane that measure methane emissions from the Aliso Canyon leak. (Joe Proudman / UC Davis)

Tony Barboza Contact Reporter

January 24, 2016 3:00 AM

http://www.latimes.com/science/la-me-porter-ranch-greenhouse-20160124-story.html

Stephen Conley has flown pollution-detecting airplanes over some of the largest oil and gas fields in the nation. But never before has the UC Davis scientist encountered as much methane in the air as in recent months over suburban Los Angeles.

Over and over, Conley has flown his single-engine plane through the invisible plume billowing from an underground natural gas storage facility and into Porter Ranch to provide California air quality officials estimates of the planet-warming emissions from the leak.

Regulators on Saturday approved a comprehensive abatement order that requires Southern California Gas Co. to take immediate steps to contain a massive natural gas leak Regulators on Saturday approved a comprehensive abatement order that requires Southern California Gas Co. to take immediate steps to contain a massive natural gas leak in Porter Ranch, permanently shut down the damaged well, establish a leak detection system and conduct an independent health study....

(Cindy Chang)

On the first flight, in November, methane levels above the community jumped to 50 parts per million, so high that Conley double-checked his instruments in disbelief.

"This is probably 20 times bigger than anything else we've measured," Conley said.

In three months, one failed well at Southern California Gas Co.'s Aliso Canyon storage field has spewed more greenhouse gases than any other facility in California. **At its height, the leak more than doubled the methane emissions of the entire Los Angeles Basin and surpassed what is released by all industrial activity in the state.**

Experts say the release of so much methane, a fast-acting greenhouse gas many times more powerful than carbon dioxide, means that the biggest environmental consequence of the leak will be its effect in boosting global warming. Long after the leak stops and the foul odors vanish, the pulse of methane will remain in the atmosphere and its damage to the climate will go on.

State regulators and scientists studying the leak warn that the longer the gas escapes into the air, the more it will work against California's progress fighting climate change, including the target announced by Gov. Jerry Brown last year to reduce emissions of methane and other short-lived climate pollutants by 40% or more by the year 2030.

"It's really moving us in the wrong direction," said Jorn Herner, chief of research planning, administration and emissions mitigation at the state Air Resources Board.

Once the leak is stopped, air quality officials plan to complete a detailed estimate of its methane emissions using computer models and data from a network of gas analyzers on towers and buildings throughout the region. It will take months to complete an accurate measurement.

Until then, Conley's measurements, though considered rough estimates, are the best indication of the climate effects from the ongoing leak. They are taken about once a week and paid for by the gas company.

If there is any good news, it is that they show the leak rate has been declining since its peak on Nov. 28, when the well released 58,000 kilograms of methane per hour. By Thursday the rate had dropped by two-thirds to 18,400 kilograms per hour.

The utility attributed the decline to its increased withdrawals of gas from the underground reservoir, "which is helping reduce the pressure that is pushing the gas up the well and out of the leak," gas company spokeswoman Kristine Lloyd said in an email.

As a result, she said, the reservoir has gone from being 90% full before the leak to at most 37% full on Jan. 10.

The utility does not have an estimate of the amount of gas released and says it cannot complete one until after the leak has stopped.

A gas well leak in the upscale San Fernando Valley community of Porter RanchA gas well leak in the upscale San Fernando Valley community of Porter Ranch has poured fumes into the neighborhood. Since the leak began in October, thousands of residents have been relocated to temporary housing. Many are reporting health issues such as headaches, nausea, nosebleeds and dizziness....

Crews are drilling a relief well to seal off the damaged one, with work expected to be completed by late February. Earlier this month the gas company abandoned a plan to capture and burn the leaking methane after regulators raised concerns about safety and explosion risk.

The utility has pledged to make up for its harm to the climate.

Brown has ordered state officials to draft a plan for the gas company to offset the emissions by funding projects in California to curb fast-acting climate pollutants such as methane.

"Those are significant but reasonable constraints," said Gary Gero, senior advisor to Climate Action Reserve, a leading certifier of carbon offsets. He said the emissions from the leak are so great that the gas company would have difficulty finding enough certified offsets to cover them.

The utility would not otherwise be required to pay for its pollution because California's climate change regulations exempt methane leaks — even enormous ones — as "fugitive emissions" that are not subject to the state's cap-and-trade program.

So far, estimates show the leak has put out the equivalent of 2.1 million metric tons of carbon dioxide — more greenhouse gas than 440,000 cars emit in a year. Because the surge of pollution is in the form of methane, it will have a more immediate heat-trapping effect on the atmosphere.

