DOCKETED	
Docket Number:	20-IEPR-04
Project Title:	Microgrids
TN #:	234074
Document Title:	National Fuel Cell Research Center Comments - on IEPR Commissioner Workshop on Assessing the Future Role of Microgrids
Description:	N/A
Filer:	System
Organization:	National Fuel Cell Research Center
Submitter Role:	Public Agency
Submission Date:	7/30/2020 1:08:30 PM
Docketed Date:	7/30/2020

Comment Received From: National Fuel Cell Research Center
Submitted On: 7/30/2020
Docket Number: 20-IEPR-04

NFCRC Comments on IEPR Commissioner Workshop on Assessing the Future Role of Microgrids, Docket 20-IEPR-04

Additional submitted attachment is included below.

NATIONAL FUEL CELL RESEARCH CENTER

University of California, Irvine
Irvine, California 92697-3550
(949) 824-1999
(949) 824-7423 Fax
http://www.nfcrc.uci.edu

July 30, 2020

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 20-IEPR-04
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: IEPR Commissioner Workshop on Assessing the Future Role of Microgrids in California: Docket Number 20-IEPR-04

The National Fuel Cell Research Center (NFCRC) submits these comments on the July 7 and July 9, 2020 California Energy Commission (CEC), California Independent System Operator (CAISO) and California Public Utilities Commission (CPUC) Commissioner Workshop on Assessing the Future Role of Microgrids in California.

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 CEC 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 July 7 and July 9 Workshops

A. The State Resilience Strategy to Address Public Safety Power Shutoffs Should Include Fuel Cell Systems in Commercial, Community and Utility Microgrids

It is important that the IEPR value and ensure the ability of technologies to reliably island for long durations while decreasing both GHG and criteria air pollutant emissions. Microgrids that use fuel cell systems as baseload power generators are able to immediately disconnect from the utility grid network and island (operate autonomously from the larger grid) when circumstances demand (e.g., grid outage), for days or weeks as required. Stand-alone fuel cell systems as distributed energy resources (DER) can also create resiliency outside of a microgrid and provide continuous clean power, in addition to islanding connections to critical loads onsite.

Many of California's healthcare providers and other vital industries—e.g., data centers, advanced manufacturing—require this type of 24-7-365 energy delivery. Momentary losses of electricity to these commercial and industrial facilities are immensely damaging, potentially impacting health and well-being of citizens and costing thousands-of-dollars per each minute that critical loads are dropped, jeopardizing both the innovation and productivity of these sectors. Access to critical electric infrastructure, especially in areas of utility grid network or power generation capacity constraints, is a prerequisite for attracting these industries and retaining them in the State, as well as meeting their growing electricity needs.

During the Workshop Session 1 on July 7 and Session 2 on July 9, both CEC Chair Hochschild and the public commenter from Enchanted Rock described the exponential increase in emissions created from diesel generators that need to cycle and run intermittently in order to ensure that electricity will be available during grid outages. Due to high operating efficiency and continuous operation, fuel cell systems generate electricity – without combustion - that is cleaner than the utility grid network and dramatically cleaner than diesel generators. Fuel cell systems have proven reduced GHG emissions compared to the utility grid network, as demonstrated by substantial data and in CPUC reports from the Self-Generation Incentive Program. [1]

As controllable and dispatchable generation technologies, fuel cell systems also complement solar and battery energy storage to reliably support larger loads and further reduce emissions. Lithium-ion battery storage systems are not well-suited to provide large-scale and long-duration power due to relatively low energy density, and self-discharge, in addition to other challenges.[2] These technical limitations of battery energy storage make fuel cells a better option for extended grid outages, with instantaneous and long-duration backup power providing capabilities. Unpredictable externalities, such as weather conditions, do not impact the reliability of fuel cell systems. Fuel cells provide extended run power without criteria air pollutant or air toxic emissions, attributes that should be prioritized based upon the duration of off-grid and backup power required at sites that include critical facilities and vulnerable populations.

