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Written Testimony of the National Fuel Cell Research Center (NFCRC) at the University of California, Irvine (UCI)

Joint Public Hearing: Power and Communication Failures from Tropical Storm Isaias

September 3, 2020

The National Fuel Cell Research Center ("NFCRC") at the University of California, Irvine would like to thank the Chairs and all of the Senators and Members of the Assembly who are jointly working to address power and communication failures from Tropical Storm Isaias. To mitigate such failures in the future, the NFCRC requests that the Legislature ensure that distributed energy resources ("DER") providing clean, resilient, and backup power generation be appropriately valued by NYSERDA and by the Public Service Commission in policy and programs.

Renewable Resilience with Distributed Energy Resources

Once again, New York has experienced severe and lengthy [storm-related] power outages. These outages have resulted in air quality emergencies impacting the lives of millions of New Yorkers.[1] It is incumbent upon the Legislature to create mandates in order to directly respond to blackouts—a seemingly annually repeating disruption, which at this point should be anticipated. New York must

[1] John Dias, *A Week After Storm, Long Island Residents Losing Their Cool Over Power Outages: 'Like Living In A Sauna'* August 11, 2020, *available at*: https://newyork.cbslocal.com/2020/08/11/long-island-extreme-heat-power-outages/.

fulfill the legislative mandate before circumstances worsen by allowing and encouraging customer-owned and community microgrids to create resiliency where NYSERDA and the Public Service Commission have failed and where intermittent renewable energy systems have failed leading to public safety and environmental health damage. Over the past several years, New York has sacrificed resilient, clean generation initiatives in favor of diesel generators,[2] electrification alone[3] (increasing reliance on the unreliable and higher polluting electrical grid), and expanding intermittent generation and limited duration storage capacity[4] that can provide no more than 24 hours of backup power. It is time for action resulting in policy and programs that protect New York ratepayers and citizens.

Unpredictable emergency events such as severe weather conditions, do not impact the reliability of a fuel cell system. Hundreds of fuel cell systems have maintained power to critical facilities and customers across the northeast during Tropical Storm Isaias and previous storms and extreme weather events. The use of DER that can provide long-duration generation should be prioritized based upon the long-duration of power required at sites during storms, which includes critical facilities and vulnerable populations. Fuel cells, which are non-combustion generation devices, provide this necessary feature of extended run-time power without criteria air pollutant or air toxics emissions.[5] Consistent with the BCA framework, these benefits and attributes of fuel cell systems and DER should be highly valued.

Fuel cells, paired with storage, wind, solar, demand response, and other technologies, can serve as the backbone for microgrids that integrate numerous distributed energy resources and controls. Fuel

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[2] New York Department of Environmental Conservation Part 201, recently revised to allow 500-hour limit on generators for public emergencies, as distinct from 200 hour limit for demand response, *available at:* https://www.dec.ny.gov/regulations/120118.html

[3] Department of Public Service and New York State Energy Research and Development Authority White Paper on the Implementation of the Climate Leadership and Community Protection Act, June 2020.

[4] NYSERDA, *Governor Cuomo Unveils 20th Proposal of 2018 State of the State: New York's Clean Energy Jobs and Climate Agenda*, January 2, 2018, *available at:* https://www.nyserda.ny.gov/About/Newsroom/2018-Announcements/2018-01-02-Governor-Cuomo-Unveils-20th-Proposal-of-2018-State-of-the-State

[5] *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

cells also operate dynamically and load follow. 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). 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 seamlessly re-connect to the utility grid network when its power is restored.

How Fuel Cells Create Clean, Resilient Power

Community microgrids allow communities to use the best fit technologies to enable long-duration service to multiple facilities. The Town of Woodbridge, Connecticut, for example, provides a template for such a community microgrid serving multiple critical facilities, as shown in Figure 1.