Natural gas consists mostly of methane. Health officials say mercaptan and other odorants added to the gas are responsible for the symptoms being reported by Porter Ranch residents, including headache and nausea. The gas also contains compounds such as benzene that can increase cancer risk through long-term exposure.

State regulators and scientists monitoring methane from the leak throughout the Los Angeles region emphasized the gas is not at concentrations that pose a health or safety risk to residents.

But its fingerprint is evident far and wide, said Riley Duren, a researcher at NASA's Jet Propulsion Laboratory in La Cañada Flintridge. **A network of gas-detecting instruments across the basin, including one sensor atop Mt. Wilson, has detected noticeable increases in methane levels as far away as Orange County and San Clemente Island, he said**.

Duren thinks estimates gathered by airplane represent a "reasonable lower bound" and that total methane emissions from the leak could be higher.

The methane is leaking from one of 115 wells at the company's sprawling facility in the Santa Susana Mountains, which stores natural gas for use across Southern California. With a capacity

of 86 billion cubic feet, it's one of the largest of more than 400 natural gas storage fields around the nation.

This is a massive leak, but it's not altogether unexpected.- Jessika Trancik, assistant professor of energy studies at Massachusetts Institute of Technology

The incident is likely to affect regulations under development by state and federal environmental agencies to reduce methane emissions from oil and gas operations.

"This is a massive leak, but it's not altogether unexpected," said Jessika Trancik, assistant professor of energy studies at Massachusetts Institute of Technology, who evaluates the climate effects of natural gas-related emissions.

That's because of a growing recognition that the nation's natural gas infrastructure is vulnerable to leaks and other failures, particularly as it ages, Trancik said.

"It's inevitable that parts of the supply infrastructure will fail, but the impacts of these kinds of events can be contained if we have more comprehensive monitoring and better predictions of which sites are at risk," she said.

Studies in recent years have found emissions in the industry are significantly underestimated by official inventories. Experts blame widespread leakage, with some estimating that between 2% and 4% of the natural gas in the nation escapes into the air at some point in the production, transmission and distribution system.

Companies have spent millions in recent years improving monitoring and tightening up equipment to reduce the risks to the climate and the public, said Rob Jackson, environmental scientist at Stanford University.

"One accident like this wipes out those benefits over the past year and more," said Jackson, who is studying the Aliso Canyon leak and thinks it is probably one of the largest in the last 50 years.

State officials might have more quickly understood the severity of the leak if they had measured its emissions earlier. The first aerial measurements came more than two weeks after the leak was reported by the gas company on Oct. 23. The Air Resources Board said it wasn't notified of the leak until Nov. 5.

UC Davis project scientist Stephen Conley measured methane emissions from the Aliso Canyon natural gas leak on Jan. 8, 2016.

Reports submitted to the state agency show that pilot Conley made his first attempt to measure emissions from the leak the same day, working for the advocacy group Environmental Defense Fund. But Conley was sent home.

"During the two-hour flight to the site at the northern edge of the Los Angeles metro area, EDF was dissuaded from the measurement by personnel from SoCal Gas, citing extreme danger," according to a report by the pilot. Just before reaching the facility, the environmental group ordered him to turn around, Conley said.

Conley returned two days later, under contract with the state, to complete the first successful emissions measurements.

"That's when we discovered this absurd level," Conley said.

The Air Resources Board released its first estimate of the greenhouse gas emissions nearly two weeks later, after what officials called an extensive review of the data.

The agency's Nov. 20 report found that the stricken well was boosting California's methane emissions by about 25%, underscoring "the urgency of stopping the gas leak."

tony.barboza@latimes.com

Twitter: @tonybarboza

Supply and Demand of Natural Gas in California

The two primary fuels that drive California's energy system are petroleum and natural gas. These resources are used in the transportation sector to generate electricity or for heating and cooling buildings and water. Natural gas has become an increasingly important source of energy since the state's power plants rely on this fuel. Combined, California's residential and commercial building sectors consume more than forty percent of the total state natural gas usage. However, only 10 percent of the natural gas California uses comes from in-state production.

