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LLNL comments on the Joint Agency Draft Results Workshop on the Senate Bill 100 Report of September 2, 2020

Additional submitted attachment is included below.

September 15, 2020

Re: SB 100 Joint Agency Report: Charting a Path to a 100% Clean Energy Future, Docket No. 19-SB-100

Dear Chair Hochschild, Chair Nichols and Commissioner Randolph,

Thank you for the opportunity to comment on the Joint Agency Draft Results Workshop on the Senate Bill 100 (SB 100) Report of September 2, 2020. We wish to offer brief comments on the technological readiness and cost estimate availability for some of the technologies mentioned in the Draft Inputs and Assumptions for the SB100 Joint Agency Report.

We understand that the agencies' interpretation of technology eligibility under the *zero-carbon resources* definition in SB100 is likely to be broader than what is included in the modeling Core Scenario. We agree, and believe that an inclusive interpretation of *zero-carbon resources* increases the likelihood of meeting the standard in a timely fashion, and also serves to reduce the cost of doing so. Nonetheless, some of the justifications for excluding certain technologies from the Core Scenario are factually incorrect, and we bring some (but not necessarily all) of these to the agencies' attention below.

Natural gas-fired combined cycle power plants with carbon capture and storage are a mature technology

Natural gas-fired generation is only listed under Candidate Resources without carbon capture and storage, the cited reason being lack of cost estimate availability. In fact, the technology is readily available and numerous cost estimates are available.

A number of technology vendors today have commercial offerings for carbon capture systems on natural gas-fired combined cycle plants, many with commercial performance guarantees. These include some of the largest and best-known turbine manufacturers that routinely supply conventional power plant components.

In addition, several institutions publish cost estimates for the technology, including the Global Carbon Capture & Storage Institute, the National Energy Technologies Laboratory, the Massachusetts Institute of Technology, Carnegie Mellon University and several others. The scientific literature is rich in publications that estimate the related costs. We are at the agencies' disposal to point staff to this body of literature and its conclusions.

Exclusion of this technology from the Core Scenario results in significant and unnecessary unabated emissions from conventional power plants.

Biomethane and waste biomass with carbon capture can generate carbon-neutral or carbon-negative electricity

The exclusion of drop-in biomethane and fuels produced from conversion of waste biomass from the Core Scenario is equally puzzling. Our recent report, Getting to Neutral: Options for Negative Carbon Emissions in California, describes a host of pathways in which electricity (and

transportation fuels) could be produced with a carbon-neutral or even carbon-negative net balance. This relies on technologies that are either readily available today, or sufficiently proven for deployment at the scale dictated by SB100 and California's 2045 carbon neutrality goal.

For example, biomethane that is captured from landfills, wastewater treatment plants or dairies could be used to generate electricity with carbon capture. Methane or hydrogen that are generated from the pyrolysis or gasification of waste biomass that would have decayed or combusted can also be used to generate electricity with carbon capture.

Conclusion

We stand ready to assist the agencies with their task of scoping feasible technology deployment scenarios that are consistent with SB100 compliance, and urge a broader and more inclusive look at the available options. The additional technology pathways we describe above not only shore up compliance with SB100 at a lower cost, but are critical for California to achieve its 2045 carbon neutrality goal. Some of these pathways can also materially support the State's forest heath and wildfire risk reduction efforts.

Respectfully submitted,

George Peridas, Lawrence Livermore National Laboratory