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National Fuel Cell Research Center Comments on Draft 2020 IEPR Update, Volume II

Additional submitted attachment is included below.

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VIA ELECTRONIC FILING

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 20-IEPR-01
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Draft 2020 IEPR Update, Volume II: The Role of Microgrids in California's Clean and Resilient Energy Future

The National Fuel Cell Research Center (NFCRC) submits these comments in response to the Notice of Availability and Request for Comments Draft 2020 Integrated Energy Policy Report (IEPR) Update, Volume II, released on March 8, 2021.

I. Introduction

The NFCRC facilitates and accelerates the development and deployment of fuel cell technology and systems; promotes strategic alliances to address the market challenges associated with the installation and integration of fuel cell systems; and educates and develops resources for the power and energy storage sectors. The NFCRC was established in 1998 at the University of California, Irvine by the U.S. Department of Energy and the California Energy Commission (Commission) in order to develop advanced sources of power generation, transportation and fuels and has overseen and reviewed thousands of commercial fuel cell applications.

II. Comments on the Draft 2020 IEPR Update, Volume II: The Role of Microgrids in California's Clean and Resilient Energy Future, Lessons Learned from the CEC's Research (Volume II)

Overall, the NFCRC encourages the Commission to acknowledge the success of the pilot programs, in supporting many different microgrid applications to support further deployment of microgrids as viable commercial technology, and to address regulatory barriers such as interconnection and lack of a standardized tariff that are impeding the rapid deployment of these solutions.

A. Fuel cells are a fuel flexible key resource within a microgrid that provides long-duration islanding capability.

Volume II delineates between "renewable" and "fossil-fueled" backup power on page 4. This delineation is misleading in that 1) battery storage often charges from the grid, which is partially renewable and partially fossil-fueled, and 2) fuel cell systems are fuel flexible and can be either renewable- or fossil-fueled, or both. The NFCRC suggests that the report acknowledge that fuel cell systems can resolve some challenges to microgrid deployment by serving as a fuel flexible resource that provides continuous power for long-duration islanding.

Fuel cell systems displace traditional emergency backup generators (almost exclusively fossil diesel combustion generators) that emit criteria air pollutants and greenhouse gas (GHG) emissions. This feature is especially critical given that poor air quality can be a major issue in economically disadvantaged communities that are often disproportionately burdened by air pollution and risks of COVID-19. By providing always-on dispatchable zero criteria pollutant emissions power, fuel cells can increase adoption of intermittent renewable wind and solar resources throughout California while significantly increasing the generation of decarbonized and pollutant-free electricity. By increasingly using renewable fuels (including renewable hydrogen) in fuel cells over time, these dispatchable systems will become a key technology for enabling completely zero emissions in all sectors of the economy.

B. Fuel Cell and Electrolysis Systems are Also Key Components of Microgrids

On pages 23-24 of Volume II, solar and battery systems are identified as key components of microgrids. Most microgrids have other technologies and these should be considered as well. The NFCRC requests the addition of fuel cells, hydrogen and electrolyzers to the final report as they are also key components that can be deployed within a microgrid.

Figure 1 on page 8 of Volume II refers to microgrid components and delineates generation into "*renewable generation*" and "*fossil fuel generator*." Fuel cell systems can serve as either renewable or clean (zero criteria pollutant) fossil-fueled generation. The NFCRC requests that the document rather use the term "*distributed energy resource*" or "dispatchable generation" to reflect the reality that some generators can be controlled while others are dependent upon the instantaneous availability of the source. This is a fundamental distinguishing characteristic of the two types of systems described. Note that both battery energy storage and fuel cell power generation can be either renewable- or fossil-fueled. Fuel cells can operate on renewable biogas, renewable methane, renewable hydrogen, or fossil natural gas or combinations of these fuels. Battery systems that are charging from the grid also accept energy from both renewable and fossil sources.

Another fundamental distinguishing characteristic that could be used in the report would be to distinguish between generators that are combustion or non-combustion resources. This fundamental difference leads to very significant differences in criteria pollutant emissions. The local air quality and greenhouse gas (GHG) emission impacts of diesel generators are significant. Non-combustion fuel cells on any fuel (fossil or renewable) improve air quality and reduce marginal grid emissions, while hydrogen fuel cell systems have zero criteria air pollutant and zero greenhouse gas emissions.