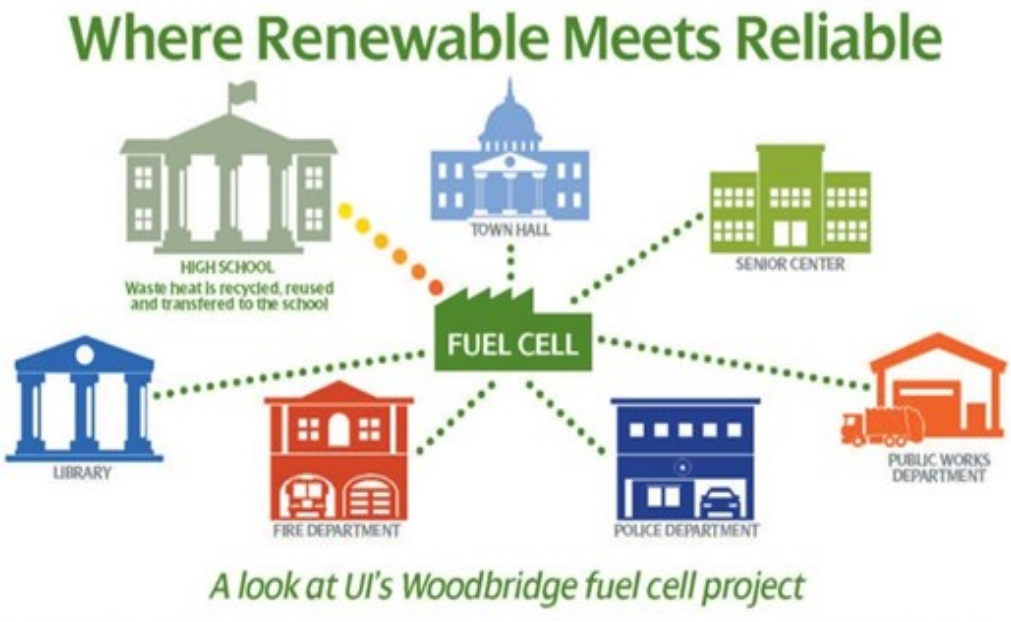


Figure 1: Town of Woodbridge Connecticut's Community Microgrid

The fuel cell microgrid is designed to supply power to the grid during regular operation and maintains power during outages for six critical town buildings, including a town hall, a senior center, a public works department, a police department, a fire department and a library. The grid-interconnected 2.8 MW FuelCell Energy system has blackstart capability and additionally provides heat to the local high school. The critical loads are sequenced by microgrid controller and an inverter follows the microgrid load. A load leveler maintains the fuel cell power constant.

FuelCell Energy fuel cells provided continual power as the backbone of microgrids at the University of California San Diego and Santa Rita jail during California's recent rolling blackouts.[6] A FuelCell Energy fuel cell provided continual power in Sonoma County through a wildfire that destroyed most of the neighborhood around it, and their fuel cells have provided continual power throughout numerous blizzards, hurricanes, blackouts, wildfires and even an earthquake.

Another example of a community utility-owned microgrid providing critical power for essential services is the Parkville Neighborhood, in the City of Hartford, Connecticut depicted in Figure 2.

[6] Elisa Wood, *See It's Dark in California but the Message is Clear: More Microgrids Needed*, October 11, 2018, *available at:* https://microgridknowledge.com/microgrids-california-power-outages/

