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Response to November 3, 2022 RFI for Clean Energy Resources for Reliability

Additional submitted attachment is included below.

Bloomenergy

November 30, 2022

California Energy Commission
715 P Street
Sacramento, CA 95814

Re: Docket 21-ESR-01. Bloom Energy Corporation Response to November 3, 2022 Request for Information on Clean Energy Resources for Reliability, Due November 30, 2022

Dear CEC Commissioners and Staff,

Bloom Energy (Bloom) appreciates the opportunity to provide feedback as the CEC identifies clean energy resources to support grid reliability. Bloom recognizes that a diverse portfolio of resources will be required to simultaneously achieve California's greenhouse gas emissions reduction, load reduction, and reliability goals. As such, Bloom submits the following feedback with a focus on properly assessing fuel cell technologies and how fuel cells can effectively contribute towards meeting California's goals.

List of Resource Types and Evaluation Attributes

The RFI seeks feedback on the following questions regarding the list of preliminary resources and qualitative and quantitative attributes by which they will be evaluated:

1) Are the categories (indicated in Tables 1, 2 and 3) appropriately representing how the CEC should be evaluating resources?

   We believe that the categories should be modified to better capture key differentiations and characteristics among resources, as well as to better align with California energy system and policy objectives, see #2 below.

2) Are there resources that should be added to or removed from the preliminary list under each of the categories (shown in Tables 1, 2, and 3)?

   Yes, fuel cells should be added to Table 1. Fuel cells can be deployed as supply-side resources and can interconnect on the transmission system as well as the distribution system, in addition to deployment behind-the-meter as demand-side resources.

3) Are there other attributes that should be considered, in addition to the ones listed in Table 4? If so, should those be considered for the qualitative and/or quantitative evaluation?

   We suggest that the following attributes to be added to those listed in Table 4:

- *Environmental benefits*, including emissions reductions, air quality, avoided water use, and land use impacts. These benefits should be considered for resource deployment generally, both during and outside of extreme events. As written, environmental aspects are only captured by GHG and pollutant emissions. The CEC should expand beyond this and consider not only emission outputs, but also emissions and energy related water use avoided over time.

- *Lack of Siting/Resource Impacts*, including noise, visual impacts, emissions, compatibility with habitat or existing human uses, contiguous sizeable land, resource thresholds (such as insolation or wind quality), permitting obstacles, development limitations, etc.

- *System benefits*, including capability to provide ancillary services and maintain power quality; avoided or lessened transmission and distribution investments; avoided system wear and tear; and avoided line losses both during and outside of extreme events.

- *Resilience benefits*, including the capability to serve load during distribution grid outages, such as during Public Safety Power Shut-offs. Resources should be able to provide electricity during any weather and during any time of the day to truly increase resiliency.

- *Energy Transition benefits*, including the ability to utilize renewable fuels without increasing emissions, and the ability to utilize the same DEBA investment as a platform for future power generation or electrolytic renewable hydrogen production. Bloom believes that the CEC can view most of the selected projects as an anchor generator for future microgrids, including both utility and customer operated microgrids. By repurposing DEBA projects in the future, more value can be obtained from current resource investments.

4) How should the attributes be weighted relative to each other? Should some attributes be weighted more than others?

> "Certainty" and "firmness" should hold the most weight, given the context and situation that has brought the CEC to release this RFI (assuming certainty in Table 4 refers to resource availability). Next, reliability attributes that extend beyond extreme events and allow the program to position for capacity shortfalls and/or PSPS events over the longer term. The term "cleanliness" should be defined in a way that includes air and water emission *reductions* (including, but not limited to, climate emissions) for the system relative to operations without the addition of those resources, avoided water use, avoided land/noise/visual and other impacts that can be quantified, even outside of extreme events, rather than limiting the definition to "Low GHG and low criteria pollutant emissions" as currently stated in Table 4. For example, a low-emitting resource that reduces emissions and water use on a net basis over the course of a year is "cleaner" than a resource that increases emissions during extreme events and does not operate (and therefore does not reduce any emissions or water use) outside

of extreme events; similarly, a resource with significant land use or habitat impacts, or with significant noise or visual impacts, may not be viewed as “clean” from a community/stakeholder standpoint.

5) What data/information sources can help inform characterization and evaluation (both qualitative and quantitative) of the different resources?