Fuel cell systems generate 24/7, clean, load-following power at close to 100% capacity factors. Compared to other front-of-the-meter and behind-the-meter generation, the combination of high efficiency and very high capacity factor results in the displacement of more GHG emissions than equivalent-sized intermittent resources. This high capacity factor corresponds to the production of clean, renewable electric energy (MWh) per unit of power capacity (MW) that is on the order of six (6) times that of solar power systems (assuming a 15% capacity factor for solar) and on the order of three (3) times that of wind power systems (assuming a capacity factor of 30% for wind). Thus, investments in fuel cells microgrids produce vastly more energy than wind or solar power systems per unit of capacity installed. This feature is very important to the net zero operation of microgrids in urban environments where solar generation can never be installed with sufficient capacity to meet all demands. When this electric energy is produced at times of low renewable energy availability on the utility grid network, the fuel cell systems produce much lower GHG emissions per MWh. In solar-dominant renewable power systems, like that of the Western Electric Coordinating Council (WECC) this occurs the majority of the time. This translates into substantially more GHG reductions per MW installed compared to solar systems regardless of the fuel used. It could thus be appropriate and more technically accurate to say that common components of a microgrid are "*short-duration distributed energy resources*" and "*long-duration distributed energy resources*" or "*combustion resources*" and "*non-combustion resources*," or "*dispatchable resources*" and "*non-dispatchable resources*." If none of these more fundamental distinguishing characteristics can be used by the Commission in the IEPR to characterize microgrid resources, then no categorization at all would be preferred.

The NFCRC recommends that the Commission maintain a technology neutral position in defining a microgrid and its components in the Microgrid IEPR, as a microgrid represents a complete system that allows grid isolation and islanding. Page 8 attempts to redefine the definition of microgrid from the SB 1339 legislation to a more technology specific definition. The NFCRC asks that the definition from SB 1339 be cited instead in Volume II as follows:

> "Microgrid" means an interconnected system of loads and energy resources, including, but not limited to, distributed energy resources, energy storage, demand response tools, and other management, forecasting, and analytical tools, within a clearly defined electrical boundary that can act as a single, controllable, and grid-independent entity, can connect to, disconnect from, or run in parallel with, larger portions of the electrical grid, or can be managed and isolated to withstand

larger disturbances and maintain electrical supply to connected critical infrastructure.[1]

Every microgrid is unique to the site on which it is installed, and the ultimate standards and rates should facilitate installation of the most efficient, resilient system while maintaining cost-effectiveness. Given the different and unique benefits of using the technologies that are determined to be most appropriate for individual microgrids, the NFCRC emphasizes the importance of a technology neutral approach in addressing the various issues included in Volume II. Such an approach recognizes different microgrid load profiles, energy needs, and end uses of consumers and the immediate need to protect Californians from short- and long-duration outages caused by wildfires, earthquakes, extreme weather, and Public Safety Power Shutoff (PSPS) events.

Non-combustion fuel cells, paired with storage, wind, solar, demand response, or other technologies, can serve as the backbone for microgrids that integrate numerous distributed energy resources and controls. Microgrids that use fuel cell systems as baseload power can immediately disconnect from the grid and island (operate autonomously) from the larger grid when circumstances demand (e.g., during grid outages or PSPS events). The fuel cell installation innately operates as an energy management system, with critical loads for backup power already identified and immediately followed in the case of an outage. A fuel cell system can smoothly transition from grid parallel operation to fully power the load for any length of grid outage, without interruption to the end user, and to seamlessly re-connect to the utility

[1] Senate Bill 1339.

grid network when its power is restored. Fuel cell systems should absolutely be included in the discussion of microgrid components.

Additionally, on page 29 Volume II states:

> Many microgrid owners have expressed the desire to eventually eliminate the need for the fossil fuel element; however, the current clean energy technology does not provide backup generation for a long enough time. Solutions such as longer-duration energy storage technologies, which can displace the need for fossil backup generation in microgrids, are needed as the state transitions to a 100 percent renewable and carbon-free energy future by 2045.

The NFCRC asks that Volume II restate this to say that:

> Many microgrid owners have expressed the desire to eventually eliminate the need for the fossil fuel element; however, only hydrogen fuel cell clean energy technology provides sufficient long duration backup generation. Solutions such as longer-duration energy storage, fuel cell and hydrogen technologies, which can displace the need for fossil backup generation in microgrids, are needed as the state transitions to a 100 percent renewable and carbon-free energy future by 2045.