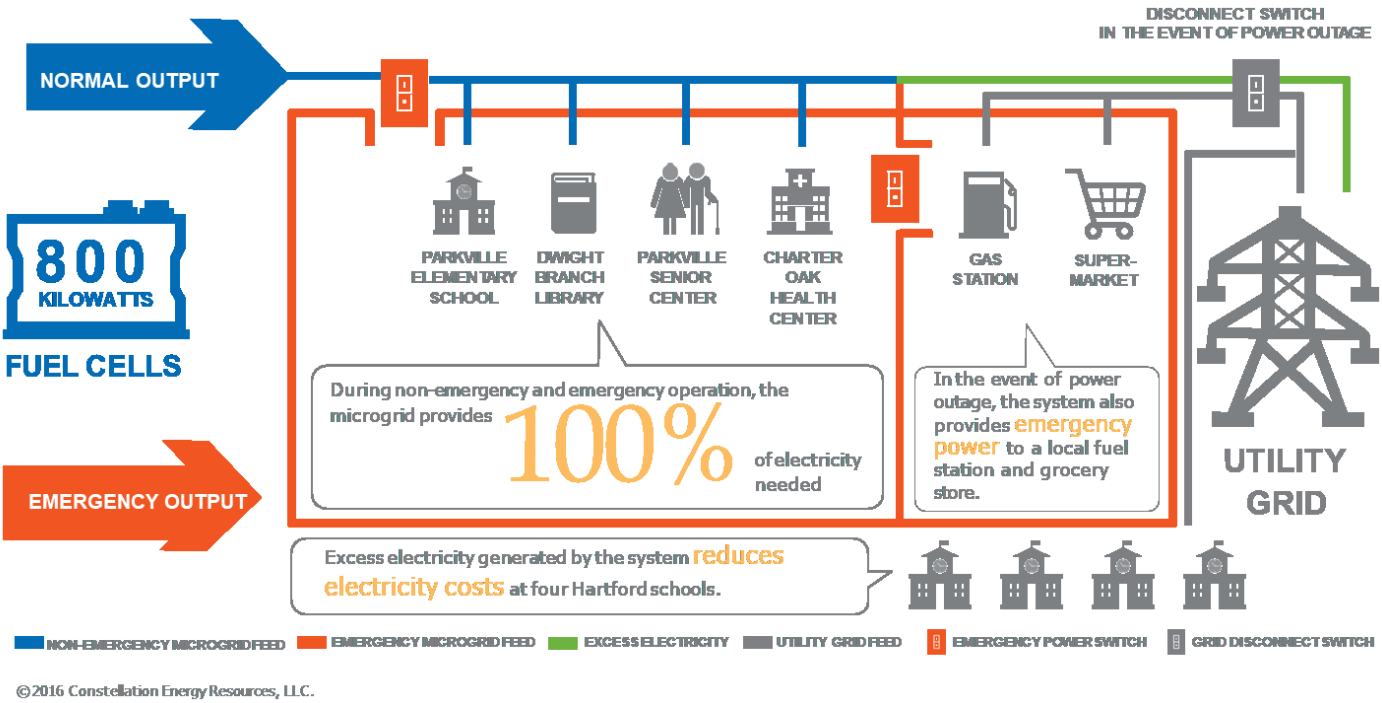
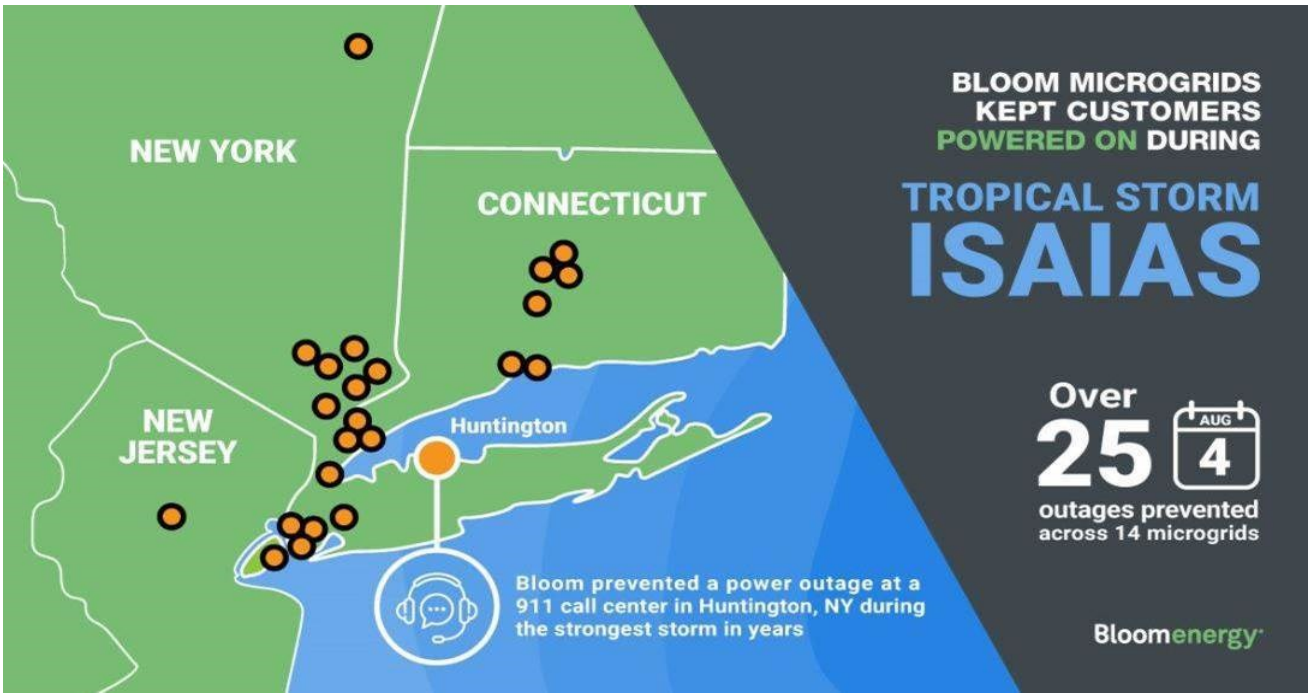