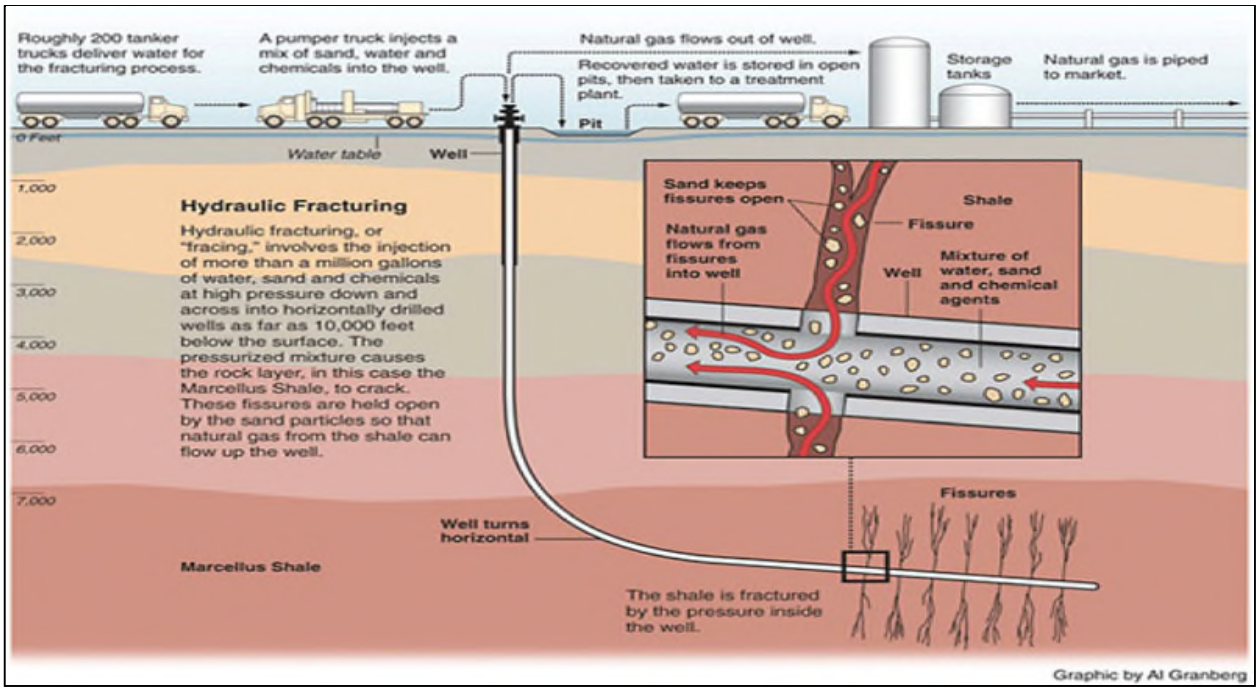
This section provides historical information on California's natural gas supply and resources. Natural gas Data, Facts & Statistics provides current data and U.S. Energy Information will give a national perspective on natural gas supply and demand. The 2015 IEPR provides legislative mandates and policies adopted specific to natural gas.

Natural Gas Supply

In the mid-1990s, horizontal drilling combined with hydraulic fracturing started what many now call the natural gas revolution. Field operators can perforate more footage and multi-stage hydraulic fracturing, the most notable technological innovation, can stimulate far lengthier zones within the formation of interest. This stimulation process involves the pumping of a sand-laden viscous fluid, usually water, into the wellbore and into the formation. Sand and water makes up about 99.5 percent of the mixture and chemicals the remaining 0.5 percent. The operational pressure cracks the rock formation and creates an extensive network of artificial fractures, with each fracture open to a width of no more than two centimeters.[1] Usually, these fractures extend up to hundreds of feet from the well bore.

Fractures held open by the proppant allow greater natural gas flow to the wellbore, and thus to the wellhead. In many instances, initial production may experience more than a ten- or twenty-fold increase after stimulation. As a result of the technological developments in exploration, drilling, and completion, low effective permeability no longer hinders production from tight sandstone and shale formations.

Figure 1 demonstrates a typical 'fracking' operation in a horizontal well along with the creation of a network of artificial fractures after the hydraulic fracturing treatment. The schematic also displays a typical multi-stage or multi-zone outcome of the subsurface treatment.



In California, hydraulic fracturing procedures tend to crack the rock along a narrow vertical band, generally starting at a point several thousand feet underground. As a result, the network of artificial fractures extends only tens to hundreds of feet away from the well (wellbore). Most of California's oil and gas production has been from vertical wells drilled into traditional oil and natural gas reservoirs (formations). Operators in California have executed few, if any, hydraulic fracturing jobs in horizontal wells.