- Details on sections on the grid that would most benefit from increased DER deployment for purposes of congestion mitigation, avoidance or deferral of transmission or distribution investments

- Information on the replacement of near-retirement, less reliable or more highly-polluting or highly water-intensive generators

- An up-to-date emissions factor for the carbon intensity of the California grid that allows for proper characterization of the emissions benefits of resources that displace higher emitting resources in every hour across the year, including both during and outside of extreme events

Resource Characterization

1) Please provide a general overview of the resource, including the following: a. Resource category (e.g., supply, demand) and type (e.g., solar) and scale (e.g., utility, distributed)?

There are various forms of fuel cells, and Bloom manufactures solid oxide fuel cells (SOFCs) and solid oxide electrolyzers (SOECs). SOFCs are a highly efficient and extremely reliable form of *non-combustion* power generation that can be deployed anywhere on the grid, either in-front-of-the meter or behind-the-meter. SOFCs can serve as a form of supply on the utility-side of the meter or can serve as a form of system load reduction when deployed on the customer-side of the meter. In either application, SOFCs provide a consistent and ultra-reliable source of electricity generation that reduces GHG emissions and virtually eliminates smog forming air pollutants and energy-related water use.

The SOFC platform is a highly efficient all-electric form of on-site electricity generation that can be deployed rapidly via skid-mounted “energy server” building blocks of either 250kW or 300kW and are capable of scaling to any size provided sufficient space is available. SOFCs are extremely energy dense and quiet, can be located virtually anywhere (including on top of existing buildings), do not require human operators, do not create visibility impacts, do not consume or discharge water, are relatively easy to permit, and are unaffected by environmental conditions like high winds, drought, or extreme heat.

Bloom "Energy Server" Solid Oxide Fuel Cell

SOFCs are uniquely suited to the energy transition because they can be installed with equipment using natural gas inputs for relatively short periods of time (e.g. as short as 6 year terms), and then can be readily upgraded as needed to operate on renewable "green" hydrogen, renewable biogas, or other climate-friendly fuels (or blends of those fuels). This limited timeframe for fossil-based operation, unlike capital-intensive procurement of resources that may operate for decades and do not have this fuel-switching capability ensures that the energy system will operate reliably while reducing emissions and water use during the near term and pre-positioning for later stages of the energy transition in the ensuing years.

The fuel-switching capabilities of SOFCs, along with their skid mounted deployment design that allows for very quick deployment and re-deployment to wherever they be needed, and their flexible project lives, means that an SOFC deployed for purposes of addressing California's capacity shortfall does not represent a long-term commitment to fossil fuels. Importantly, the same modular SOFC platform can be reconfigured from producing electricity to operating as a solid oxide electrolyzer (SOEC) system, to efficiently convert RPS-eligible electricity into "green" hydrogen.

2) How does the resource compare to conventional generation in terms of greenhouse gas and priority pollutant emissions?

SOFCs reduce emissions and deliver local air quality benefits. SOFCs are an extremely efficient and non-combustion form of electricity generation. that will reduce GHG emissions, air pollutant emissions, and water use relative to the combination of diesel back-up generators and marginal power plants that they displace. When operating on renewable biogas, renewable natural gas, hydrogen, ammonia or other low- or zero-carbon fuels, or when paired with CCUS (a lower-cost option for SOFC, as CO2 emissions from the non-combustion source are not cross-contaminated with other combustion emissions), GHG emissions can be eliminated.

According to eGRID data from the Environmental Protection Agency, Bloom's ES-5 systems have been more carbon efficient than marginal emissions from the California grid (CAMx region) for the last 8 years. For instance, in 2020 marginal emission rates were more than 1,000 lbs/MWh on the California grid, in contrast to approximately 800 lbs/MWh from Bloom's systems.[1] It should be noted that marginal California grid emissions have been increasing in the last several years instead of decreasing.

[1] eGRID data can be found at https://www.epa.gov/egrid.

3) How does the resource support reliability (e.g., supply, permanent load reduction, net peak reduction, or emergency asset?) (List all that apply.) a. How can the resource be used as an incremental on-call resource during emergencies?

An SOFC will support resource reliability by providing near-absolute assurance that it will be providing power at the time of emergency events or other critical system needs. SOFCs are an inherently reliable (99+% availability) form of system load modification that benefit the distribution system by consistently and permanently taking load off the system.

