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SoCalGas Comments on Joint Agency Workshop on Increasing the Need for Flexibility in the Electricity System

Additional submitted attachment is included below.

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California Energy Commission
Dockets Office, MS-4
1516 Ninth Street
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Subject: Comments on 2017 Integrated Energy Policy Report, Docket Number: 17-IEPR-07, Joint Agency Workshop on the Increasing Need for Flexibility in the Electricity System

Dear Chairman Weisenmiller and fellow Commissioners:

The Southern California Gas Company (SoCalGas) appreciates the opportunity to submit comments in response to the California Energy Commission's (CEC) 2017 Integrated Energy Policy Report (IEPR) Joint Agency Workshop on the Increasing Need for Flexibility in the Electricity System held on May 12, 2017.

As the CEC, the California Public Utilities Commission (CPUC), and the California Independent System Operator (CAISO) consider how best to address the need for increased flexibility in the electricity system, SoCalGas offers the following points for consideration.

1) The natural gas system is a safe and reliable cost-effective resource,
2) Power-to-Gas (P2G) should be recategorized at the CPUC as a storage resource,
3) The economics of P2G storage technology are unique in that energy storage costs decrease dramatically at scale, and
4) An explanation on why the amount of hydrogen allowed in natural gas systems varies.

As increasing amounts of renewable energy (such as from solar and wind generation) are introduced into the electric system, there is a greater need to match load to available resources and to store renewable electric energy for later use. Natural gas storage and generation is and can be relied upon to quickly respond to shortfalls and reduce stress on the grid caused by the intermittency of renewable power production.

P2G may be used as another measure in a diverse portfolio to integrate renewables and manage excess renewable energy while supporting California's ambitious climate and air targets. P2G is the process of using electricity to split water and create hydrogen, which can be further converted to methane if desired, and allows for storing large amounts of energy

for long durations. Our research indicates that P2G store energy less expensively than batteries for durations over 6 to 8 hours, providing a potentially more cost-effective strategy for day-night, weekly, and seasonal electricity storage. Therefore, this technology can help the state to support increased renewable and traditional energy storage, increased system flexibility and resiliency, and with reaching climate change policy goals. Additionally, P2G can help ensure system reliability through management of over-generation, providing flexible energy storage, resource adequacy and flexibility, and addressing regional reliability needs. Lastly, P2G largely relies on existing infrastructure, existing permits and existing rights of way. Aside from the P2G plant itself – ranging from approximately 300 sq. ft. to just under 1 acre – there are no additional environmental or land intrusions, no new hazardous materials transportation issues, or related.

1) The natural gas system is a safe and reliable cost-effective resource

During the workshop, Chair Weisenmiller stated that if the natural gas system does not demonstrate its safety record, the public would not consider P2G a viable option for energy storage. We'd like to address this concern directly.

First, it is critical to note that a vast majority of residents on the West Coast of the U.S. trust and rely on natural gas for their home heating.[1] Over 90% of homes in our service territory today use natural gas for water and space heating. While some interest groups and their lobbyists argue loudly against the natural gas system, the suggestion that "the public" does not support natural gas is downright incorrect and simply not supported by the facts. Over 90% of residents surveyed prefer natural gas water heating and natural gas cooking in the home[2].

Second, the U.S pipeline network has a "strong safety record of pipelines," according to the U.S. Department of Transportation.[3] A study published in Environmental Science & Technology led by a team from Washington State University found that emissions from local natural gas distribution systems in cities and towns throughout the U.S. have decreased in the past 20 years, to levels 36 to 70% lower than the 2011 U.S. Environmental Protection Agency inventory. Since 1990, the number of pipeline leaks have decreased 25% for pipeline mains and 16% for services due to a concerted effort by natural gas utilities to enhance safety via upgrades and modernization of our nation's pipeline network, including using better pipe materials, sealing cast iron joints and enhancing leak detection and repair procedures.[4]

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[1] 2014 Visions Home Preference Survey, Meyers Research LLC, and 2016 Market Strategies Survey. https://www.socalgas.com/for-your-business/builder-services/visions-home-preference-survey and https://www.nwnatural.com/AboutNWNatural/PressRoom/2016PressReleases/HomebuyerPreference/.