The Monterey shale, a mostly oil "play" located in the San Joaquin Valley, contains about 15 billion barrels of oil and natural gas liquids and an undetermined volume of associated natural gas, according to an estimate prepared for the U.S. EIA in 2011.[2] Due to numerous fault lines and pressure from historic seismic activity, the sedimentary strata of the Monterey shale are bent into folds. This folding formation is not as conducive to horizontal drilling as the Bakken or Marcellus shale deposits.[3] Some industry experts believe that performing advanced, three-dimensional seismic surveys will be necessary before the Monterey shale can be extensively developed.[4]

[1] One inch equals 2.54 centimeters.

[2] INTEK, Inc., Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays, July 2011.

[3] The Bakken shale formation (predominantly oil) and Marcellus shale formation (predominantly gas) are located in North Dakota and neighboring states and Pennsylvania and neighboring states, respectively. They are the most prolific hydraulically fractured shale plays in the United States, and are used in this case for the sake of comparison to the Monterey shale formation, which has a very different geologic structure than either of them.

[4] 23 AAPG Explorer. November 2012. The Monterey Shale - Big Deal or Big Bust.

Natural Gas Demand

Natural gas is used for everything from generating electricity to cooking and space heating to an alternative transportation fuel. In 2012, total natural gas demand in California for industrial, residential, commercial, and electric power generation was 2,313 billion cubic feet per year (Bcf/year), up from 2,196 Bcf/year in 2010 (Table 1). Demand in all sectors except electric power generation remained relatively flat for the last decade due in large part to energy efficiency measures, but demand for power generation rose about 30 percent between 2011 and 2012.

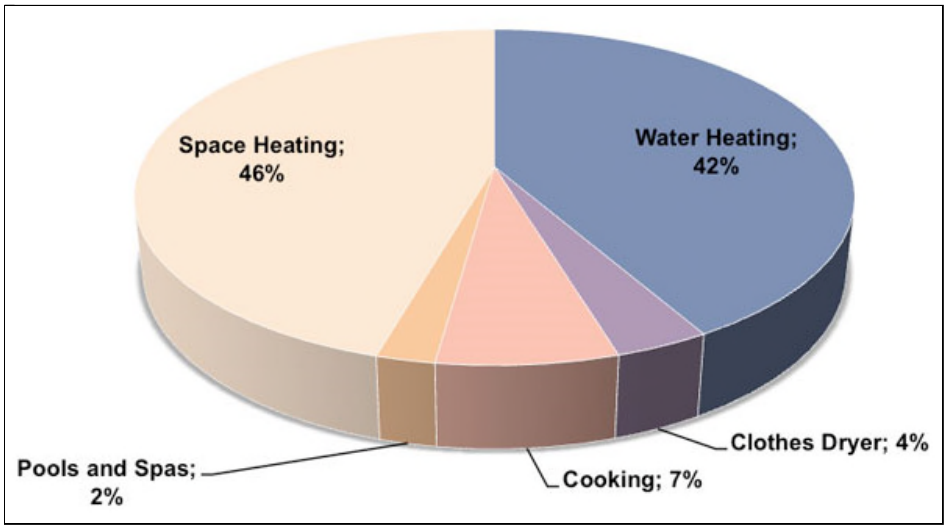
Table 1: Natural Gas Demand in California by End Use from 2010 to 2012

Natural Gas Demand by End Use (Bcf/y)	2010	2011	2012
Residential	509	519	485
Commercial	199	201	201
Industrial	548	559	577
NG Vehicle	18	16	17
Electric Power	922	796	1032
Total Natural Gas Demand	**2,196**	**2,091**	**2,313**

Over 90 percent of households with gas service have gas heating, which accounted for 46 percent of all residential gas consumption in 2012. Water heating, including that for clothes washers and dishwashers, consumes the second largest portion at 42 percent, as shown in Table 2.

Table 2: Residential Natural Gas Consumption, 2012

Residential Natural Gas Consumption	Thousand of Therms Per Year (Mtherms/y)	Percentage
Water Heating	2,633	41.71%
Clothes Dryer	228	3.61%
Cooking	434	6.88%
Pools and Spas	141	2.24%
Space Heating	2,876	45.56%
TOTAL	**6,312**	**100%**



Natural gas residential energy efficiency savings from appliance and building standards totaled 3,812 million therms in 2012. Building and appliance standards have had a proportionally larger impact on residential natural gas than on electricity or commercial gas use. Residential standards account for natural gas demand savings of 21 percent in 1990 compared to a 1975 baseline, 33 percent in 2000, and 39 percent in 2010. Commercial standards account for demand savings of 3.8 percent in 1990, 7.0 percent in 2000, and 9.3 percent in 2010.

