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SoCalgas Comments On EPIC 4 Investment Plan Scoping - Technology Advancements for Energy Storage

Additional submitted attachment is included below.

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Mike Petouhoff
California Energy Commission
Docket Unit MS-4
Docket No. 20-EPIC-01
715 P Street
Sacramento, CA 95814-5512

Subject: Comments on the Electric Program Investment Charge 2021-2025 Investment Plan Scoping - Technology Advancements for Energy Storage

Dear Mr. Petouhoff:

Southern California Gas Company (SoCalGas) appreciates the opportunity to provide public comments on the California Energy Commission (CEC) Electric Program Investment Charge 2021-2025 (EPIC 4) Investment Plan Scoping – Technology Advancements for Energy Storage workshop held July 20, 2021. We commend the leadership of the CEC; extension of the program funding for another ten years provides an important implement for advancing the public interest. It is vital that the state continue its role as a hotbed for clean energy innovation for the rest of the country and the world. More specifically, we offer the following comments on the CEC's technology advancements for storage research initiatives:

1. Enhancing ancillary services by coupling batteries with existing gas-fired power plants could reduce gas burned and associated emissions.
2. Microgrids, hydrogen fuel-cell innovation, and related technologies can reduce electric grid demand, increase resiliency, and reduce greenhouse gas emissions.
3. Advancing the gas grid's long-duration storage of clean fuels like hydrogen to support the State's decarbonization and reliability goals.

1. **Enhancing ancillary services by coupling batteries with existing gas-fired power plants could reduce gas burned and associated emissions.**

Ancillary services are foundational for deployment of energy storage, across several different markets. Moreover, as extreme weather events are impacting the resiliency and reliability of our power system, energy storage systems are necessary to maintain acceptable grid operation in California and across the country. Electricity grids therefore require a minimum level of service capacity, including spinning and non-spinning reserves to provide the primary functions of:

a. Steadying the power grid through frequency control when demand and production are misaligned over short-term time periods.[1]
b. Making sure energy reserves are accessible during unplanned changes in generational output, plant failures, or line outages.[2]

Currently, California power plants are required to run at *PMin* to sufficiently provide ancillary services. In this scenario, *PMin* is defined as the minimum normal capability of the generation unit.[3] However, if existing powerplants are coupled with battery storage technologies, gas-fired power plants do not necessarily need to operate at *PMin* to provide ancillary services. For instance, batteries may be able to provide ancillary services while significantly reducing greenhouse gas emissions from existing power plants by allowing them to remain offline for more hours. By using a relatively minor coupling modification, California could reduce the amount of gas burned and associated emissions for providing ancillary services, while increasing thermal efficiency for such gas-fired power plants.

As an example, AES Corporation, an electrical power distributor, is actively modernizing a gas-fired power plant that combines a lower profile cycle gas turbine at the Alamitos Energy Center in Long Beach.[4] AES is essentially updating an outmoded gas power plant built in the middle of the 20th century with more efficient, lower emitting technologies. This low-profile combined cycle gas turbine (CCGT) power plant will be consolidated with a 100MW/400 MWh battery energy storage system (BESS).[5] The BESS is not integrated to replace existing gas fired units themselves, but

[1] Guidehouse, "Market Data: Ancillary Service Markets for Energy Storage," 2017. Available at https://guidehouseinsights.com/reports/market-data-ancillary-service-markets-for-energy-storage.
[2] Ibid.
[3] *See* California Independent System Operator Glossary of Terms and Acronyms, 13 November 2015. Available at http://www.caiso.com/Pages/glossary.aspx?Paged=TRUE&p_SortBehavior=0&p_Letter=P&p_Term=Participating+Intermittent+Resource+Program&p_ID=1008&SortField=Letter&SortDir=Desc&PageFirstRow=451&SortField=Letter&SortDir=Desc&&View=%7B8034109D-E87A-4203-90DC-41FF59CA116E%7D.
[4] Andy Colthorpe, "AES switches on 400MWh California battery project alongside 'modernised' natural gas plant," *Energy Storage News,* 27 January 2021. Available at: https://www.energy-storage.news/news/aes-switches-on-400mwh-california-battery-project-alongside-modernised-natu.
[5] Ibid.

instead improve their operations. AES began the modernization project in the second quarter of 2017 and construction is ongoing. There are significant environmental benefits expected because of this project as a whole - the modernized CCGT power plant will use 70 percent less fresh water and will avoid using ocean water for cooling.[6] The Alamitos Generating Station is a prime example of combining a battery facility with a gas power plant to further integrate renewables and thus, achieving decreased emissions associated with the gas power plant's activities.

