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SoCalGas Comments on the CEC Non-Lithium Ion Long Duration Storage Workshop

Additional submitted attachment is included below.



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The Honorable David Hochschild
Chair, California Energy Commission
Docket Unit, MS-4
Docket No. 19-ERDD-01
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Comments on the CEC Workshop on Advancing Non-Lithium-Ion Long Duration Energy Storage Technologies

Dear Chair Hochschild,

Southern California Gas Company (SoCalGas) appreciates the opportunity to provide public comments on California Energy Commission’s (CEC) April 5, 2022 Workshop on Advancing Non-Lithium-Ion Long Duration Energy Storage Technologies. As California Public Utilities Commission (CPUC) President Alice Reynolds mentioned during her opening remarks, “long duration storage is increasingly an important part of California’s electricity mix. It is needed to ensure reliability and reduce greenhouse gas emissions during net peak periods.”¹ In addition to helping meet daily net peak demand when renewables are intermittent or unavailable, hydrogen storage can also be a viable long duration and seasonal storage solution while helping provide grid reliability at a minimal cost.

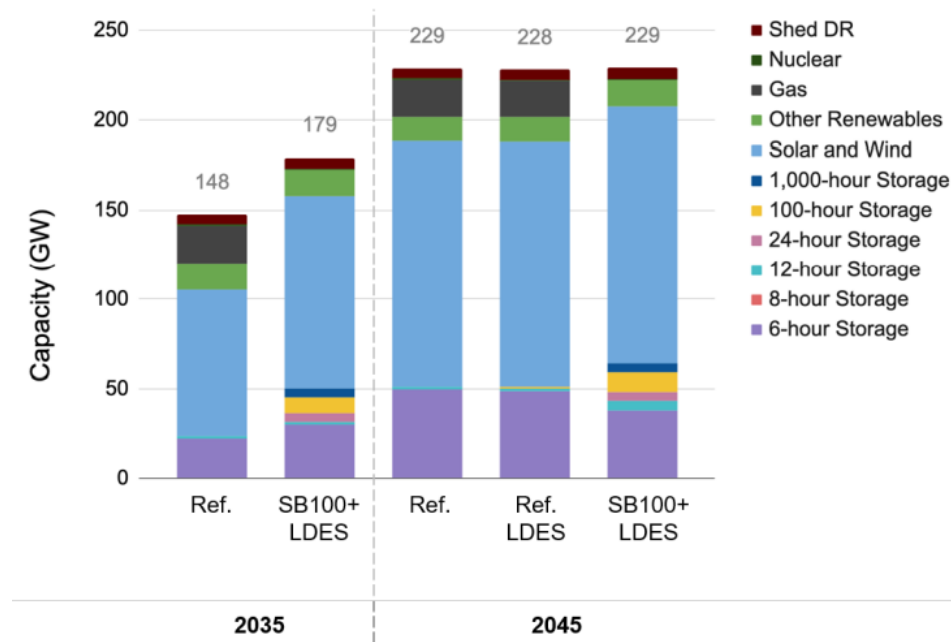
In an effort to add more context to the discussion of long duration energy storage (LDES) technology options, our comments focus on the following topics: 1) E3 Long Duration Storage Deployment Scenarios highlight the need for the gas grid as a long duration storage asset; 2) Studies show that renewable hydrogen coupled with batteries can offer long duration and seasonal storage solutions to support grid reliability; and 3) Research highlights renewable hydrogen as long duration storage will be key to providing zero emission power for essential energy services.

¹ See “CEC Workshop on Advancing Non-Lithium-Ion Long Duration Energy Storage Technologies,” CEC, April 5, 2022, available at: https://www.energy.ca.gov/event/funding-workshop/2022-04/workshop-advancing-non-lithium-ion-long-duration-energy-storage?utm_medium=email&utm_source=govdelivery.

1) E3 Long Duration Storage Deployment Scenarios highlight the need for the gas grid as a long duration storage asset

In the E3 Deployment Scenarios for 2045,² the Core Reference scenario selects gas generation to meet capacity needs. The 2045 Core Reference plus LDES scenario remains largely unchanged despite the multitudes of LDES choices available to the model. Only when gas generation is manually removed from the candidate resource list in the SB 100+ LDES scenario are longer duration storage options such as 100-hour and 1,000-hour storage selected by the model. Figure 1 below summarizes E3 Deployment Scenarios results, highlights the value of gas generation as a source of capacity and long duration storage, and shows a nearly one-for-one substitution of LDES for gas capacity.