[2] 2014 Visions Home Preference Survey, Meyers Research LLC

[3] https://primis.phmsa.dot.gov/comm/PipelineBasics.htm?nocache=8264

[4] Lamb et al (2015) Direct Measurements Show Decreasing Methane Emissions from Natural Gas Local Distribution Systems in the United States. Link to study at: http://pubs.acs.org/doi/abs/10.1021/es505116p?_ga=1.155985595.1447121853.1445893145

SoCalGas has been and continues to be committed to safety. We are further enhancing the security of our system and always work to improve our practices by applying forward-looking safety strategies. Our aim is to continuously drive process enhancements throughout our system and operations to meet or exceed state and federal safety regulations, and to stay abreast of industry leading practices—consistent with our safety-first culture.

We continue to use industry-leading processes and technologies to enhance the safety and resiliency of our system. For example, we have installed numerous infrastructure and safety enhancements at our Aliso Canyon storage facility, and are working with the CPUC to implement these same enhancements at our three other storage facilities. In our pipeline system, we replaced all cast-iron pipes—known to have higher leak incidents—over two decades ago and continue to work on pipeline safety investments.

We were also an early member of the U.S. EPA's "Natural Gas STAR" program, which encourages companies to voluntarily reduce methane emissions from their systems by implementing best practices (BPs). Since joining that program in 1993, we've mitigated over 800,000 metric tons of CO_2e. We will continue to implement new BPs through this program and others, including the implementation of Senate Bill 1371, Natural Gas Leak Abatement (Chapter 525, Statutes of 2014). And in accordance with the CPUC Natural Gas Leak Abatement Proposed Decision,[5] SoCalGas will be implementing 26 BPs, in particular, eliminating all leaks within a maximum of three years of discovery.

Additionally, our Pipeline Safety Enhancement Program (PSEP) has been ongoing since 2012. PSEP identifies various pipeline sections throughout our system without a record of a pressure test and slates them to be pressure-tested or replaced. PSEP includes provisions to upgrade, replace, or retrofit hundreds of mainline valves in the system with technology that allows them to be opened or closed remotely, or that automatically shuts off the flow of natural gas in the event of a large pressure drop.

As P2G technology develops, we are working with researchers and experts to determine how to safely integrate the technology with existing infrastructure. Although molecular hydrogen is smaller than methane, initial research done at the University of California, Irvine demonstrated that injecting it into test pipelines did not cause an increase in leak rates. Additionally, much of the P2G technology, such as electrolyzers and hydrogen fuel cells, is already well-established and proven to be safe to operate.

2) P2G should be recategorized at the CPUC as a storage resource

Currently, P2G does not qualify as a storage resource in the CPUC procurement program. Mixed mode storage (electrical energy stored as chemical energy) needs to be addressed in future CPUC proceedings. The CPUC Decision on Track 2 Energy Storage Issues, equates P2G to biogas and concludes that P2G projects that convert and store electricity on a

[5] Rulemaking (R.) 15-01-008, Conclusion of Law 23.

natural gas pipeline do not qualify because the natural gas pipeline does not qualify as a storage component.[6]

The analogy to biogas used in the Decision does not reflect a critical technical difference between biogas and P2G: P2G stores energy from the electricity grid. In a P2G system, the natural gas pipeline is serving the same function as the cells in a battery, the storage tanks in a flow battery, the storage vessels in a compressed air system, or the ice in an electricity-to-ice system. The Decision also draws a false distinction between the "pipeline system" and the storage resources which are an integral part of the natural gas system in ruling that the pipeline system is not a storage resource. As such, for P2G, a natural gas pipeline serves the same function as traditional, eligible storage components, and should be deemed an eligible storage component. It is also consistent with the requirements of AB 2514, Energy Storage Systems.

