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Form Energy comments on SB 100 Inputs and Assumptions workshop

Please find our comments attached. Thank you.

Additional submitted attachment is included below.

March 1, 2024

Liz Gill
California Energy Commission (CEC)
Docket Unit, MS-4
Docket No. 23-SB-100
715 P Street
Sacramento, California 95814

Re: Comments on the Senate Bill 100 Inputs and Assumptions Workshop

Dear Ms. Gill:

Form Energy appreciates the opportunity to comment on the February 16, 2024 SB 100 Inputs and Assumptions Workshop. We urge the CEC to study, plan for, and, ultimately, implement steps to achieve a truly clean, reliable, and zero emissions (i.e., 0 $MMTCO_2$) electricity grid. Per comments detailed previously,[1] this SB 100 planning cycle provides a timely opportunity for the CEC and other energy agencies to begin accurately assessing and planning for these outcomes. Accordingly, we recommend that the SB 100 report and scenario analysis:

- Include a diverse set of firm zero-carbon resources as available resource options, including multi-day storage (MDS), mirroring the CPUC's IRP inputs and assumptions for such resources;
- Evaluate scenarios that achieve 0 MMTCO in the electricity sector in the 2035-2045 timeframe; and
- Ensure that all scenarios at least align decarbonization outcomes in the electricity sector with those Scoping Plan outcomes in other sectors and with requirements in AB 1279, which requires:
    - Achieving a range of emissions of 20-30 $MMTCO_2$ in the electricity sector by 2030;
    - Capping total emissions from the electricity sector in all non-0 $MMTCO_2$ scenarios at <8.7 $MMTCO_2$ in 2045 (we appreciate this is a direction the agencies seem to be moving); and

[1] Form Energy Comments on SB 100 Analytical Framework, available at: https://efiling.energy.ca.gov/GetDocument.aspx?tn=253125&DocumentContentId=88330

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- Including costs associated with carbon capture to remove or contain associated emissions from the atmosphere in the costs of greenhouse gas emitting resources.

We strongly urge the CEC to apply expanded load coverage and 0 MMT scenarios to all of the alternative scenarios besides the Reference, Base and Minimum Compliance scenarios. Not doing so essentially makes all scenarios "minimum compliance" scenarios. We believe that modeling scenarios of further decarbonization are insightful because they highlight the opportunities for carbon reduction, and associated costs, which is a necessary step to determine if they represent reasonable outcomes. We believe that, with emerging technologies that allow a fuller and total decarbonization, there are reasonable opportunities to go further when it comes to decarbonization. Not modeling these scenarios misses an opportunity to identify the complete range of comparative costs and benefits among technologies and strategies that the analysis endeavors to explore.

About Form Energy – Enabling a Fully Renewable, Cost-Effective, and Reliable Electrical Grid

Form Energy is developing, manufacturing, and commercializing a new class of multi-day energy storage system that will enable a fully renewable electrical grid that is reliable and cost-effective year-round, even in the face of multi-day weather events. Our first commercial product is a rechargeable iron-air battery capable of continuously discharging electricity for 100 hours at a system cost competitive with legacy power plants. With over 600 employees, Form Energy is headquartered in Somerville, MA, with offices in Berkeley, CA and the Greater Pittsburgh area. Our first commercial manufacturing facility is under construction in Weirton, WV, and will begin operations mid-to-late 2024, ultimately employing over 750 employees and producing 500 MW of capacity per year.

Form Energy has over 5 GWh of projects under contract and development, with our first project expected to come online in 2024 with utility Great River Energy in Minnesota. Form Energy was recently awarded a $30 million grant from the CEC for a 5 MW/500 MWh project at the site of a Pacific Gas & Electric substation in Mendocino County, which is expected to come online in 2025. Other announced projects include:

- Two projects with Xcel Energy, including a 10 MW/1,000 MWh system at the Sherburne County Generating Station in Becker, Minnesota, and a 10 MW/1,000 MWh system at the Comanche Generating Station in Pueblo, Colorado – both expected to come online as early as 2025.
- A 10 MW/1,000 MWh project in New York, supported by a grant from NYSERDA, which will come online as early as 2025.
- A 15 MW/1,500 MWh project with Georgia Power to come online as early as 2026.

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- A 5 MW/500 MWh project with Dominion Energy in Virginia, to come online as early as 2026.

These systems have been designed in coordination with the local utilities and are intended to maximize the utilization and flexibility of renewable resources, and help support grid reliability as the thermal fleet transitions by providing reliable, clean energy whenever it is needed – including during the most challenging grid conditions, such as the multi-day extreme weather events that are increasingly impacting California's electricity grid as the impacts of climate change become increasingly apparent.

Recent CEC-funded study shows multi-day storage can enable zero-carbon grid at comparable cost.

The CEC has funded studies evaluating the role of long duration energy storage on the electricity grid, recently releasing a study conducted by E3 and Form Energy that showed a significant role for long duration energy storage in California's energy future.[2] Specifically, the study identifies a need for 5-37 GW of long duration energy storage through 2045. Deploying LDES at these levels could lower overall system costs, reduce air pollution, and mitigate land impacts via not needing to build out as many other resources.

Notably, including long duration energy storage in resource portfolios can achieve zero emissions in the power sector at essentially the same cost as the SB 100 core scenario, and can achieve zero emissions at much lower costs than currently envisioned in "no combustion" scenarios that don't include non-lithium-ion long duration energy storage.

We urge the CEC to build on this study and others that have found similar results, and begin planning for resources needed to transition our grid to zero emissions in the future.