Figure 2: City of Hartford's Parkville Microgrid

Constellation Energy collaborated with the City of Hartford, Connecticut Light & Power, and GI Energy to design, construct and operate a microgrid with an 800 kW Bloom Energy baseload fuel cell system with 640 kW of grid islanding capability. This system provides 100% of electricity for the



senior center, elementary school and library, which are facilities that can serve as a refuge for residents during emergencies or bad weather. In the event of a major grid outage, the microgrid maintains power to those facilities and additionally powers a supermarket and gas station. The Parkville Microgrid provides a real-world example of why sizing constraints should be waived to facilitate a resilient energy system that can meet additional loads during a grid outage. Virtual net metering allows excess electricity to be provided back to the grid when desired to offset electricity costs for four other local schools. The electrical conduits are located underground to further ensure resilient power. A power purchase agreement with the City also had significant cost savings and avoided upfront capital investments and maintenance costs for passive backup equipment. During Tropical Storm Isaias, Bloom Energy systems prevented over 25 outages in the Northeast, as shown in Figure 3.

Figure 3: Bloom Energy Northeast Microgrids prevented more than 25 outages during tropical storm Isaias

Fuel cell systems are available on the market and have been used by telecommunications companies for critical backup and primary power at cell phone towers, cable nodes, and telecommunications hubs for nearly two decades. Commercial products are available on the market and have been deployed in government communication networks, telecommunication and utility backup power applications that scale from below 1kW to multi-MW capacities. There are more than 5,000 telecommunication and cable locations using fuel cell systems for backup power in North America. Fuel cell systems have provided backup power to telecommunications during natural disasters like hurricanes in the Southeastern U.S. and the Caribbean, and in California after earthquakes and wildfires. During Hurricane Sandy in 2012 and Hurricane Isaias in 2020, fuel cell systems were instrumental in providing

backup power for cell towers and keeping cell phone communications open for many in New York, New Jersey, and Connecticut.[7]

Fuel cell systems that can run on stored hydrogen—scalable to the required runtime—have been commercially deployed since the early 2000s. Other fuel cell systems that are used for cell tower backup power can run on a mixture of methanol/water fuel, which can reduce total system footprint for extended runtime (beyond 72 hours). Higher power fuel cell systems (200kW and up) that use biogas, hydrogen or natural gas are also being used today by telecommunications providers such as AT&T,[8] Cox[9] and Verizon.[10] These systems are grid-connected and seamlessly take over the load during a grid outage. They also operate as long as fuel is available and have run for weeks at a time during extended outages in the Northeast.