2. **Microgrids, hydrogen fuel-cell innovation, and related technologies can reduce electric grid demand, increase resiliency, and reduce greenhouse gas emissions.**

CEC's investment of nearly $180 million over the last decade is advancing microgrid research and to expanding the benefits of microgrids in enabling a clean and resilient energy grid in California. Microgrids have the potential to reduce demand on the electrical grid, increase resiliency in the community, and reduce greenhouse gas emissions. An important function of a microgrid is the ability to continue to operate even during power outages, such as those caused by extreme weather events. To be capable of fulfilling this function, a microgrid must be supported by a reliable fuel transportation system and source. This fuel can be used in stationary fuel cells, fuel cell electric vehicles, as well as clean combined heat and power applications and microturbines when energy from the electric grid is otherwise unattainable.

There are some market segments for which these technologies are of particular significance. Table 1 shows various market segments with facilities that do not lend themselves well to the integration of renewable generation technologies in behind-the-meter (BTM) applications. Due to intermittent generation, space limitations, cost-effectiveness issues, and overall level of demand, solar photovoltaics (PV) and battery storage seldom meet electric load needs for various customer classes. Many of these market segments are considered essential businesses and/or facilities that provide essential public health and safety services for society and thus should have the opportunity to utilize the "right fit" technology to provide for reliability and resiliency.

[6] Ibid.

Table 1. Critical Facilities Analyzed in SoCalGas Service Territory

Building Type	Number of Buildings Analyzed	Average Electric Load (kW)	Maximum Thermal CHP Size (kW)	Summer Loads met by PV Output (%)	Storage Capacity for 24-hour Resilience (kWh)	Life-Support Loads
Hospitals	296	3,706	1,800	4%	88,877	Yes
Nursing Homes (med-large)	794	369	100	6%	9.044	Yes
Colleges/ Universities	215	4,943	1,000	10%	112,488	-
Hotels	656	677	600	10%	15,411	-
Restaurants (large)	3,595	291	200	9%	6,563	-
Fast Food Restaurants	6,392	52	n/a	13%	1,125	-
Grocery Stores (large)	648	370	170	23%	7,166	-
Gas Stations	747	79	n/a	3%	6,077	-
Fire Stations	637	25	n/a	63%	361	Yes
Police Stations	157	277	n/a	40%	4,747	Yes

Within the City of Fremont, for instance, solar and battery storage microgrids were installed at three critical fire stations. These microgrids protect critical facilities against electric grid power outages as the batteries have capacity to island for 8-12 hours. At any given time, the Fremont fire stations can island for three hours.[7] The fire stations also installed diesel generators as a secondary backup to the solar and battery microgrid. According to Rachel DiFranco, Sustainability Manager of the City of Fremont, the secondary diesel generators are used during critical needs and are still run monthly to test and make sure they work properly for such needs.[8] As such, an emissions challenge remains prevalent with the use of solar and battery microgrids. Utilizing another technology, such as fuel cells running on hydrogen, renewable natural gas, or natural gas can reduce harmful emissions emitted by secondary backup diesel generators.[9]

In fact, earlier this month the CEC announced an award for a project supported by SoCalGas' Research Development & Demonstration (RD&D) for the Mobile Renewable Back-up Generator Systems (MORBUGs) solicitation (GFO-20-310).[10] The goal of this project is to design and

[7] *See* Rachel DiFranco Presentation on Resilience Impacts on the Microgrid Market at 2020 IEPR Commissioner Workshop on Assessing the Future Role for Microgrids in California, 09 July 2020. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=233761&DocumentContentId=66393.

[8] Ibid.

[9] SoCalGas also filed a Petition for Modification of CPUC Decision (D.)15-10-049 in CPUC Application (A.)14-08-007, relating to its Distributed Energy Resources Services Tariff. The petition seeks to expand eligibility of the tariff to meet the reliability and resiliency needs of critical customers and decrease greenhouse gas emissions and reducing reliance on diesel backup generation.

[10] *See* CEC Notice of Proposed Award for Mobile Renewable Backup Generation (GFO-20-310, Group 3), 09 July 2021. Available at https://www.energy.ca.gov/sites/default/files/2021-07/GFO-20-310_NOPA%20_Cover_Letter_and_Results_Table_Group_3_07-09-2021.docx.

demonstrate two zero-emission hydrogen fuel cell mobile backup generation vehicles (H_2BUG) capable of driving up to 180 miles to emergency and disaster relief locations and providing at least 35 kW of continuous power for a minimum of 48 hours. The project demonstrates the ability for the systems to provide backup power in various climate zones and high fire risk areas. We suggest the CEC continue to fund projects such as these through EPIC.

Fuel cells can operate to provide baseload power generation; however, more research is needed to address increased flexibility of microgrid operation and dispatch to the larger grid when called upon.[11] A fuel cell can also act like an energy storage system because the fuel can be stored onsite or through existing pipelines. Such flexibility could allow generators to turn down during times of solar PV generation, allowing higher penetration of renewables while still supporting the continuous operation of the microgrid.