[1] SGIP 2016-2017 Self-Generation Incentive Program Impact Evaluation Report. Submitted by Itron to Pacific Gas & Electric Company and the SGIP Working Group, September 28, 2018. Available at: https://www.cpuc.ca.gov/General.aspx?id=7890

[2] Saeedmanesh, A., Mac Kinnon, M. and Brouwer, J. *Hydrogen is Essential for Sustainability, Current Opinion in Electrochemistry* 2018, 12:166–181.

Fuel cell microgrids are already in operation, replacing diesel generators and reducing air toxics, criteria air pollutants and greenhouse gas emissions. Two of FuelCell Energy's microgrid projects in California remained operational in areas impacted by PSPS, providing steady, reliable power to the University of California, San Diego and to the Santa Rita Jail during a time when over 3 million Californians were generally affected by PSPS.[3] The University of California, San Diego runs a microgrid with photovoltaic systems, a FuelCell Energy system, battery energy storage systems, and a gas turbine to create exceptional reliability and redundancy.

B. Fuel Cells Enable Microgrids in Disadvantaged Communities

Fuel cell systems displace traditional emergency backup generators (almost exclusively diesel combustion generators) that emit criteria air pollutants and GHG. This feature is especially critical given that the majority of California currently suffers from poor air quality and faces major challenges in achieving clean air for the many citizens that live and work within these areas, especially including economically disadvantaged communities that are often disproportionately burdened by air pollution and risks of COVID-19. By providing always-on zero criteria pollutant emission power, fuel cells can increase adoption of intermittent renewable wind and solar resources throughout the state while significantly increasing the generation of decarbonized and pollutant-free electricity.

[3] Available at: https://finance.yahoo.com/news/fuelcell-energy-details-microgrid-performance-134209974.html

The Con Edison Brooklyn Queens Demand Management and Demand Response Program[4] ultimately avoided nearly $1 billion in ratepayer costs through the use of targeted distributed generation installations. The Program projects include a community microgrid at Marcus Garvey Village in Brooklyn, New York using solar, storage, and Bloom Energy fuel cell systems together serving a low-income housing development, to optimize the efficiency, reliability, and affordability of the project - and improve neighborhood air quality.[5]

Other Community Microgrids

States, utilities, and customers across the Northeast have opted to use resilient, long-duration microgrids with fuel cells and other technologies in response to increasingly frequent natural disasters and grid interruption events. During the four storms that buffeted the East Coast from March 2-22 in 2018, millions of customers lost power, including those served by the electric grid in the vicinity of nine fuel cell microgrid sites. Despite the combined 26 electric utility outages, all nine fuel cell microgrids maintained power throughout these events. Other fuel cell systems in the Northeast powered critical communications and emergency shelters in the aftermath of these storms. Fuel cells also supplied critical load power to a healthcare facility during triple-digit temperature heat waves that triggered outages for 57,000 customers in Southern California in 2018. Additionally, fuel cells withstood the 2019 Ridgecrest earthquakes, the Sonoma fires in 2018, the 6.0 magnitude Napa earthquake in 2014, and even when a bulldozer was accidently dropped upon them at a customer site in 2016.

[4] Brooklyn Queens Demand Management Demand Response Program available at: https://www.coned.com/en/business-partners/business-opportunities/brooklyn-queens-demand-management-demand-response-program

[5] Available at: https://www.nyceec.com/wp-content/uploads/Marcus-Garvey-Apartments-NYCEEC-Case-Study-1.pdf

Whether natural or human-caused outages occur, fuel cells have a critical role in providing valuable resilience to all Californians.

During the July 7 workshop, a panelist erroneously stated that the natural gas system is not reliable. To the contrary, this is another advantage for natural-gas fueled fuel cell systems that offers significant reliability and environmental benefits. Natural gas can be reliably delivered (greater than five-nines (> 99.999%) reliability is regularly achieved[6]) for continuous backup power for weeks at a time with nearly zero criteria pollutant emissions and greenhouse gas reducing operation. These systems also do not depend upon truck delivery of fuel and the associated emissions of diesel fuel delivery that diesel gen-sets require.