The NFCRC also recommends that the Commission review the case studies presented by the Stationary Fuel Cell Collaborative on their website to better illustrate how these fuel cell and hydrogen technologies are being used today in microgrids.[2]

C. Customer-Owned Microgrids are the Most Common Microgrids

The NFCRC points out that the footnote 10 on page 19 of Volume II states that:

> Based on the information gained by the California Energy Commission's (CEC's) Electric Program Investment Charge (EPIC) staff in managing the microgrids shown in Figure 2 and Table 1, and information gained

[2] California Stationary Fuel Cell Collaborative, *Fuel Cells for Decarbonization and Resilience in California.* Available at: [Slide 1 (casfcc.org)]

from public workshops on microgrids, more than 80 percent of the clean energy microgrids that can be estimated are customer-owned.

This is important data to inform the current California Public Utilities Commission (CPUC) Microgrid proceeding R. 19-09-009 that has conversely prioritized the standardization of a multi-property tariff before a customer-owned microgrid tariff. With the latter being most common today, and therefore able to provide the most rapid deployment for resilience and public safety, the CPUC should consistently prioritize that development of a customer-owned standardized microgrid tariff, per the mandate of SB 1339 and the Commission analysis. The state of California and its ratepayers would benefit by the communication of these findings from the Commission to the CPUC.

D. Critical Facilities That Can Be Served By Microgrids Are Expansive and in the Public Interest.

On page 17, the Microgrid IEPR refers to the CPUC's De-energization Decision *D.19-05-042* and refers to "*updates*" to this decision. *D. 20-05-051* is the more recent Decision that should be referred to in the IEPR, as it supersedes *D. 19-05-042*. Facilities that were added by *D. 20-05-051* include public safety answering points and transportation facilities and infrastructure. The NFCRC recommends that additional facilities be included to truly address community resilience needs and public safety. Microgrids should have the ability to serve multiple customers in the event of an outage. For example, a grocery store, gas station, bank, and a private hospital could all be connected within a community microgrid or connected to carry the backup power load when the grid goes down. All these facilities provide essential services during an outage or emergency event.

E. Correction/Notation of Electrolyzer at StoneEdge Farm Microgrid

The microgrid at StoneEdge Farm is described on page 20 of Volume II. The NFCRC requests that the Commission add more detail to the following sentence and include the electrolyzer that produces hydrogen for the fuel cell systems: "Its microgrid consists of multiple generation sources, including solar PV, a fuel cell, and a small generating microturbine using natural gas; it also has battery, *electrolyzer* and hydrogen energy storage." (20) Similarly, on page 32, Mac McQuown was referring to the function of the electrolzyer in describing how hydrogen is made and the NFCRC requests that the report make the following addition: "They are developing this seasonal storage by hydrolyzing water (collected on site from rain) *with an electrolyzer* to make hydrogen."

F. Research Topics to Support Long-Duration, Resilient, Clean Microgrids

The NFCRC would like to reiterate the research topics that are important to growth of long-duration, resilient, clean microgrids.

1. Pilots to demonstrate 100% renewable data centers (both primary and backup power with all storage required) – starting with a containerized data center;

2. Pilot demonstrations of integrated solar, wind, battery & fuel cell microgrid systems for data centers;

3. Alternative backup power generation designs, e.g., use distributed generators for both primary and backup power generation (focused on RD&D in switchgear, controls, and design for reliability);

4. Integrated power and cooling for data centers, e.g., high temperature fuel cells with absorption chilling and/or dehumidification;

5. Alternative data center designs for distributed generation, e.g., Microsoft idea of "in-rack" generation (by fuel cell, flow battery, …) to eliminate the need for back-up generation;

6. Hydrogen ecosystem – renewable hydrogen and oxygen from data centers shared with other uses (e.g., vehicles, forklifts, wastewater treatment, ammonia plant);

7. Reversible solid oxide cells plus solar/wind power using the natural gas grid for long-term storage;

8. Renewable electrolysis & biogenic hydrogen production demonstrations to engender cost reduction; and

9. Investigations into reliability and resiliency of pipeline delivery of fuel, e.g., delivery of renewable hydrogen via pipeline to meet data center requirements.

Closing Comments

The NFRC appreciates the opportunity to comment on the 2020 IEPR Update, Volume II: The Role of Microgrids in California's Clean and Resilient Energy Future and proposes that the Commission highlight the use of fuel cell systems and hydrogen that should be part of the recommended strategy for meeting California emissions reduction policy goals. The NFCRC also recommends that the Commission address regulatory barriers that inhibit the use of these fuel cell systems in California microgrids. The IEPR should remain technology neutral so that it includes all technologies with long-duration operation and that also reduce air pollutants and increase resiliency, both of which have direct positive impacts on all California communities.

Respectfully submitted,

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