Comments on Workshop Slides

We appreciate the detailed presentation and additional opportunity to weigh in on the analytical framework and assumptions for the next SB 100 Joint Agency Report. In addition to the high level comments and observations provided above, we offer the following comments on the workshop slides and discussion:

[2] Go, Roderick, Jessie Knapstein, Sam Kramer, Amber Mahone, Arne Olson, Nick Schlag, John Stevens, Karl Walter, and Mengyao Yuan. 2024. Assessing the Value of Long-Duration Energy Storage in California. California Energy Commission. Publication Number: CEC-500-24-003. https://www.energy.ca.gov/sites/default/files/2024-01/CEC-500-2024-003.pdf

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- Slide 11: The CEC should ensure that diverse emerging technologies, including long-duration storage, are included in all scenarios, including the Base Scenario. At present, it appears that the CEC may not be including diverse resources in the Base Scenario.

- Slides 13-14:
    - If PLEXOS is being used as a capacity expansion tool, the CEC should prioritize using the most granular chronology possible so that renewable energy and load variability are realistically modeled and the value of long-duration and multi-day storage is most accurately reflected.

    - We are concerned that REGEN has fundamental limitations that may make it unlikely for that model to ever select long-duration storage or multi-day storage in a capacity optimization. This limitation is due to REGEN's apparent use of weighted representative hours to represent the electric sector.[3] Consequently, we recommend that long-duration storage and multi-day storage should be provided as an input to PLEXOS regardless of REGEN outputs.

    - Additionally, based on REGEN documentation, it appears that this model may be calibrated to 2015 data. We strongly encourage the CEC to model a range of weather years to accurately characterize future resource needs based on realistic weather conditions.

- Slide 15: It is essential that the CEC model resource adequacy and conduct production cost modeling using a long look-ahead and model forecast horizon, otherwise the model will not accurately model long-duration and multi-day storage and appropriately capture the value of these resources.

- Slide 17: We strongly encourage the CEC to ensure that load forecasts and generation forecasts are correlated to the same weather year, and that the CEC model a diverse range of weather years. This is particularly important in high electrification scenarios.

- Slide 24: We strongly recommend that the CEC include a more diverse set of candidate resources, including diverse long-duration energy storage resources such as Form Energy's iron-air batteries. To ensure that California's multiple grid planning processes are as aligned as possible, we encourage the CEC to align its resource inputs and assumptions with the CPUC's 2022-2023 IRP Inputs and Assumptions.[4] The CPUC's

[3] Based on REGEN documentation: https://us-regen-docs.epri.com/v2021a/approach/electric-model.html#design-of-aggregated-segments
[4] Available at https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2023-irp-cycle-events-and-materials/inputs-assumptions-2022-2023_final_document_10052023.pdf

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Inputs and Assumptions reflect substantial stakeholder input, influence the majority of load serving entities' resource requirements, and also include a more diverse set of resources than those that the CEC has listed.

- Slide 25: We recommend that the CEC reflect that a 40% ITC apply to iron-air multi-day storage in modeling. It is also likely reasonable to assume that lithium-ion storage should be modeled as receiving a 30% ITC due to the preponderance of lithium-ion battery supply originating from foreign suppliers

- Slides 26-27 and 56: When modeling hydrogen resources, it is important to consider that 100% hydrogen combustion turbines are not commercially available in 2025. We also encourage the CEC to model hydrogen resources inclusive of balance of system costs (e.g. to include the costs of compressors, pipelines, storage tanks, etc.) so these resources are modeled in a manner that is comparable to other resources. Previous studies that ignore these costs often assume that hydrogen supply is available without reflecting the costs of producing, transporting and storing hydrogen.

- Slide 29 and 57: **We strongly encourage the CEC to include a more diverse set of long-duration energy storage technologies and to also include multi-day storage as a resource class, inclusive of Form Energy's iron-air battery technology, which will be first deployed in California in 2025 supported by a CEC grant. For representative technology costs and specifications, we recommend that the CEC refer to its recently released EPIC-funded study by E3 and Form Energy, Assessing the Value of Long-Duration Energy Storage in California.**[5] We also believe that this slide overstates the cost of seasonal storage, and we recommend the CEC instead reference the costs of seasonal storage included in the CEC-funded study we reference above.

- Slide 41: We strongly encourage the CEC to model multiple weather years and to ensure that both load and generation are correlated to the same year. See the CEC-funded study of long-duration storage referenced above to demonstrate the importance of this approach and for discussion about methodology and data sources recommended.

- Slide 45: We reiterate that all SB 100-compliant scenarios beyond "Minimum Compliance" should at least include an alternative that considers expanded load coverage.

- Slide 46: We reiterate that all SB 100-compliant scenarios beyond "Minimum Compliance" should at least include an alternative that achieves 0 $MMTCO_2$ in 2045.

[5] Available at https://www.energy.ca.gov/publications/2024/assessing-value-long-duration-energy-storage-california

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- Slide 57: Additional guideposts and references for long duration energy storage should include the forthcoming SB 423 report, outcomes identified in the CEC-funded E3/Form Energy long duration energy storage study and other studies evaluating zero carbon scenarios, and guideposts to achieve 0 $MMTCO_2$ emissions in the power sector.

- Slide 60: If possible, we encourage the analysis to consider roles that resources like long duration and multi-day storage and others can serve to provide non-wires transmission alternatives or to lower overall transmission needs by lowering overall needs for new generation and storage capacity.

Thank you again for the opportunity to comment on the Senate Bill 100 Inputs and Assumptions Workshop, and for all your work to deliberately and effectively advance California's clean energy goals. Please do not hesitate to reach out with any questions or follow up items.

Sincerely,

Mark Thompson
Senior Director, State Affairs
Form Energy
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