Figure 1: E3 Deployment Scenarios Total Resource Portfolio by Scenario & Model Year³



It is important to note that gas capacity and the natural gas pipeline system itself have the potential to function as an innate form of long duration storage. This can allow gas system capacity to provide a dispatchable, just-in-time energy resource that can help to meet peak load during certain times of the year for a few hours or a few days. Gas capacity is thus a flexible long duration dispatchable capacity resource with Effective Load Carrying Capacity (ELCC) above 90 percent, as shown on slide 13 of the workshop presentation.⁴ As California moves away from fossil

² See “CEC: Staff Workshop on Research to Assess Long-duration Energy Storage Deployment Scenarios,” CEC, March 29, 2022, available at: <https://www.energy.ca.gov/event/workshop/2022-03/staff-workshop-research-assess-long-duration-energy-storage-deployment>.

³ *Ibid.*

⁴ *Ibid.*

generation, the State’s energy system will still need the long duration storage and capacity currently provided by natural gas. Alternatives like lower carbon intensive fuels can fulfill the various roles of natural gas including supporting the reliability of the electric grid and commercial and industrial sectors. Clean fuels such as renewable hydrogen, renewable natural gas (RNG) and fuel blends with carbon capture can serve the same function that natural gas provides.

The close to one-for-one replacement of gas with LDES from this initial modeling suggests that the multiple values of gas capacity, and its low-carbon alternatives, will further become visible as the new modeling toolkit is developed and implemented. SoCalGas looks forward to supporting the future decarbonized electric grid by providing clean fuels delivered through a flexible and reliable pipeline infrastructure.

2) Studies show that renewable hydrogen coupled with batteries can offer long duration and seasonal storage solutions to support grid reliability

Presenter Gabe Murtaugh of California Independent System Operator (CAISO) noted during the CEC workshop that Integrated Resource Planning (IRP) forecasts found “the discharge period for the marginal storage resources [during the evening ramp up period] in 2024 is already longer than four hours.”⁵ This means that a four-hour duration battery would not be sufficient to provide energy across the entire evening ramp period. In addition, CAISO stated a zero emissions grid may require long duration storage that has a range of 100+ hours, or seasonal storage, in the long run to maintain operational grid reliability as there are multi-day periods of low solar and wind during winter months.⁶ Based on this, we believe that batteries will need to be coupled with an additional long duration storage technology like renewable hydrogen.

Renewable hydrogen can offer long duration and seasonal storage because it can be stored in the existing natural gas infrastructure and, thus, used to generate electricity when renewable energy sources are not available. In addition, an independent 2021 study by the Massachusetts Institute of Technology (MIT) Energy Initiative found that “hydrogen-fired power generation can be the more economical option when compared to lithium-ion batteries - even today, when the costs of hydrogen production, transmission, and storage are very high. If there is a place for hydrogen in the cases [MIT] analyzed, that suggests there is a promising role for hydrogen to play in the energy transition.”⁷ Further, a 2020 Caltech study on the *Role of Long-Duration Storage in Variable Renewable Electricity Systems* found introducing long duration storage (defined as more than 10 hours hydrogen energy storage) into an energy system reduced total system costs relative to a battery only system, regardless of the mix of variable renewable generation technologies (*see*

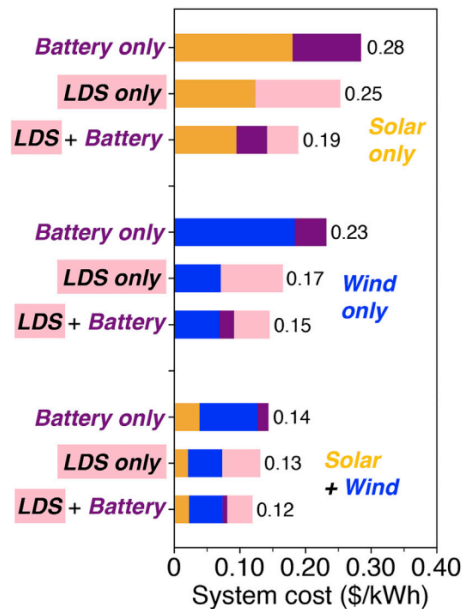
⁵ *Ibid.*, CEC Non-Lithium-Ion Long Duration Energy Storage Technologies Workshop.

⁶ *Ibid.*

⁷ See “Making the case for hydrogen in a zero-carbon economy,” MIT, August 31, 2021, available at: <https://news.mit.edu/2021/making-case-hydrogen-zero-carbon-economy-0831>.