Fuel cells can also use decarbonized gases like renewable gas and hydrogen. Renewable gases can be stored in pipelines and used to generate power when needed. Fuel cells enable businesses, residents, emergency responders and local governments to invest in adequate preparation for the challenging scenarios brought about by climate change. Additionally, combined heat and power technologies provide reliable energy in the form of electricity and heat. Diversification of power sources throughout a given community helps residents obtain energy security, in the event of climatic hazards and risks. Moreover, when deployed by essential service providers, such as fire stations, hospitals, and schools, these critical service providers secure their ability to remain operational during extreme hazardous events.

In addition to the crucial reliability resiliency attributes exhibited by microgrids, there are also clean, flexible fuel cell microgrids capable of delivering financial and environmental benefits. This is evident at Stone Edge Farms Estate Vineyards and Wines in Glen Ellen, California, which utilizes hydrogen from rainwater and solar panels that comes at a marginal cost of zero.[12] During the summer months, Stone Edge Farms can island with solar as its primary fuel, however, hydrogen is mostly used during the winter months.[13] The diversity and integration of fuels at Stone Edge Farms allows for a more consistent, reliable from of energy that can be better tailored to meet the needs of the customer based on seasonal conditions, while reducing greenhouse gas emissions. We believe projects such as this should be funded by EPIC because the funding will bring new clean and resilient technologies to market as well as help the technology become cost-effective for consumers.

[11] *See* CPUC Distributed Energy Resources Services Tariff Application 14-08-007, 08 August 2014, at 5. Available at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M349/K245/349245336.PDF.

[12] *See* Mac McQuown Presentation on Economic Consideration for Microgrid Deployment at 2020 IEPR Commissioner Workshop on Assessing the Future Role for Microgrids in California, 09 July 2020. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=233764&DocumentContentId=66396.

[13] *See* Jorge Elizondo Presentation on Economic Considerations for Microgrid Deployment at 2020 IEPR Commissioner Workshop on Assessing the Future Role for Microgrids in California, 09 July 2020. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=233764&DocumentContentId=66396.

Lastly, SoCalGas is committed to advancing fuel cell microgrid solutions to support the electric grid. Currently, SoCalGas is powering its two largest Los Angeles facilities with Bloom Energy AlwaysOn Microgrids to reduce air pollution, greenhouse gas emissions, and electricity costs, while increasing reliability for our 22 million customers.[14] SoCalGas is also committed to partnering with businesses, research universities, and State agencies to advance the integration of fuel cells at data centers and other critical facilities. For example, SoCalGas partnered with Microsoft and the University of California Irvine (UCI) in 2019 to investigate how both solid-oxide and proton exchange membrane fuel cells can lower emissions and increase energy reliability and this research is awaiting publication.[15]

3. **Advancing the gas grid's long-duration storage of clean fuels like hydrogen to support the State's decarbonization and reliability goals**

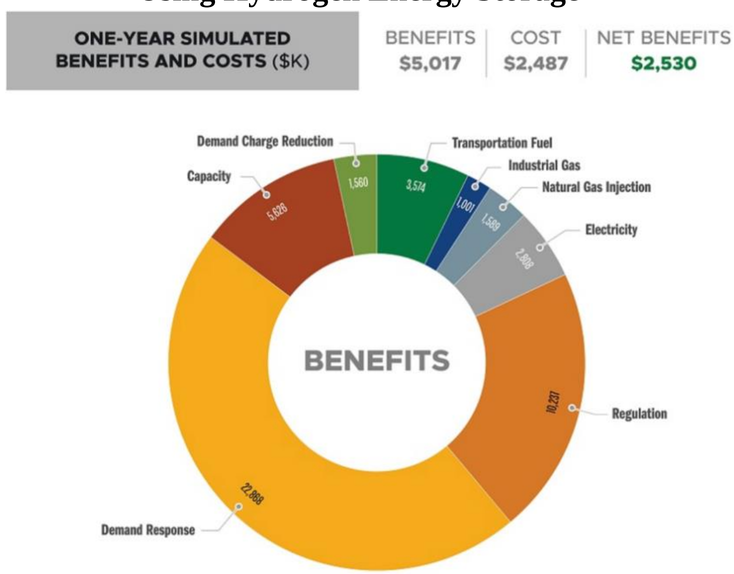
First, it is critical for the Electric Program Investment Charge (EPIC) to recognize that the gas grid is a considerable resource for long-duration storage. Hydrogen storage can support myriad activities like rapid fueling, long-range travel, and can accommodate larger payloads than alternative long-duration energy storage technologies.[16] According to Jack Brouwer, Associate Director of the National Fuel Cell Research Center at UC Irvine, there are many applications that cannot be directly electrified, such as steel manufacturing, cement production, plastics, pharmaceuticals development, and computer chip fabrication – these fundamental industry requirements especially necessitate hydrogen storage to facilitate their longevity in California carbon neutral future.[17]

