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Benz Air Engineering Comments on Draft Version - Grant Funding Opportunity - Community Energy Resilience Investment (CERI) Progr

Benz Air Engineering looks forward to provide any follow up questions regarding this optimum method of providing grid resiliency.

Additional submitted attachment is included below.

Rethink Steam

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CLEAN AND INTELLIGENT ENERGY SOLUTIONS

LAS VEGAS, NV - LOS ANGELES, CA - MODESTO, CA - PORTLAND, OR

January 17, 2024
Re:DraftSolicitationConceptofCleanDispatchableGenerationInitiative(23-ERDD-01)

Benz Air Engineering Co, INC, ("BAE") files these comments in response to the California Energy Commission's Draft Solicitation Concept of Clean Dispatchable Generation Initiative ("solicitation concept") released on August 9, 2023.

About BAE

Having expertise in electrical generation and all aspects of steam, its generation and use, and driven by its vision of the affordable, reliable, net-zero carbon grid of the future, BAE has developed and commercialized a new power generation technology - the Boiler Accessory – decarbonizing existing hard to electrify boilers and fluid heaters with renewable electrical power when available while providing local power at less than half the current grid heat rate. BAE's boiler accessory offers a unique capacity and energy solution that simultaneously addresses the critical AND immediate need to reduce greenhouse gas and criteria pollutant emissions, while also providing a near-term use of excess renewable electric production.

Modular and scalable, BAE's boiler accessory leverages existing hard-to-electrify emission sources as a heat and electrical energy sink, amplifying the carbon reduction of excess renewable electrical generation and firming California's grid at half the carbon rate of the highest known efficient electric generation. Depending on the grid supply, BAE's Boiler Accessory can utilize up to the limit of the existing facility electrical supply to directly reduce greenhouse gas emissions of generating hot water or steam in a wide range of commercial and industrial applications. As the electrical grid transitions from periods of high renewable generation to generation supplied by traditional greenhouse gas emitting combined cycle generation and higher carbon single cycle sources such as fuel cells and linear generators, BAE's Boiler Accessory flamelessly augments fluid heaters and boilers with highest possible efficient incremental use of fuel, resulting a net heat rate of just 4000btu/kw-hr HHV – less than half the carbon intensity of any local generation technology such linear generators. BAE's inverter-based technology offers the widest range of valuable grid and environmental benefits including the fastest transition from consuming renewable electricity to generating ultra-low carbon electricity, the only known way to decarbonized hard-to-electrify emissions sources such as boilers while firming the grid at less than half the carbon footprint of microturbines, linear generators or fuel cells

1. **Executive Summary:**

BAE thanks the California Energy Commission ("Commission") for the opportunity to provide comments on the solicitation concept. Through these comments, we recommend:

- The Draft CERI GFO language should be amended to clarify that clean distributed generation is a type of distributed energy resource ("DER") included in Eligible Activities under the stipulation that the net heat rate of such DERs is substantially less than the current and future grid heat rate.

2. Responses to Questions Posed to Stakeholders in the Draft Solicitation Concept

The Draft CERI GFO language should be amended to clarify that clean distributed generation is a type of distributed energy resource ("DER") included in Eligible Activities under the stipulation that the net heat rate of such DERs is substantially less than the current and future grid heat rate.

Boiler accessories have strong potential to provide grid benefits during the near- and medium-term for several reasons. First, boiler accessories are dispatchable, capable to quickly ramp up/down and then transitioning to decarbonize hard-to-electrify sources, thereby providing both primary power (which encompasses capacity, energy, and ancillaries) and backup power – including ramping to full load from standby within ~2-3 seconds, and finally electrify steam or hot water production that heretofore wasn't considered an option for the CEC. Because they are dispatchable, boiler accessories can firm variable renewables to maximize the value of co-located solar or wind and thereby help accelerate the adoption of these resources. Utilizing direct or heat pump-generated steam, the boiler accessory can directly utilize renewable generated electricity during the spring, winter, and fall afternoon hours and then instantaneously shift into combined heat and power providing grid support at less than half the grid or alternative single cycle generation carbon footprint currently being promoted by the CEC. And, by being fuel flexible due to advances in robust power electronics, boiler accessories are highly cost-effective as they can operate on hydrogen, ammonia, biogas, natural gas, and propane. The boiler accessory is entirely within the control of the host boiler, resulting in no additional point source of emissions and no separate air permit. The less than 1ppm NOx emissions AND stoichiometric exhaust combined with the accessory's direct conversion of feedwater into high-value steam results in highly effective combined heat and power, heat of which can be used in all industrial and commercial facilities. This means they can be deployed immediately in over 6000 sites throughout California to provide capacity and load reduction to the grid using traditional fuels and seamlessly transition to zero-carbon electricity once they become widely available. Regardless of fuel, BAE's boiler accessory produces the very same power of linear generators, or fuel cells without the non-combustion charade, rather the boiler accessory is essentially a perfect boiler burner, resulting in sub 1ppm nitrogen oxide ("NOx") emissions, improving local air quality. Finally, by their modular size (20.5' x 8.5' x 9.5') and perfect fit to existing hard-to-electrify emission sources, boiler accessories are an ideal fit to electrical load pockets, deferring expensive transmission and distribution investment.