Figure 2 below).⁸ The Caltech study compared system costs of solar, wind, and a combination of solar and wind generation systems working in conjunction with battery, long duration storage, and a combination of battery and long duration storage. Of all the different combinations, the case when long duration storage was used in combination with a wind-solar-battery system resulted in the lowest system cost.⁹ In least-cost systems, batteries are used primarily for intra-day storage (4+ hours) and long duration storage is used primarily for inter-season (100+ hours) and multi-year storage.¹⁰

Figure 2: Caltech Study Finds System Costs Differ Based on Technology Combinations, Dowling et al. (2020)



As the renewable energy mix on the grid increases to over 60 percent, resource planning models are predicting that energy production will exceed “demand in over 20 percent of the hours of the year, totaling between 5 percent and 10 percent of all renewable power produced.”¹¹ Addressing this seasonal imbalance will require large scale storage resources capable of storing power over longer duration cycles. The long duration and seasonal storage need for storing renewable energy will increase as California moves towards 100 percent clean energy goals.

⁸ See “Role of Long-Duration Storage in Variable Renewable Electricity Systems,” Dowling et al., September 16, 2020, available at: [https://www.cell.com/joule/fulltext/S2542-4351\(20\)30325-1?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS2542435120303251%3Fshowa%3Dtrue](https://www.cell.com/joule/fulltext/S2542-4351(20)30325-1?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS2542435120303251%3Fshowa%3Dtrue).

⁹ *Ibid.*

¹⁰ *Ibid.*

¹¹ See “Integrating Clean Energy Technologies with Existing Infrastructure,” University of California, Irvine (UCI), January 30, 2020, available at: http://www.apecp.uci.edu/PDF_White_Papers/Integrating_Clean_Energy_013020.pdf.

3) Research highlights renewable hydrogen as long duration storage will be key to providing zero emission power for essential energy services

Recent net-zero emissions energy systems studies^{12,13} note that many essential energy services (across multiple sectors of the economy) need to be accommodated using resources that can be produced, stored, transmitted, distributed, and converted back to electricity with zero emissions. Renewable hydrogen as a long duration or seasonal energy storage resource can serve this strategic need. Schmidt et.al¹⁴ in their study, addressing the future levelized costs of energy storage technologies, evaluated the technology suitability of nine different energy storage solutions under 12 different grid use applications (which includes energy arbitrage, demand response, black start, seasonal storage, transmission and distribution deferrals, congestion management, bill management and power quality) as shown in Figure 3 (below). The study identifies hydrogen as one of the key energy storage technologies that is best for long duration discharge applications. The study also identifies that hydrogen is one of the two technologies that can offer grid support services across all 12 applications.

Figure 3: Qualitative Analysis of Electricity Storage Applications and Technology Suitability, Schmidt et al. (2019)¹⁵

| Role | Application | Pumped Hydro | Compressed Air | Flywheel | Lithium Ion | Sodium Sulfur | Lead Acid | Vanadium Redox Flow | Hydrogen | Supercapacitor |
|-------------------|----------------------------|--------------|----------------|----------|-------------|---------------|-----------|---------------------|----------|----------------|
| | 1. Energy arbitrage | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| System Operation | 2. Primary response | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 3. Secondary response | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 4. Tertiary response | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | 5. Peaker replacement | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | 6. Black start | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 7. Seasonal storage | ✓ | ✓ | | | | | ✓ | ✓ | |
| Network Operation | 8. T&D investment deferral | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | 9. Congestion management | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Consumption | 10. Bill management | | | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | 11. Power quality | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 12. Power reliability | | | | ✓ | ✓ | ✓ | ✓ | ✓ | |

¹² *Ibid.*

Conclusion

We offer these comments to contribute to the CEC's efforts towards achieving California's decarbonization goals while maintaining reliability, resiliency, and affordability of our energy system. The discussion on long duration storage would benefit from being broadened to include hydrogen, which experts agree is a viable long duration and seasonal storage solution that supports energy grid reliability. Thank you for your consideration.

Respectfully,

/s/ Priscilla R. Hamilton

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¹³ See "Net-zero emissions energy systems," Davis et al., 2018, available at:

https://www.researchgate.net/publication/326049153_Net-zero_emissions_energy_systems.

¹⁴ See "Projecting the Future Levelized Cost of Electricity Storage Technologies," Schmidt et al., January 16, 2019, available at: <https://www.sciencedirect.com/science/article/pii/S254243511830583X>.

¹⁵ *Ibid.*