Hydrogen used for long-duration storage can now be produced at very competitive costs, especially when utilizing electricity to achieve these cost reductions. SoCalGas recently submitted the HyDeal LA Program to the Department of Energy as an initiative to architect a green hydrogen ecosystem, aiming to achieve an at-scale procurement of green hydrogen at approximately $1.50/kg in the Los Angeles basin by 2030.[18] When considering the economic feasibility of a hydrogen storage project, Pacific Northwest National Laboratory (PNNL) used a tool it developed, "Hydrogen Energy Storage Evaluation Tool (HESET)," to model and evaluate a broad range of use cases and grid applications to calculate overall economic benefits through revenue and cost

[14] SoCalGas, "SoCalGas Now Powering Two Los Angeles Facilities with Bloom Energy AlwaysON Microgrids," 17 July 2020. Available at https://www.prnewswire.com/news-releases/socalgas-now-powering-two-los-angeles-facilities-with-bloom-energy-alwayson-microgrids-301095300.html.
[15] SoCalGas, "2019 Annual Report: Fostering Breakthrough Innovation," April 2020. Available at https://www.socalgas.com/sites/default/files/2020-04/2019%20SoCalGas%20RDD%20Annual%20Report.pdf
[16] *See* Jack Brouwer Presentation on Zero Emissions Energy with Hydrogen, 18 March 2021. Available at: https://sites.ps.uci.edu/solutions/wp-content/uploads/sites/19/2021/03/Brouwer_StS_Seminar_031821.pdf.
[17] Ibid.
[18] SoCalGas Company, "SoCalGas Aims to Advance Transformative Hydrogen Technologies via U.S. Department of Energy Hydrogen "Earthshot" RFI," 26 July 2021. Available at: https://newsroom.socalgas.com/press-release/socalgas-aims-to-advance-transformative-hydrogen-technologies-via-us-department-of.

savings.[19] According to PNNL, the HESET determined that when assessing the economic viability of a hydrogen storage system through the utilization of a 1-10MW electrolyzer, the system yielded 1.5 times the return on investment when the system maximized stacked value streams.[20] Furthermore, bundling grid services with hydrogen energy storage can make hydrogen storage even more cost-effective. As seen below in Figure 1, the co-optimization strategy, utilized by PNNL and its HESET, determined that the one-year simulated benefits and costs of using hydrogen energy storage for multiple pathways resulted in net benefits of approximately $2,530,000.[21]

Figure 1: One-Year Simulated Benefits and Costs Analysis (in $ thousands) Using Hydrogen Energy Storage[22]



Included in the model above are various economic characteristics of hydrogen energy storage, such as capacity, demand charge reduction, and regulation. Simulated benefits and costs are calculated while considering coupling and trade-offs. The output below is the performance a cost-benefit analysis for hydrogen energy storage via the Hydrogen Energy Storage Evaluation Tool.[23]

The CEC can help to proactively bridge the funding gap and promote hydrogen as a cost-effective, long-duration seasonal storage solution through acknowledging the attributes of the gas system as a resource to address long-duration storage technologies. Investment in hydrogen infrastructure would help catalyze the broader hydrogen economy, support further fuel diversity and resiliency, support decarbonization goals, and provide long-duration and clean storage capabilities.

[19] Lynne Roeder, "Hydrogen Energy Storage at Your Service," Pacific Northwest National Laboratory, 20 June 2021. Available at https://www.pnnl.gov/news-media/hydrogen-energy-storage-your-service.
[20] Ibid.
[21] Ibid.
[22] Note that the Graphic is by Kelly Machart, Pacific Northwest National Laboratory. Available at https://www.pnnl.gov/news-media/hydrogen-energy-storage-your-service.
[23] "Energy Storage Evaluation Tool: Overview," March 2021. Available at: https://eset.pnnl.gov/overview.

Conclusion

Successful energy storage solutions compel additional consideration of the enhancement of ancillary services through the coupling of batteries with gas-fired power plants, enabling medium-term storage with microgrid and fuel-cell innovation, and supplementing efforts to utilize hydrogen for long-duration storage. We commend the research, development, and deployment efforts included within the EPIC Program. As the State moves toward a clean energy future, the EPIC Program continues to encourage investment in applied energy science that provides tremendous public benefit, while increasing the commercialization of these critical technologies. Without the ratepayer-funded EPIC Program, many of the technological demonstrations would not be brought to scale. It is in the public interest to invest in a diversified energy storage portfolio for the State's energy system to make sure it continues to be reliable and resilient amid climate change. We look forward to continuing this important discussion with the CEC on advancing energy storage technologies.

Respectfully,

/s/ Kevin Barker

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