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**Bloom Energy comments on November 18 SB 100 Technical Workshop**

*Additional submitted attachment is included below.*



December 4, 2019

Chair David Hochschild  
California Energy Commission  
1516 Ninth Street  
Sacramento, CA 95814

**Re: Comments on SB100 Technical Workshop**

Dear Chair Hochschild,

Bloom Energy<sup>1</sup> (Bloom) appreciates the opportunity to provide these comments on the **SB 100 Technical Workshop**. We value the California Energy Commission's ("Commission") leadership with the IEPR to provide "policy recommendations to conserve resources; protect the environment; ensure reliable, secure, and diverse energy supplies; enhance the state's economy; and protect public health and safety."<sup>2</sup> We also appreciate the Commission's role in the SB100 Joint Agency Report to provide "a review of the 100 percent zero-carbon policy focused on technologies, forecasts, then-existing transmission, and the maintenance of safety, environmental and public safety protection, affordability, and system and local reliability."<sup>3</sup> Highly efficient, non-combustion fuel cells can help the Commission meet these ambitious and laudable goals, and should be included in the technology review.

Earlier this year, we announced a partnership with CalBio to provide renewable, always-available electricity to EV charging networks from dairy waste, supporting the transition to electrified transportation while avoiding emission of the powerful GHG methane.<sup>4</sup> In September, we announced a collaboration with Samsung to develop large cargo ships powered by Bloom's Energy Servers and natural gas, which could prove an innovative, cost-effective way for ships to comply with ARB's At-Berth Regulation while docking.<sup>5</sup> With multiple world class ports, California will see direct and indirect benefits of improved air quality and reduced GHG emissions from these

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<sup>1</sup> Bloom develops on-site distributed generation using innovative fuel cell energy technology that utilizes natural gas or biogas. Our unique on-site power generation systems utilize an innovative new fuel cell energy technology with roots in NASA's Mars program. Derived from a common sand-like powder, and leveraging breakthrough advances in materials science, our technology is able to produce clean, reliable, affordable energy, practically anywhere, from a wide range of renewable energy sources or traditional fuels. Our Energy Servers are among the most efficient energy generators on the planet; providing for significantly reduced electricity costs and dramatically reduced greenhouse gas emissions. By generating power on-site, where it is consumed, Bloom Energy offers increased electrical reliability and improved energy security, providing a clear path to energy independence.

<sup>2</sup> Public Resources Code §25301(a)).

<sup>3</sup> <https://www.energy.ca.gov/sb100>

<sup>4</sup> <https://www.bloomenergy.com/newsroom/press-releases/calbio-and-bloom-energy-generate-renewable-electricity-dairy-waste>

<sup>5</sup> <https://www.bloomenergy.com/newsroom/press-releases/bloom-energy-and-samsung-heavy-industries-team-up>

ships. These developments show Bloom’s commitment and important role to decarbonizing some of the most challenging sectors.

Building upon these innovations, there is immense potential to capture carbon from solid oxide fuel cells (SOFC)—whether running on natural gas or biogas—resulting in a pure stream of CO<sub>2</sub> from the exhaust of this non-combustion technology. This would make the sequestration or utilization of CO<sub>2</sub> relatively simple and highly cost-effective. Indeed, a meta-study published by researchers from the Department of Chemical Engineering at McMaster University in 2017 found that SOFC with CCS have the lowest levelized cost of electricity and the lowest GHG emissions of any other electricity generation technology that could deploy carbon capture processes.<sup>6</sup>