SOFCs are proven in hundreds of microgrid deployments, including at critical facilities across the state of California. When deployed behind customer meters SOFCs can not only reduce system load on a permanent basis, but also "free up" back-up generators that can in turn be used as incremental short term emergency assets without impacting the operations of the underlying facility.

SOFCs are generally interconnected in a fashion that reduces system demand while also allowing for injection of power into the distribution system, and can potentially offer not just load reduction but power deliveries. When deployed on the grid side of the meter, SOFCs can serve as an ultra-reliable form of electricity supply that can be targeted anywhere on the distribution system to relieve congested circuits, avoid traditional infrastructure investments, or to serve as the "anchor" generators for future area-wide and/or utility-owned microgrids.

4) How many new MWs and MWhs can the resource provide per year, taking into account resource characteristics and known barriers between now and 2035? a. How is that different if used incrementally as an emergency asset during an extreme heat event?

As a resource category fuel cells are capable of providing California with 1000s of MW per year between now and 2035. Bloom manufacturers locally in California and Delaware, which allows Bloom to avoid barriers that may impact other distributed energy companies producing overseas.

SOFCs can produce system and societal benefits like those described above year-round, while simultaneously serving as an emergency asset during an extreme heat event.

5) What is the levelized cost for the resource in $/MW-yr. and $/MWh-yr. from 2023 to 2035?

Due to the long list of costs, values, and benefits excluded from the equation, Bloom believes that the CEC should not place weight nor make decisions based on the LCOE. Levelized cost of energy (LCOE) is a simplistic metric that oversimplifies the cost of electricity, therefore making it an inappropriate metric to use when analyzing the value of distributed energy resources. In fact, in the U.S. Energy Information Administration's latest Annual Energy Outlook 2022 they state, "LCOE… do[es] not capture all of the factors that contribute to actual investment decisions, making direct comparisons of

LCOE… across technologies problematic and misleading as a method to assess the economic competitiveness of various generation alternatives."[2]

The LCOE also fails to account for the value of resiliency and overall reliability served, both during and outside of extreme events, and fails to incorporate time of generation or likelihood of performance at the time of peak need; i.e. it fails to account for those attributes that are the very purpose of the DEBA program.

The CEC should instead consider not only initial cost but the overall value of the system and societal "co-benefits" that a given system creates for the electric system and the communities that system serves, including those items listed in response to question #3 above.

6) What is the average length of time from ordering or purchasing the resource to operation? How long does that typically take in today's market? What conditions must be met to deploy the technology rapidly? (e.g., transmission interconnection, building electrification or upgrades, etc.)

The average time from ordering to operation is approximately 6-9 months. The longest lead time issue is generally the local building permit process. These time frames can be very significantly shortened to the extent that related processes are expedited.

The most important condition that must be met is a clear and consistent economic signal that spurs a timely customer commitment, either in the form of a CEC customer incentive or a utility tariff that appropriately recognizes the system benefits provided by reliable DERs.

7) For an emerging technology, when will it be ready for deployment, and at what scale?

Fuel cells are not an emerging technology. Fuel cells were invented over a century ago and have been used in practically every NASA space mission since the 1960s. They are unique in that they can be used for a wide range of applications, from generating power for satellites and space capsules, to powering fuel cell vehicles like automobiles, buses, or boats, to generating primary or emergency backup power for buildings. SOFCs are a proven technology with over two decades of successful deployment history.

Bloom's SOFC technology is deployed today at over 800 sites in the U.S. and overseas, both behind-the-meter and in-front-of-the-meter, including many of the highest reliability requirement customers in the world, such as data centers, advanced manufacturing, and medical applications.

8) Is the target customer primarily residential, commercial, agricultural or industrial?

[2] Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022. March 2022. https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf

Commercial & industrial, manufacturing, health care, data centers, government, utilities, and other customer verticals have been Bloom's primary customers. Bloom's SOFCs can just as easily be deployed for utility use on distribution circuits or on the bulk power system.

9) What are the key non-financial barriers to the development and implementation of this resource (including, but not limited to, permitting, interconnection, supply chain, customer acceptance, and alignment with policy goals)?