P2G uses electricity, including surplus renewable electricity, for electrolysis to make hydrogen or methane gas that can be stored in existing natural gas storage resources. This innovation "can optimize the use of the significant additional amounts of variable, intermittent, and off-peak electrical generation from wind and solar energy that will be entering the California power mix on an accelerated basis."[7] This resource is also modular and can be cited virtually anywhere on the grid. As such, it serves bulk storage, load-shifting and other functions, such as load following and voltage support—all core functions defined in the CPUC use cases.[8]

Because of the need for load shifting and because it uses available, ubiquitous natural gas infrastructure, P2G, consistent with AB 2514, "can reduce costs to ratepayers by avoiding or deferring the need for new fossil fuel-powered peaking power plants and avoiding or deferring distribution and transmission system upgrades and expansion of the grid."[9]

Further, by using available resources, storing electricity generation in the gas grid, and potentially displacing fossil-based natural gas, P2G is also "cost effective and [can] either reduce emissions of greenhouse gases, reduce demand for peak electrical generation, defer or substitute for an investment in generation, transmission, or distribution assets, or improve the reliable operation of the electrical transmission or distribution grid."[10] P2G also uses "mechanical, chemical, or thermal processes to store (electrical) energy that was generated at one time for use at a later time."[11]

P2G that uses a natural gas pipeline as a storage component should be deemed eligible to meet storage procurement targets because enabling the development of P2G is good public policy. It is recognized by U.S. energy agencies as an important energy storage solution[12]

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[6] *See* D. 17-04-039 at 11-13.
[7] AB 2514, Section 1(b).
[8] *See* D.13-10-040 at 14; D.12-08-016 at 23.
[9] AB 2514, Section 1(c).
[10] Cal. Pub. Util. Code § 2385(a)(3).
[11] Cal. Pub. Util. Code § 2385(a)(4)(D).
[12] 19 See, e.g., Hydrogen Energy Storage and Power-to-Gas, Establishing Criteria for Successful Business Cases, NREL; Josh Eichman, Marc Melaina, 10/26/2015 (available at: http://www.nrel.gov/docs/fy16osti/65386.pdf); NREL Teams with

and plays a key part of energy storage in countries and regions with ambitious renewable energy and climate goals, such as Germany,[13] Denmark,[14] and Ontario, Canada.[15] As such, P2G use would be consistent with California's role as a global frontrunner on climate and renewable energy policy to embrace this storage technology.

P2G must ultimately succeed on its competitiveness in function and cost. However, categorical exclusion of P2G as a storage component deprives P2G vendors of a critical market-forcing function allowing that outcome and the potential attendant benefit to ratepayers. Two other regulatory barriers include, a lack of electric rate structures that reflect the low or even negative price of excess renewables and a lack of ability to capture the full value of the environmental benefits of renewable hydrogen and methane in offtake markets whether transportation, industrial, commercial, or residential uses.

In addition to addressing the regulatory barriers mentioned above, immediate action to launch meaningful commercial P2G pilots at the MW and above scale. There is also a need for additional policies, such as those called for in Senate Bill 1383, Short-lived Climate Pollutants, to solidify the market prices for renewable gas in all uses.

3) The economics of P2G storage technology are unique in that energy storage costs decrease dramatically at scale

The central system component of P2G is electrolyzers that use water and electricity as feedstock to create hydrogen. Currently, electrolyzers show energy conversion efficiency (electrical energy input to energy content of hydrogen) in the range of 70% or higher and some systems are projecting efficiency of 90%. In comparing costs of alternative storages systems, both the storage rate (power typically measured in MW) and amount of energy stored (typically measured on MWh) must be considered. P2G systems have the important feature that system cost does not increase in proportion to storage quantity as is the case with battery systems. For this reason, the comparative economics for P2G improve as energy storage capacity increase (i.e. the number of hours of storage at a given input or output rate limit).

As California progresses to an ever-higher renewable fraction on the electric grid, the need for longer-duration storage will increase. Serving an early morning load from renewable electricity generated in the late afternoon requires a storage duration of over 12 hours. At

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Southern California Gas to Launch First Power-to-Gas Project in U.S.,4/15/15 (available at: http://www.nrel.gov/esi/news/2015/16489.html); Power-to-gas brings a new focus to the issue of energy storage from renewable sources, US Energy Information Administration;7/24/15 (available at: https://www.eia.gov/todayinenergy/detail.cfm?id=22212).