Except for the industrial and petroleum extraction sectors, natural gas demand is seasonal. In the winter, natural gas consumption spikes as residential and commercial customers ramp up space heating. For gas used in electric generation, periods of warmer weather increase demand for air conditioning. These seasonal trends affect both the overall demand for natural gas and the requirements of pipelines and storage to deliver the gas when it is needed and store it when it is not.

[5] KEMA, 2009 California Residential Appliance Saturation Survey: Executive Summary, California Energy Commission, October 2010, CEC 200-2010-004,ES, pages 9 and 11

[6] California Energy Demand 2014-2024 Final Forecast Mid-Case Finale Baseline Demand Forecast Forms, Electricity Efficiency Conservation savings by Planning Area and Sector Mid.xls, Table A-8 http://www.energy.ca.gov/2013_energypolicy/documents/demand-forecast_CMF/mid_case/

[7] Melissa Jones, Leon Brathwaite, Paul Deaver, et.al., 2012 Natural Gas Market Trends, California Energy Commission, 2012, CEC-200-2012-004, p. 73.

Natural Gas to Generate Electricity

Natural gas-fired generation has become the dominant source of electricity in California, as it fuels about 43 percent of electricity consumption followed by hydroelectric power. [8] Because natural gas is a dispatchable resource that provides load when the availability of hydroelectric power generation and/or other sources decrease, use varies greatly from year to year. The availability of hydroelectric resources, the emergence of renewable resources for electricity generation, and overall consumer demand are the variables that shape natural gas use in electric generation. Due to above average precipitation in 2011, natural gas used for electricity generation was 617 billion cubic feet (Bcf), compared to lower precipitation years in 2010 and 2012 when gas use for electric generation was 736 Bcf and 855 Bcf, respectively. [9]

The thermal efficiency of California's gas-fired generation improved more than 22 percent between 2001 and 2012 because of an increased reliance upon combined cycle power plants and reduced dependence upon aging power plants. Moreover, the average heat rate of all gas-fired generation, excluding cogeneration, declined from 9,997 Btu/kWh to 7,805 Btu/kWh between 2001 and 2012. [10] The less efficient generation may still serve peaking, ramping, and reliability purposes, which are required over fewer hours.

[8] Nyberg, M. 2012. Quarterly Fuel and Energy Report. http://energyalmanac.ca.gov/electricity/total_system_power.html

[9] http://www.eia.gov/dnav/ng/ng_cons_sum_dcu_SCA_a.htm

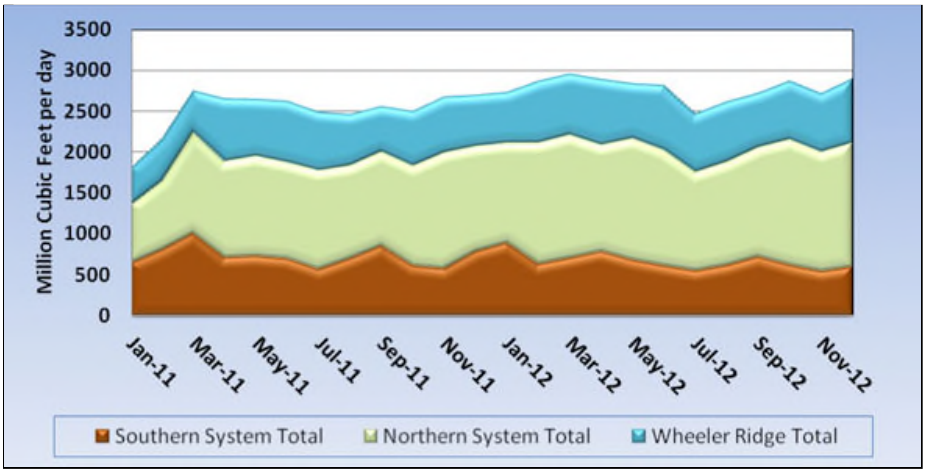
[10] The amount of energy used by a power generator to produce one kilowatt hour of electricity.