Distributed energy generation can be a threat to coupled load serving entities; therefore, causing delayed interconnection, increased costs of interconnection, or other barriers to deployment. If and where this exists, the Energy Commission's backstop siting authority should be made available where local jurisdictions are acting in a discriminatory fashion so as to protect their utility arm revenues. Interconnection timing and costs can be a barrier in other circumstances as well, particularly to beneficial exports. The Energy Commission should look into how DER interconnection and injections into distribution systems can be expedited so as to best leverage the benefit of customer investments for California's energy system needs.

10) What are the key financial barriers to the development and implementation of this resource?

An economic signal, such as through a DER tariff that reflects the value DERs provide to the energy system, is the largest financial barrier. Currently, California lacks a clear DER tariff that provides economic signals for DER investment that supports California's energy system needs and policy goals. As a result, Californians are increasingly investing in diesel generation, with an installed base reaching a significant percentage of the overall generation fleet, and with operating hours that are much greater than anticipated for what were considered backup resources. With a clear and fair tariff, customers and developers would have the revenue certainty needed to spur investments in reliable, resilient capacity that meaningfully contributes to near- and mid-term needs while making progress towards long-term energy goals.

11) What types of benefits or impacts is the resource anticipated to have on low income and disadvantaged communities, and tribes, if any in terms of development and deployment?

The benefits, as described above on pages 3-5, range from emissions reduction, water savings, and increased energy security, as well as reduced noise, visual blight and other benefits resulting from reducing reliance on combustion resources often located in those areas.

Input on Distributed Electricity Backup Assets Program Design

1) What size of resource and what types of customers should the program target?

Given the urgent need for capacity by summer 2023, minimum and maximum project sizes should not be constraints in DEBA for commercially proven technologies. Rather, locations that would have the effect of maximizing system, customer, or community "co-benefits" should be a focus of the program.

2) What types of incentive structures and amounts are needed to accelerate the development and deployment of this resource?

Bloom supports incentives that are proportional to the values that resources provide to the energy system. For example, customers deploying resources that will reliably operate during declared stage alerts and that also reduce burdens on surrounding areas (in terms of air emissions, noise, blight and water use, particularly when located in disadvantaged communities) should receive some compensation, particularly to help guide their investment to better choices than diesel backup generation.

In June 2022, Bloom commissioned MRW & Associates to perform an assessment of the value that additional fuel cells provide to the electrical system through avoided or deferred investment in generation, transmission and distribution infrastructure. The resulting report found that the base amount for avoided ratepayer costs by deploying fuel cells and other long duration DERs translates to roughly \$13/kW-mo – \$21/kW-mo after taking into account avoided generation, transmission and distribution capacity costs, depending on the distribution service territory of the DER customer. It should be noted that this analysis was based on the California Public Utilities Commission's 2021 Avoided Cost Calculator (ACC); the new 2022 ACC contains significantly higher avoided cost figures. Bloom is open to further discussing this analysis and staff and sharing MRW & Associates' results.

3) What types of conditionalities and measurement and verification requirements should the program include to ensure funded resources participate and deliver during emergency events?

Resources should provide a demonstrable and predictable reduction of load, reduce the need for and cost to load serving entities ("LSEs") to procure new capacity, and provide stability during peak grid hours.

4) In general, please provide any specific proposal or recommendation on the design and implementation of the DEBA program.

The DEBA program should adhere to existing CARB criteria for air pollutant requirements, as provided in their Distributed Generation Certification Program.

DEBA should permit projects to pair other incentives if necessary to fully fund projects. The Commission should ensure that DEBA guidelines do not conflict with the federal Inflation Reduction Act (IRA). The CEC should confirm that participation in DEBA does not preclude resources from capturing tax credits or other incentives.

Resources participating in DEBA should also be allowed to participate in other demand response programs so long as there is sufficient capacity on reserve to fulfill the requirements of DEBA to serve as on-call resources during emergencies. So long as DEBA resources are prioritizing participation in the Emergency Load Reduction

Program (ELRP) or the Demand Side Grid Support (DSGS) program for emergency load reduction, they should be permitted to help the grid in non-emergency situations or blue-sky conditions and leverage other programs if projects have sufficient capacity and capabilities to do so.

Bloom appreciates CEC staff's work in this effort and in advancing clean energy technologies. As a company that calls California home, Bloom is a committed partner as we collectively transition towards our clean air and energy goals. We appreciate the opportunity to participate and to provide feedback.

Best Regards,

Christina Tan
Sr. Energy & Environmental Policy Manager