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Mainspring Energy Comments on Gas R&D Program FY 2024-2025 Proposed Budget Plan Workshop (23-ERDD-02)

Additional submitted attachment is included below.

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January 19, 2024

California Energy Commission
Docket Unit, MS-4
Docket No. 23-ERDD-01
715 P Street
Sacramento, California 95814

Re: *Gas Research & Development Program Fiscal Year 2024-2025 Budget Plan* (23-ERDD-02)

Mainspring Energy, Inc., ("Mainspring") files these comments in response to the California Energy Commission's Gas Research & Development ("R&D") Program Fiscal Year 2024-2025 Budget Plan workshop ("R&D Plan workshop") held on December 15, 2023.

About Mainspring

Driven by its vision of the affordable, reliable, net-zero carbon grid of the future, Mainspring has developed and commercialized a new power generation technology —the linear generator— delivering local power that is dispatchable and fuel-flexible. Mainspring's linear generator offers a unique capacity and energy solution that simultaneously addresses the critical need of reducing greenhouse gas and criteria pollutant emissions, while also enhancing grid reliability and resilience.

Modular and scalable, Mainspring's linear generators can be deployed near load, either customer- or grid-sited. Mainspring's inverter-based technology offers a full range of valuable grid benefits including fast (and unlimited daily) starts/stops, a wide dispatch range from minimum to maximum load, quick ramping, and in many cases on-site fuel storage which allows linear generators to firm renewables for short or extended periods of time, thereby facilitating the continued rapid adoption of a reliable energy grid. Our local linear generators add capacity and resilience to the grid while also providing enhanced flexibility to help avoid renewable curtailment.[1]

I. Executive Summary

Mainspring thanks the California Energy Commission ("Commission") for the opportunity to provide comments on the R&D plan workshop. The comments herein respond to the questions posed regarding the Fuel-Flexible Distributed Power Generation initiative in the Renewable Generation topic area.

[1] For additional information on technical specifications and performance benefits, visit https://www.mainspringenergy.com/technology/.

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

A. How can equity considerations be centered in the fuel-flexible initiative?

Equity is an essential component of building a fair future for California's communities when developing the grid of the future. Equity can be centered in a number of ways; first, siting projects in low-income, disadvantaged, and rural communities, as well as communities that have historically faced outsized impacts from fires and public safety power shutoff ("PSPS") events empowers these communities through increased resilience and reduced emissions. Given that these communities often see outsized impact from weather events, which often necessitates the use of diesel backup generators that significantly diminish local air quality, deploying localized non-combustion generation provides essential low-emission power. Approximately one third of Mainspring's linear generators deployed in California to date have been sited in disadvantaged communities, meaning they are already improving air quality for and enabling front line communities to retain use of vital infrastructure even during grid outages and extreme weather events.

Second, equity can be centered by ensuring that some component of this program focuses on accelerating deployment of charging infrastructure for medium- and heavy-duty ("MDHD") electric vehicles ("EVs"). Currently, the vast majority of MDHD vehicles are diesel-powered –with many located in, or routinely passing through, disadvantaged communities– representing an important and well-recognized candidate for electrification.[2] The significant projected increase in MDHD fleet EVs necessitates a sizable amount of additional capacity at a time when our current grid strains to meet even existing demand.[3] As demonstrated in the Draft 2023 Integrated Energy Policy Report, current utility timelines to install the capacity necessary to power and interconnect MDHD projects is multiple years, driven by supply chain constraints arising from the period needed to manufacture and deliver new appurtenant equipment (e.g. the switchgear and transformers necessary to serve this new load), the volume of interconnection applications utilities are receiving, and other factors.[4] Moreover, recent delays in the development of new clean capacity and the ongoing need to invest in older coastal power plants and diesel generation to ensure grid and local reliability make clear that California needs more options to meet state and local climate, air quality, and resilience goals. Deploying fuel flexible generation, including linear generators, to rapidly energize EV charging stations enables immediate charging of EVs by operating as grid-independent microgrids before utility interconnection, and then serving as clean fuel-powered resilience and flexible load after utility interconnection takes place. Prior to utility interconnection, microgrids can provide immediate power to get charging infrastructure up and running, accelerating the timeline for vehicle electrification, while front-loading the impact of improved air quality for disadvantaged and under-resourced communities. After interconnection, microgrids provide much-needed clean and resilient capacity to the grid while displacing the need for diesel backup generators for use during extreme weather and grid events. Without clean resilience, basic services provided by the growing number of EVs –especially MDHD vehicles– will come to a halt during grid outages

[2] California Air Resources Board, "California Takes Bold Step to Reduce Truck Pollution", June 25, 2020. Available at: https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution

[3] California Energy Commission, "Assembly Bill 2127 Electric Vehicle Charging Infrastructure Second Assessment Staff Draft Report", p. 59. August 2023.

[4] California Energy Commission, "Draft 2023 Integrated Energy Policy Report", p. 25. November 13, 2023.

B. How would project siting and/or a community benefits plan help address equity considerations?

Similar to Mainspring's response to the previous question posed in the R&D workshop materials, siting projects to alleviate the challenges frontline communities face is particularly valuable. This is true not only for residents, but for the critical infrastructure communities rely on – such as medical facilities, cold storage facilities, data centers, and others that represent commercial and industrial applications where high levels of reliability are of paramount importance. These facilities and the communities they serve cannot afford long-duration outages. This is further reinforced by California's efforts to electrify both buildings and transportation; during extended grid outages communities and businesses cannot afford to lose access to electric buses, garbage and drayage trucks, and freight movement that provide essential services. As electrification efforts take hold, these communities should not have to endure the status quo of being forced to rely on diesel backup generators that negatively impact air quality when the grid goes down. As such, a project siting or community benefits plan should incorporate not only the benefits of increased resilience and improved air quality, but also the continuity value of essential services to those communities.