[13] See http://www.dena.de/en/projects/renewables/power-to-gas-strategy-platform.html.

[14] See, e.g., the Biocat power-to-gas project supported by the Danish state owned grid operator, Energinet, along with a consortium of European industry leaders. Information available at: http://biocat-project.com/.

[15] Ontario's IESO chose a Power-to-Gas project as a Preferred Respondent in its procurement of Grid Energy Storage. See http://www.hydrogenics.com/about-the-company/newsupdates/2014/07/25/hydrogenics-selected-for-2-megawatt-energy-storage-facility-in-ontario.

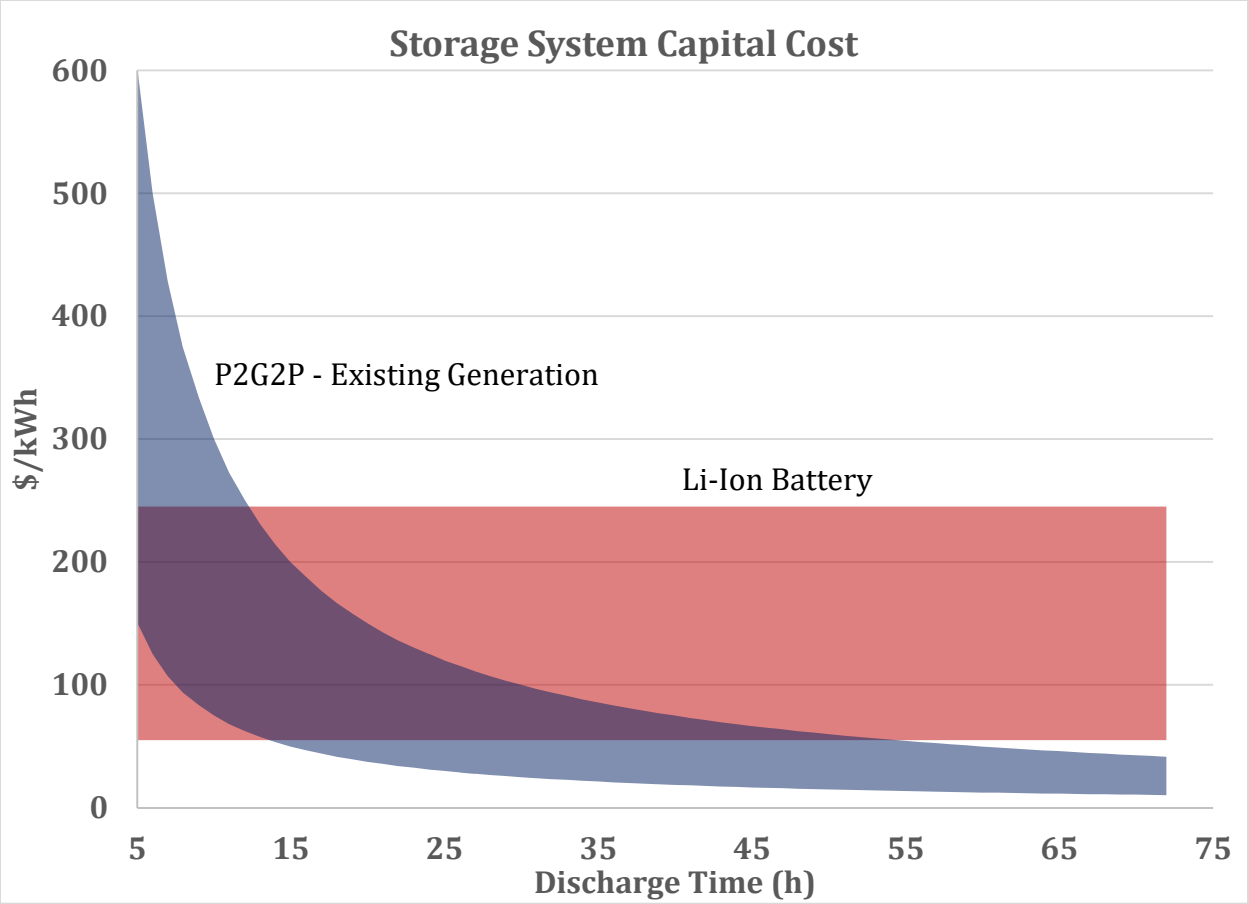
high levels of renewables, daily and weekly weather patterns and seasonal variations in resource availability will require storage over days, weeks, and months.

