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Additional submitted attachment is included below.

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September 22, 2023

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

Re: *IEPR Commissioner Workshop on the Potential Growth of Hydrogen* (23-IEPR-06)

Mainspring Energy, Inc. ("Mainspring") hereby submits these comments to the California Energy Commission ("Commission") on the Integrated Energy Policy Report ("IEPR") Commissioner Workshop on the Potential Growth of Hydrogen ("workshop") held on September 8, 2023 .[1]

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 non-combustion 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, with the ability to immediately generate electricity from a range of renewable fuels – including both 100% hydrogen and ammonia (a hydrogen carrier). 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 renewable energy grid. Our locally-sited linear generators add capacity and resilience to the grid while also providing enhanced flexibility to help avoid renewable curtailment.[2] 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.

[1] In these comments, Mainspring refers to the California Air Resources Board, the California Energy Commission, and the California Public Utilities Commission as the "Joint Agencies," consistent with SB 100's delegation of reporting obligations to these agencies.
[2] For additional information on technical specifications and performance benefits, visit https://www.mainspringenergy.com/technology/.

I. Executive Summary

Mainspring thanks the Commission for the opportunity to provide comments on the workshop. Through these comments we assert:

- Hydrogen is an essential means of providing clean firm power for California's future grid;
- Linear generators are a hydrogen-ready non-combustion distributed generation resource that can drive immediate benefit for California's grid.

II. Hydrogen is an Essential Means of Providing Clean Firm Power for California's Future Grid

Hydrogen, as well as hydrogen carriers such as ammonia, both of which can be utilized to provide long-duration energy storage, are essential building blocks for a clean, reliable grid. As the deployment of variable renewable energy generation increases in the form of solar and wind, these resources will need to be supplemented with dispatchable clean firm power in order to meet grid needs. This is rendered even more critical as extreme weather events become more volatile – forcing Californians to endure longer grid outages. Storing renewable energy in the form of hydrogen is a central means of ensuring a resilient, reliable energy system while meeting increasingly-stringent state climate goals. Clean hydrogen can be used to supplement variable renewables across hours, days, weeks, and even seasons to mitigate both periods when solar and wind and production are decreased (i.e. when the sun is not shining and wind is not blowing), as well as more damaging grid stresses.

Hydrogen is valuable across a wide range of applications, as demonstrated in a number of workshop presentations. Among the most important are commercial and industrial applications where high levels of reliability are of paramount importance (e.g. critical infrastructure such as medical facilities, cold storage facilities, data centers, etc.). These and similar facilities cannot weather long duration outages; while a range of resources can provide short-term reliability, hydrogen is an essential tool for long-duration energy storage. 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 the essential services provided by electric buses, garbage and drayage trucks, and freight movement. 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.

Meeting state climate goals, local air quality requirements, and ensuring a resilient, reliable grid all require a form of long-duration renewable energy storage; clean hydrogen is well-positioned to enable achievement across all these goals. Particularly in light of the California Air Resources Board's ("CARB") Advanced Clean Fleets Rule rule ("ACF Rule"), efforts to rapidly deploy fleet zero-emission vehicles ("ZEVs") at scale requires consideration of on-site clean resilience for use during grid outages; hydrogen-powered distributed generation is a useful tool to enable fleet operators to continue serving their communities during outages. Finally, hydrogen can be made off-site and then transported to locations that need it (either by pipeline, rail, or truck), to either be used immediately or stored for future needs – thereby removing the constraints that hinder other forms of long-duration energy storage and enabling clean hydrogen to be available wherever it is needed.

III. Linear Generators are a Hydrogen-Ready Non-Combustion Distributed Generation Resource that can Drive Immediate Benefit for California's Grid

As illustrated in the workshop presentations, hydrogen-fueled clean firm power can play an important role in creating California's grid of the future. 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. This is exemplified by the findings of the Joint Agency Reliability Planning Assessment, which highlights the need for up to 10,000 MW of additional capacity by the end of 2025.[3] It is essential that the Commission develop a diverse array of resources –including clean firm power– to ensure California's reliability needs are met while achieving the state's climate goals. Linear generators represent a unique technology that provides an important and broad set of benefits. By being both dispatchable and fuel-flexible, while utilizing a non-combustion reaction, linear generators represent a highly useful tool in achieving California's climate, air quality, and resilience goals.

First, the fuel-flexibility of Mainspring's linear generators provides unique benefits to both grid operators and end-use customers. Linear generators are already being deployed to run on readily-available fuels today, such as biogas, and can easily transition to other low- or zero-carbon fuels (e.g., clean hydrogen and ammonia) as soon as they become available. No hardware changes are required for a linear generator to switch fuels, enabling a smooth transition to a zero-carbon retail electric supply. Linear generators therefore represent a "bank" of hydrogen-capable generation that can instantly transition into zero-carbon generation to help power not only California's grid, but its hydrogen economy as well. Moreover, by using two moving parts and no lubricants, linear generators represent a functional, reliable resource.

Second, linear generators use a low-temperature, uniform 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. The use of UL-listed inverters for straightforward interconnection enables linear generators to be sited wherever power is needed and permitted in the most stringent air quality regulatory environments. Additionally, linear generators are modular, with the ability to deploy as many units as may be needed to power a given site. Linear generators may therefore serve a large commercial customer's backup generation need (thereby avoiding diesel-fueled backup), represent a facet of a multi-resource microgrid, provide clean resilience to electric vehicle ("EV") charging stations, or provide a utility-scale solution to alleviate congestion constraints and add local resiliency. As the grid evolves and load-serving entities undertake an unprecedented effort to procure new generation, linear generators will provide essential flexibility to add to the range of resources needed to meet state climate and air quality targets.

Finally, full dispatchability allows linear generators to consistently match power output with the specific energy need – thus avoiding unnecessary curtailment of renewable resources. Unlimited daily starts and stops means linear generators running on hydrogen can provide both clean firm power and zero-carbon backup power whenever it is needed – even during periods of low variable renewable generation (e.g. when the sun is not shining and the wind is not blowing).

The aforementioned characteristics enable a wide range of applications to which linear generators can be deployed. As an example, deploying linear generators to immediately power EV charging stations enables fleet operators to meet CARB's ACF Rule and easily transition these generators to utilize hydrogen as a form of clean resilience. The mass adoption of medium- and heavy-duty ("MDHD") fleet EVs to meet this requirement necessitates a sizable amount of additional capacity at a time when our current grid strains to meet even existing demand. Currently, 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

[3] Joint Agency Reliability Planning Assessment SB 846 Quarterly Report and AB 205 Report at 11. February 2023.

receiving, and other factors. However, California cannot afford to wait for supply chain issues to be resolved, nor the interconnection process itself to be reformed, in order to meet the ACF Rule as well as broader climate goals. This is especially true for MDHD EVs that need significant additions in charging capacity (routinely requiring multiple megawatts for each charging station) and which are often replacing diesel-powered trucks operating in disadvantaged communities. Linear generators can immediately power EV charging stations, operating as grid-independent microgrids before utility interconnection, and then serving as hydrogen-powered clean 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 and achievement of ACF Rule requirements, 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 polluting diesel backup generators for use during extreme weather and grid events. Without clean resilience, basic services provided by the growing number of EVs come to a halt during grid outages.

Mainspring applauds the Commission for recognizing the importance of hydrogen to California's clean energy future, and stands ready to utilize clean fuels –including hydrogen and ammonia– to help enable the state to build its grid of the future.

IV. 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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