The need for long-duration power generation from DER was apparent as some of these natural disasters, such as Winter Storm Alfred in 2011 and Superstorm Sandy in 2012, caused grid outages for weeks at a time. In response to these and other extended outages, the towns of Woodbridge and Hartford, Connecticut have installed microgrids to maintain essential community services during extended outages – and these fuel cell microgrids serve as examples of what is possible for California to handle public safety power shutoffs and other emergencies.

- United Illuminating's Woodbridge facility uses a 2.5 MW combined heat and power fuel cell resource enabling a municipal micro-grid.[7] This microgrid supplies primary power to the grid, heat to a high school and maintains backup power during outages

[6] Gas Technology Institute, Assessment of Natural Gas and Electric Distribution Service Reliability July 19, 2018. Available at: https://www.gti.energy/wp-content/uploads/2018/11/Assessment-of-Natural-Gas-Electric-Distribution-Service-Reliability-TopicalReport-Jul2018.pdf

[7] Available at: https://finance.yahoo.com/news/fuelcell-energy-details-microgrid-performance-134209974.html

for six critical town buildings: a fire department, senior center, police department, town hall, public works department, and library.

- Constellation Energy has developed a fuel cell-based community microgrid for the City of Hartford, Connecticut.[8] This microgrid provides 100% of power for an elementary school, a public library, a senior center and a health center. In the event of a grid outage, the system also powers the critical loads of a nearby gas station and supermarket to maintain essential services in the community.

C. Regulatory Barriers to Microgrids in California Must be Addressed to Facilitate Broad Installations and Use of Microgrids

Regulatory barriers exist in California that have been addressed in states like Connecticut. The IEPR should recommend addressing the following barriers to microgrid deployment:

1. ***Address non-bypassable charges for departing load customers***

Customer generation departing loads are subject to utility non-bypassable charges even when electric service is partially or wholly discontinued. Under the existing NEM tariff, customers using fuel cell systems "for electric generation are exempt from non-bypassable charges."[9] Any utility microgrid tariffs should exempt customers using CARB DG-certified DER in microgrids from non-bypassable charges.

[8] Available at: https://microgridknowledge.com/microgrid-and-fuel-cell-hartford/
[9] https://www.pge.com/tariffs/assets/pdf/tariffbook/ELEC_SCHEDS_E-DCG.pdf

2. *Reduce standby charges*

Under the existing NEM tariff, customers using fuel cell systems for electric generation are also exempt from standby charges.[10] To the extent that charges for transmission and distribution services are recovered through demand charges in any billing period, no standby charges should be applied in that monthly billing cycle to fuel cell customer-generators or behind-the-meter microgrid customers.[11]

3. *Streamline interconnection of individual microgrids with multiple technologies deployed within them via single-point of interconnection*

Streamlined interconnection processes for microgrid services are required during Public Safety Power Shutoff (PSPS) events. Fuel cell systems can provide additional grid services needed during PSPS events, with a larger size and the ability to island and/or export continuously and for long periods of time.

Fuel cells are inverter-based technologies that are operating in commercial and industrial facilities today, and grid-connected both behind-the-meter and in front-of-the-meter - with the ability to take on the backup power load requirements. In addition, fuel cell systems can provide grid services, including reactive power (KVAR), voltage support, frequency support, and power factor correction dispatch. Fuel cell systems also meet the UL1741-SA certification, which requires these capabilities.

As non-combustion generation devices, paired with storage, wind, solar, demand response, battery storage or other technologies, fuel cells can serve as the backbone (establish the AC voltage signal) for microgrids that integrate numerous

[10] https://www.pge.com/tariffs/assets/pdf/tariffbook/ELEC_SCHEDS_NEMFC.pdf
[11] Id.

distributed energy resources and controls. Microgrids that use fuel cell systems as baseload power are able to 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 inherently 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 provided that fuel is available, without interruption to the end user, and later seamlessly re-connect to the utility grid network when its power is restored.