Boiler accessories provide the CEC a solution to electrify emission sources directly, utilizing renewable electricity directly for steam production obviating the high losses associated with hydrogen electrolysis and subsequent combustion – all while providing the Distributed Electricity

Backup Assets program and Clean Energy Reliability Investment Plan, as well as the solicitation concept itself. , California has established aggressive targets to combat the climate crisis, and clean distributed ultra-low carbon generation and renewable electrical sinks are essential to ensuring that greenhouse gas emissions reductions can be achieved without sacrificing affordability, year-round reliability, and multi-day resilience. BAE appreciates the opportunity to provide the Commission the best, near-term and only solution to electrify hard-to-electrify emission sources while firming the grid with at half the carbon footprint of fuel cell, linear or grid generation.

The CEC considers boilers and fluid heaters hard-to-electrify for good reason. Electrifying just one of 3 back-up boilers at the University of California, Berkeley, electrifying this source would require between 10 to 30 megawatts, the latter exceeding the current capacity of the University's grid connection. Obviously, much of the use or high-pressure steam for comfort heating can be electrified at less than a quarter of electricity using ground source heat pumps. Nevertheless, the conversion of the University to a zero-carbon footprint promises considerable expense and time to complete, during which its current carbon footprint continues unabated. So too is the situation with numerous other Universities, hospitals, food processors, industrial component manufacturers and petrochemical plants, all dependent on steam, its generation and use.

While there are a number of both near- and medium-term technical targets worth considering advancing technologies to a higher Technology Readiness Level ("TRL"), notably the ability to immediately provide both primary and backup power, all these concepts should be evaluated holistically with regard to the potential to the immediate potential to reduce of carbon emissions, rather than on a single metric. For example, an industrial, commercial or institutional customer calculates total cost of ownership based on a combination of capital and operating costs. Further essential values are the effective useful life of a system, ramp rate, emissions, start-up time, as well as air permitting costs and ability to provide both primary and backup power. Success for clean dispatchable generation is an amalgamation of these metrics, and may be weighted different depending on a customer site, local needs, etc. Simply put, the combined heat and power net thermal heat rate of 4300btu/kw-hr or less provides the electricity at less than half the current grid heat rate and less than 4¢/kw-hour, yielding a considerable ROI for customers with hard-to-electrify emission sources. A boiler accessory's year simple payback provides owners a cost effective without any need of State or Local supplemental financing. Providing these hard-to-electrify source customers with electrical rates corresponding to the actual electricity costs of power generation would incentivize the use of renewable electric energy that otherwise would be transferred out of state at considerable cost to CAISO and no in state reduction of power.

In developing this solicitation concept, the Commission mustn't fall for the false promise of single cycle generation. While lean low-temperature combustion such as promoted by manufacturers of linear generators provides higher single-cycle efficiency, the utilization of fuel, be it gas or hydrogen, is no more than 50% meaning the remainder heat is expelled as waste. Single-cycle electric generation cannot approach that provided by the boiler accessory's high-value high-

temperature heat with electric generation, regardless of claimed efficiency. Indeed, heat rates of linear generators, microturbines and fuel cells are all over 8000btu/kw-hr. Rather, all of these metrics drive value in tandem and may demonstrate value in varying degrees for a given project site. Incentivizing clean distributed generation that provide useful heat in hard-to-electrify applications simultaneously enables increased reliability in California's grid of the future while reducing costs and the risk of stranded assets. Particularly in light of the recent proliferation of high carbon footprint single cycle generators, (fuel cells, linear generators and microturbines) it is essential that the Commission appropriately value highly efficient technologies to prevent energy users from purchasing exotic single-cycle resources where half what is burned is wasted, dependant on sole-sourced parts which are made by just one company, as well as energy, environmental, and air quality regulations advance. Fuel efficient electric generating technologies represent the most prudent investment of state funds.

During some spring, fall and winter afternoon hours, renewable generated electricity exceeds that of the demand of California's grid requiring detaching solar generation from the grid or paying neighboring states to take the over produced renewable power. This overproduction has in part provided the incentive to produce hydrogen as essentially a battery, consuming over produced electrical power for electrolysis of hydrogen from water. Hydrogen is proposed as a way to decarbonize hard-to-electrify sources such as boilers and fluid heaters. There are considerable problems with this approach, not the least of which is the very low net thermal efficiency of the approach. Consider that the CEC estimates the current thermal efficiency of converting a therm of electricity to a therm of combusted hydrogen is just 66%, hydrogen's application to a boiler results in a 3 to 6% loss of efficiency.

Conclusion: Benz Air Engineering appreciates the opportunity to comment on this important draft GFO, and looks forward to collaborating in the future.

Thanks
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