Fuel cells also operate dynamically, such as the Doosan fuel cell systems that can load follow at a rate of 10 kW/sec (going up in power) per 460kW system with unlimited down transient capability. In the event of a grid outage, the Doosan unit is capable of a transition to full grid independent power in 10 seconds (note that the unit does not shut down but goes down to idle state and then ramps to full power).

Behind-the-Meter Customer-Owned DER

Stone Edge Farm, located in Sonoma, California, operates its own state-of-the-art microgrid consisting of a number of clean technologies working in conjunction to provide sustainable energy for facility operations. One component of the micro-grid is a hive of Plug Power GenSure fuel cells that

[7] U.S. Department of Energy, Calling All Fuel Cells, December 7, 2012. Available at: https://www.energy.gov/articles/calling-all-fuel-cells

[8] AT&T Progress Toward our 2020/2025 Goals, at 4. Available at: https://about.att.com/content/dam/csr/sustainability-reporting/PDF/2017/ATT-Goals.pdf

[9] Doosan Fuel Cell America Project Profile: Cox Communications. Available at: http://www.doosanfuelcellamerica.com/en/news-resources/project-profiles/

[10] GreenTech Media, Verizon's $100M Fuel Cell and Solar Power Play, April 30, 2013. Available at: https://www.greentechmedia.com/articles/read/verizons-100m-fuel-cell-and-solar-power-play

produce 26kW to power Stone Edge's "critical grid". This critical grid powers their servers, fiber optic network, Ethernet, gates, alarms, and security lighting. Hydrogen for the GenSure fuel cells, and for multiple fuel cell vehicles operated by Stone Edge, is provided by electrolyzers, which are powered by solar arrays. One of the electrolyzers is provided by recently acquired Giner ELX. It provides up to 200kg of hydrogen per day. The electrolyzer is a "plug and play" unit, designed for easy water and electrical connection, so Stone Edge can quickly connect and begin producing hydrogen for their microgrid needs.

Figure 4: Plug Power Fuel Cells at Stone Edge Farm Microgrid

The micro-grid in Figure 4 was developed by Wooster Engineering Specialties, a general engineering contractor specializing in alternative energy, and combines a number of off-grid energy solutions with peak shaving and load shifting services to Stone Edge Farm for energy self-sufficiency and carbon footprint reduction. The grid-tied micro-grid is capable of islanding and operating continuously and autonomously, and is also generating extra energy so that Stone Edge Farm can sell a substantial amount of this energy back to the local utility, PG&E.

Legislative Action is Required to Value Resilient DER

To better meet the critical power needs of New York, without increasing diesel combustion, the NFCRC recommends placing an appropriate value of resiliency in the Value of DER ("VDER"), which is deemed a successor to both the net energy metering tariff and NYSERDA customer-sited DER programs. Location, capacity, environmental and energy benefits all accrue to behind-the-meter DER but are not appropriately valued or compensated. Grid islanding resources, like microgrids, are no longer incentivized in New York. Critically, the VDER[11] mechanism to compensate DER has left out the value of resiliency and behind-the-meter DER. The value of resiliency was formally embodied in NYSERDA's Customer-Sited Tier DER program, which was closed before the VDER tariff has been finalized and put in place. The NFCRC encourages New York to place a higher value on behind-the-meter resources that can operate through grid outages of any duration—from a few hours to a few weeks or more. Because the agencies have consciously cancelled the programs that support behind-the-meter DER, prior to the launch of the full VDER tariff, the Legislature has an opportunity to step in and mandate the inclusion of behind-the-meter resources in this compensation mechanism.

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[11] https://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun/Contractors/Value-of-Distributed-Energy-Resources.