C. What are the most promising innovations, applications, and technology priorities for fuel-flexible distributed generation?

Linear generators have strong potential to provide grid benefits in the near-, medium-, and long-term for a number of reasons. First, linear generators are dispatchable, able to quickly ramp up/down thereby providing both primary power (which encompasses capacity, energy, and ancillaries) and backup power – including ramping to full load from standby within ~10 seconds. Because they are dispatchable, linear generators can firm variable renewables to maximize the value of co-located solar or wind – and thereby help accelerate adoption of these resources. And, by virtue of being fuel flexible due to advances in robust power electronics, linear generators are highly cost-effective as they can operate on, and readily switch between, hydrogen, ammonia, biogas, natural gas, and propane. This means they can be deployed immediately to provide capacity and load reduction to the grid using traditional fuels, and seamlessly transition to clean fuels once they become widely available. Regardless of fuel, Mainspring's linear generators produce power without combustion, resulting in ultra-low nitrogen oxide ("NOx") emissions, improving local air quality. Finally, by virtue of their modular size (20.5' x 8.5' x 9.5') linear generators are space- and land-efficient and can be sited in load pockets, deferring expensive transmission & distribution investment.

The applications for which linear generators provide benefits are broad. Mainspring has already deployed linear generators across a number of locations in California, including units sited at logistics facilities, grocery stores, wastewater treatment plants, and landfills – and continues to expand the number of units in service.[5] Notably, linear generators have already been recognized by the CEC in a number of settings, including the Distributed Electricity Backup Assets program. California has established aggressive targets to combat the climate crisis, and clean, fuel-flexible distributed generation resources like linear generators are essential to ensuring that greenhouse gas emissions reductions can be achieved without sacrificing affordability, year-round reliability, and multi-day resilience. Mainspring appreciates the

[5] See, for example:
https://www.powermag.com/pairing-solar-with-linear-generators-yields-a-revolutionary-ci-energy-solution/
https://napavalleyregister.com/news/local/napa-sanitation-district-going-greener-with-new-power-source/article_681ae698-0fa9-11ee-86cd-afee16747155.html
https://www.kcra.com/article/how-yolo-county-leaders-transforming-their-landfill/41433005

Commission recognizing linear generators as a resource, and looks forward to continuing to deploy linear generators across customer segments and fuel types to demonstrate the resilience, environmental, and economic value fuel flexible, dispatchable distributed generation provides to California.

D. To what extent are you seeing combustion vs. non-combustion technologies as part of fuel-flexible distributed generation in the near- and medium-term?

Non-combustion generation technologies are key to fuel-flexible distributed generation resources – which itself are an important tool for rapidly adding meaningful capacity to California's grid while simultaneously reducing criteria pollutants and lowering carbon emissions. As an example, linear generators use a low-temperature, uniform non-combustion reaction that maintains peak temperatures below the levels at which NOx forms (1500°C), resulting in near-zero NOx emissions at all loads – including during start-up. This is in contrast to the burning of a fuel with a flame, which creates high temperatures and high NOx emissions. California's South Coast Air Quality Management District recently adopted linear generator-specific requirements in the form of Proposed Rule 1110.3, highlighting the low NOx operation of this technology.[6] As the grid evolves and load-serving entities undertake an unprecedented effort to procure new generation, linear generators combine low-emissions with essential flexibility to add to the range of resources needed to meet state climate and air quality targets, as well as resilience goals.

E. What gaps are there from private sector investment for advancing fuel-flexible generation that are best addressed by the state?

Projects in the biogas sector (especially landfills, dairies, and wastewater treatment facilities) are particularly important in demonstrating the value of locally-sited fuel-flexible clean dispatchable generation for a number of reasons. First, many of these facilities produce much more fuel than can be used onsite (which is often flared when unused), representing a ready source of power that can be used to help meet peak demand on the system. Second, biogas projects are capital intensive and often require incentives to meet investor requirements. Facilities that are in a position to use excess fuel and turn it into power that can be exported to the grid (rather than flaring the gas) are often ineligible for state incentives (e.g. the Self Generation Incentive Program ("SGIP")). Third, biogas projects require a strong revenue source to offset the high capital costs. This may work for projects such as some dairy biogas facilities that produce electricity that is competitive in the Low-Carbon Fuel Standard ("LCFS") market – a market where economically viable carbon credits can be generated and add to the revenue of a project. However, power generated from many biogas facilities, especially landfills, does not produce enough revenue to be economically competitive relative to other LCFS-eligible projects, which drives investment interest away. Market-based Power Purchase Agreements ("PPA") alone are insufficient to achieve investor return requirements. In summary, biogas projects require incentives –including those being made available through this solicitation– to become economically viable. Finally, variability in the content of biogenic fuels can vary depending on the source (e.g. landfill, dairy, wastewater treatment), further reinforcing the need for fuel-flexible generation in this important segment.

Similarly, as discussed previously in Mainspring's responses to the R&D Plan workshop questions, state investment to accelerate deployment of charging infrastructure for medium- and heavy-duty vehicles using fuel-flexible distributed power generation is an area that can materially help to meet the state's climate and energy goals – which disproportionately improves air quality for disadvantaged communities by reducing diesel particulates. The focus of this fuel-flexible distributed power generation initiative in

[6] South Coast Air Quality Management District, "Rule 1110.3 Emissions From Linear Generators", Adopted November 3, 2023.

particular can drive valuable capacity investments for the grid, while improving local resilience, and help mitigate the impact of local particulate emissions for local communities.

III. Conclusion

Mainspring appreciates the opportunity to comment on this important workshop, and looks forward to collaborating in the future.

Sincerely,

/s/ Serj Berelson

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