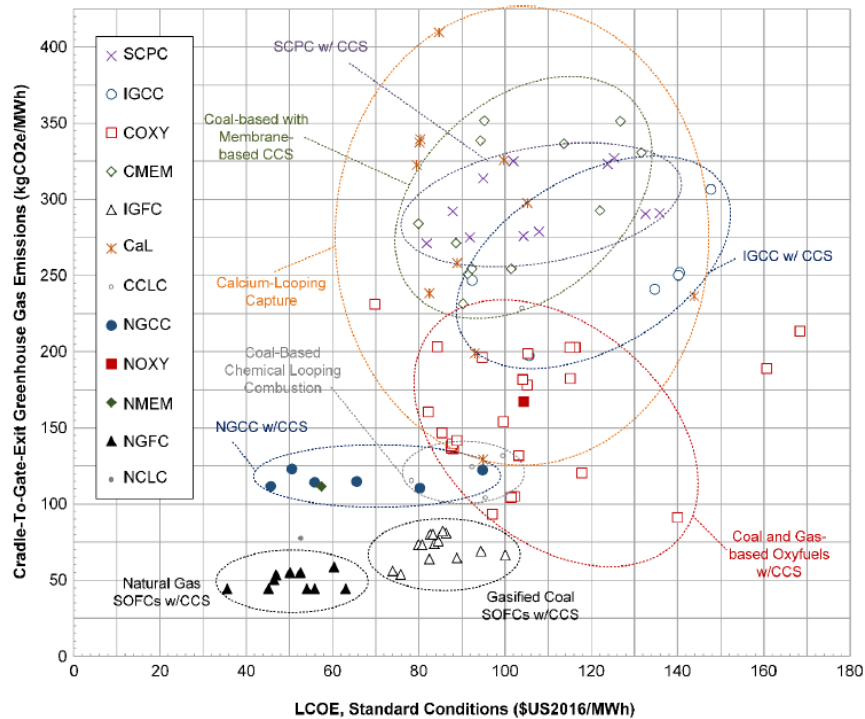


Figure 12. Scatter plot of the calculated LCOE at standard conditions of each plant vs. the calculated life cycle greenhouse gas emissions, using as-reported fuel price assumptions. NOXY = natural gas-based oxyfuels, NMEM = natural gas based membranes, NGFC = natural gas (solid oxide) fuel cells, and NCLC = natural gas-based chemical looping combustion.

As such, fuel cells paired with carbon capture would offer a zero emission power source with high reliability that can provide always-on electricity. Based on the challenges outlined in expert presentations at the IEPR Commissioner Workshop on Near-Zero Carbon Electricity, a zero emission, reliable, and affordable power source

<sup>6</sup> Adams II, T.A.; Hoseinzade, L.; Madabhushi, P.B.; Okeke, I.J. Comparison of CO<sub>2</sub> Capture Approaches for Fossil-Based Power Generation: Review and Meta-Study. *Processes* **2017**, *5*, 44.

such as this can help California reach its ambitious 2050 goals while reducing air pollution and increasing grid resilience.

E3 outlined in its presentation a high electrification scenario dominated by EVs, where meeting the GHG emissions reduction goals requires technological breakthroughs, or a high level of battery energy storage. Bloom Energy Servers with carbon capture, as a zero emission power source with high reliability, could prove to be one of the “reach technologies” E3 did not anticipate.

EFI estimates the electricity sector’s greatest opportunity to reduce emissions is through outfitting natural gas combined cycle NGCC power plants with CCUS. They estimate this has the potential to reduce GHG emissions by 17.7 MMTCO<sub>2</sub>, the second largest reduction potential estimated. Solid oxide fuel cells with carbon capture, at scale, will be cheaper, more efficient, and avoid criteria air pollutants.<sup>7</sup>

EFI also outlined the challenge associated with seasonal intermittency of other zero carbon generation sources. This seasonal and daily intermittency poses resiliency and capacity challenges to grid operators. As a zero emission power source which is available 24/7/365, fuel cells with carbon capture can mitigate some of the problems posed by seasonal intermittency inherent in other zero carbon generation sources.

We agree with the California Hydrogen Business Council’s comments that “solar, wind, hydro, and batteries, while important, will not allow California to achieve its clean energy and climate goals alone; innovation and investment in additional solutions will be needed, and hydrogen and fuel cells ought to be among those considered.”<sup>8</sup> We similarly encourage the Commission to include fuel cells paired with carbon capture, utilization, and storage in the SB100 Joint Agency Report.

We thank the Commission for the opportunity to provide feedback and reiterate that highly efficient, non-combustion fuel cells should be an integral component of the Commission’s continuing efforts to chart a resilient, prosperous, sustainable, and equitable energy future for all Californians.

Respectfully,



Sara Mulhauser  
Senior Manager, Structured Finance



Sam Schabacker  
Policy Manager

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<sup>7</sup> NGCC with CCUS will not avoid criteria air pollutant emissions from these dirty plants. Bloom Energy Servers have negligible criteria air pollutant emissions.

<sup>8</sup> Comments from California Hydrogen Business Council dated October 17, 2019.