Gas Implication of San Onofre Nuclear Generation Station Closure

In early, 2012, the San Onofre Nuclear Generation Station (SONGS) Units 2 and 3 were taken offline due to problems discovered during maintenance inspections. Combined, the units at SONGS provided 2,200 MW of generating capacity to the Southern California region (Orange County and San Diego area). In December 2011, daily average natural gas demand on the SoCal Gas system was about 2,693 million cubic feet per day (MMcf/d). Since the closure of SONGS, demand on the SoCal Gas system rose to 2,950 MMcf/d in March 2012, a 257 MMcf/d increase from December 2011 natural gas demand, as shown in Figure 2. The California ISO reported that thermal generation from other sources also increased by more than 1,000 MW. Having ample available natural gas storage inventory levels and spare interstate pipeline capacity was likely key in ensuring that additional demand for natural gas was met with no reliability issues.

During the summer of 2012, the generation needed to make up for the loss of SONGS energy came almost entirely from the fossil-fuel plants in Southern California that do not use once-through-cooling. [11] In addition, Huntington Beach units 3 and 4 (452 MW) were converted from generation capacity to reactive support devices. [12] Increased transmission capacity from Sunrise Powerlink and Barre-Ellis also helped ensure power quality and reliability. All these efforts along with energy efficiency, and the potential to enact demand response and Flex Alerts helped to ensure that load was met reliably in the Southern California region for the summer of 2012.

Figure 2: SoCal Gas System Natural Gas Demand



In June 2013, Southern California Edison Company made the decision to permanently close and decommission SONGS. California will need to make up for the loss of this generating capacity with natural gas, renewable resources, and purchased power in the immediate years ahead. Governor Brown established a task force to develop and assess options to shore up local area capacity requirements in the absence of SONGS. A draft plan was released in August 2013. In early 2013, the California Public Utilities Commission (CPUC) issued a revised scoping order and assigned commissioner ruling, which focus on the need for resource procurement authority for capacity to satisfy local capacity requirements with SONGS offline. [13]

[11] The State Water Resources Control Board implemented a policy in May 2014 to phase out the use of once-through-cooling in coastal power plants that use ocean water. As a result, 20,704 MW of natural gas-fired generation will need to be retired, retrofitted or repowered to satisfy the OTC policy if they can secure CPUC-approved power purchase agreements.

[12] Reactive support device: A device that helps improve and maintain power quality by keeping current and voltage levels in phase within acceptable parameters.

[13] Barre-Ellis connects two key southern California substations, while the 117-mile Sunrise Powerlink connects Imperial County (solar energy) to San Diego.

Once-Through Cooling and Natural Gas

On May 4, 2010 the State Water Resources Control Board (SWRCB) approved a once-through cooling (OTC) policy that included many grid reliability recommendations made by the California Independent System Operator (California ISO), as well as a join implementation proposal developed by the Energy Commission, California Public Utilities Commission (CPUC), and California ISO. The Office of Administrative Law approved the policy on September 27, 2010, and it became an effective regulation on October 1, 2010. The OTC policy will require electric generators to reduce or eliminate the use of coastal or estuarine water to minimize the harmful impacts of cooling water intake structures on the environment. The OTC policy recognizes that some of these plants are critical for system and local reliability. They may also provide operational services needed to integrate renewable resources into the state's electric grid. Some power plant owners will repower their facilities and use dry cooling technologies to replace OTC, while others will retire their facilities altogether. The permanent closure of San Onofre Nuclear Generation Station in 2012 presents additional challenges to the grid especially in Southern California, which provided generating capacity and voltage support for the region. California's energy agencies are working closely together to evaluate reliability needs in this region and the potential to use a balanced portfolio of options, including natural gas plants and preferred resources, to replace OTC plants and SONGS. In the near-term, the need for additional natural gas for power generation in Southern California may put strains on natural gas infrastructure in the region. In the longer term, the total demand for natural gas for electric generation is expected to decline as newer more efficient natural gas plants replace older, less efficient gas plants and more renewable resources come on-line to displace natural gas generation. Some of this reduction is likely to be offset by the need to use natural gas plants to provide the operational flexibility - requiring them to run at lower efficiency - that is necessary for integrating increasing amounts of renewable resources

[14] See http://www.energy.ca.gov/2013_energypolicy/documents/2013-09-09_workshop/2013-08-30_prelim_plan.pdf.

[15] CPUC 2012 Long Term Procurement Planning proceeding, Track 4.

[16] http://www.energy.ca.gov/renewables/tracking_progress/documents/once_through_cooling.pdf