Future costs of both electrolyzers and batteries are uncertain as both technologies, while fully commercial, are early in their commercial deployment and significant technical advances and learning-curve effects can be expected. Electrolyzers are earlier on the learning curve than batteries so may have greater cost improvement potential.

A complete comparison of the cost of alternative storage systems requires definition of a complete use case including the number of hours that the system is charging and the number of hours that it is discharging, system efficiency, capital cost, operating cost and other factors. However, efficiency adjusted capital cost is a good metric for cost effectiveness across a variety of use cases. The U.S. Department of Energy and other organizations have documented current and forecast costs for batteries and electrolyzers[16],[17]. The figure below shows the capital cost, adjusted for conversion losses, for a lithium-ion battery and an electrolyzer system injecting hydrogen onto the gas grid for later use in an existing combined-cycle power system for storage durations up to 72 hours.

While there is uncertainty in the cost forecast for both storage technologies, this figure shows, depending on the relative progress of the technologies in improving cost, that P2G could reach cost parity with a battery system with a storage duration of less than 5 hours. For storage duration of greater than about 50 hours, P2G is forecast to provide storage less-expensively than batteries even when comparing current P2G costs to forecast future cost for batteries. In addition, self-discharge, which is not accounted for in this comparison, poses a technical challenge for batteries in long-duration storage applications (batteries lose charge over time).

[16] U.S. Department of Energy, H2A Production Case Studies for Current (and Future) Central Hydrogen Production from Solid Oxide and PEM Electrolysis (Version 3.0)
[17] DOE/EPRI Electricity Storage Handbook in Collaboration with NRECA, Sandia National Laboratory, 2015.



4) An explanation on why the amount of hydrogen allowed in natural gas systems varies

During the workshop, Tom Doughty from CAISO asked why there was such a variation on the amount of hydrogen that could be in the natural gas system. This is due to different gas quality requirements or interchangeability, such as staying within an allowable Heating Value or Wobbe Number range. For example, according to discussions with Hawaii's Gas Company, 9-11% hydrogen is maintained in their system to maintain Wobbe of 1280. For instance, the California Air Resources Board limits hydrogen to 0.1% (CCR Title 12 Section 2292.5) and some vehicle manufacturers have also places limits. Other limitations can be due to natural gas vehicle limits. Many European countries limit hydrogen levels before they reach 2% because of sensitive natural gas vehicles steel tanks (UN ECE R 110).

As per SoCalGas' gas quality standard in Rule 30 Tariff Section J Biomethane Delivery Specification, our hydrogen trigger level is 0.1% which was based on a literature review of existing hydrogen limits in the natural gas industry and natural gas vehicle fuel specifications at the time (2012).

Conclusion

SoCalGas appreciates the opportunity to submit these comments on how best to address

the need for increased flexibility in the electricity system. The natural gas system is safe and reliable, however currently there are regulatory barriers that need to be addressed to make P2G storage technology effective. The cost of P2G is going down and can provide a range of grid services, including energy time shifting (arbitrage), voltage and frequency regulation ramping, system capacity, rapid demand and supply response, and T&D investment deferral. P2G is safe, although like any energy carrier, has its own risks and benefits that can and must be managed.

Please do not hesitate to contact us for more information on the safe reliability of the natural gas system and the opportunity for P2G storage technology.

Sincerely,

/s/ Tim Carmichael

Tim Carmichael
Agency Relations Manager
Southern California Gas Company