D. Microgrids with Hydrogen are Operating in California

Per the Session 2 presentations and comments of StoneEdge Farm Microgrid and Jorge Elizondo, the developer, Plug Power hydrogen fuel cells made a renewable, long-duration microgrid possible, while also offering peak shaving and long-duration backup power. These zero-emission fuel cell systems generally range from 5 kW to 500 kW and instantly provide backup power operating on renewable hydrogen when the grid goes down and can serve as a critical part of a microgrid storage and generation system.

During the second panel of Session 2, Chair Hochschild had asked about the use of hydrogen in the Stone Edge Farm microgrid (winner of the Governor's Environmental and Economic Leadership Award). This microgrid combines a number of off-grid energy solutions with peak shaving and load shifting services for energy self-sufficiency and carbon footprint reduction and is designed to scale as needed. The microgrid uses solar powered electrolysis for hydrogen production and 26 kW of Plug Power fuel cells and hydrogen storage to provide reliable and long-duration backup power when the grid goes

down or when self-sustaining renewable islanding is otherwise desired (even when the utility grid network is available). This behind-the-meter, grid-connected microgrid can island and operate both continuously and autonomously, as well as generate extra energy for Stone Edge Farm with no criteria air pollutant or air toxic emissions, quiet operation, and in a minimal footprint. When the site was evacuated during the October 2017 wildfires in Sonoma, this microgrid continued to reliably operate for over a week via remote control and monitoring.[12]

Summary of Fuel Cell Advantages and Attributes

To summarize, fuel cell systems have many advantages for microgrids:

- Continuous power in the event of a grid outage or de-energization event;
- Baseload clean power in communities with constrained transmission, including disadvantaged communities or rural locations;
- Long-duration (longer than 24 hours) generation for emergency service centers, telecommunications and critical services such as hospitals, gas stations, and grocery stores, including continuous power to these facilities that are co-located on the same block[13];
- By natively producing DC power, fuel cells are able to efficiently charge electric vehicles, buses, and other machinery during a grid outage and do so while minimizing the efficiency losses that occur when converting to AC power;
- Underground fuel lines eliminate the vulnerability to weather and risk of sparks from traditional poles and wires of electric grid infrastructure;

[12] https://microgridknowledge.com/microgrid-stone-edge/
[13] https://microgridknowledge.com/microgrid-and-fuel-cell-hartford/

- Modular design allows the system to continue operating even while individual components are being repaired or replaced;
- Time-to-build, uptime, and recovery time are all faster than the electric utility grid network can achieve;
- Leading power density: Fuel cells produce the largest quantity of zero emissions electricity in proportion to their equipment footprint compared to any technology currently on the market.
- Fuel cell systems have a very low noise profile - an average of ten decibels lower than diesel generators in all cases.
- Fuel flexibility means that fuel cells in microgrids can be powered by biogas, hydrogen or natural gas – all of which are substantially cleaner than diesel fuel.

III. Closing Comments

The NFRC appreciates the opportunity to comment on the 2020 IEPR Commissioner Workshop on Assessing the Future Role of Microgrids in California and recommends that the CEC highlight the use of fuel cell systems and renewable gas that should be part of the recommended strategy for meeting California emissions reduction policy goals. The NFCRC also recommends that the CEC address regulatory barriers that inhibit the use of these fuel cell systems in California microgrids. The IEPR should prioritize technologies that also reduce air pollutants and increase resiliency, both of which have direct positive impacts on all California communities.

Respectfully submitted,

_____/s/_____

Dr. Jack Brouwer
Director
National Fuel Cell Research Center
University of California, Irvine
Irvine, CA 92697-3550
Tel: 949-824-1999 Ext. 11221
E-mail: jb@nfcrc.uci.edu