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NFCRC Comments on Walsh Data Center Initial Study and Proposed Mitigated Negative Declaration, 19-SPPE-02

Additional submitted attachment is included below.

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California Energy Commission
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Re: Docket No. 19-SPPE-02
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Walsh Data Center Initial Study and Proposed Mitigated Negative Declaration: Docket Number 19-SPPE-02

The National Fuel Cell Research Center (NFCRC) submits these comments to the California Energy Commission (CEC) regarding the February 18, 2020 Walsh Data Center Initial Study and Proposed Mitigated Negative Declaration ("Walsh Study").

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 (CEC) in order to develop advanced sources of power generation, transportation and fuels and has overseen and reviewed thousands of commercial fuel cell applications.

Many of California's data centers and other vital industries—e.g., healthcare facilities, advanced manufacturing—require 24-7-365 energy delivery with very high reliability. Even momentary losses of electricity to these commercial and industrial facilities are immensely damaging, potentially impacting the health and well-being of citizens and costing thousands-of-dollars each minute that critical loads are dropped, jeopardizing the innovation, livelihood 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.

II. Comments on the Walsh Data Center Initial Study and Proposed Mitigated Negative Declaration [1]

On page 5.6-5 the Walsh Study states that:

> "Current commercial fuel cells are generally limited to lower energy density gaseous fuels such as natural gas or hydrogen, with their inherent storage problems related to space and safety. Furthermore, gas-fired engines are too slow to start in such a short time as needed by the data center to prevent loss of data and also they are subject to fuel supply interruptions, therefore, they are not a suitable alternative for use by data centers."

It is not clear if that latter statement is referring to fuel cell systems as gas-fired engines (fuel cell systems are non-combustion electrochemical generation resources, not gas-fired

[1] Walsh Data Center Initial Study and Proposed Mitigated Negative Declaration, CEC-700-2020-003, Docket No. 19-SPPE-02 docketed on February 18, 2020, at 5.6-5.

engines) but this reference to combustion and startup time will nonetheless be addressed by the NFCRC as well.

In response to March 23, 2020 comments of the Bay Area Air Quality Management District,[2] CEC staff further [and falsely] state that:

> "however, currently the technology for solar power, battery storage and fuel cell technologies on a scale of around 80 MW as required for this project are not expected to fit in the space available for this project. Also, for the fuel cell option, pipeline natural gas is not likely to have the same reliability as the liquid fuel diesel proposed for the Walsh Backup Generating Facility (WBGF)."[3]

NFCRC comments focus on responses and corrections to these statements of the CEC from both the February 18 Initial Study, as well as the CEC responses to comments on the Walsh Study.

A. Energy density and reliability of gaseous fuels

CEC staff have asserted that "Current commercial fuel cells are generally limited to lower energy density gaseous fuels such as natural gas or hydrogen." It is true that current commercially-available fuel cell systems operate on natural gas or hydrogen. This is not a limitation, however, but rather an advantage that offers significant reliability and environmental benefits in comparison to the higher volumetric energy density fuels, such as diesel fuel. Natural gas can be reliably delivered (greater than five-nines

[2] Bay Area Air Quality Management District Comment Letter for Walsh Data Center MND, docketed March 23, 2020 at 3.
[3] California Energy Commission Staff Responses to Comments Received on the Walsh Backup Generating Facility Initial Study docketed April 1, 2020 at 6.

(> 99.999%) reliability is regularly achieved[4]) for continuous backup power for weeks at a time with nearly zero criteria pollutant emissions and greenhouse gas reducing operation of natural gas-based fuel cells. These systems also do not depend upon truck delivery of fuel and the associated emissions of diesel fuel delivery that diesel gen-sets require. While on-site storage of hydrogen or natural gas would require more space than diesel fuel on an energy basis, such storage is 1) entirely feasible (when required), 2) is required in lesser amounts due to the high efficiency of fuel cell systems, and 3) is required in lesser amounts because not all of the fuel must be available on-site (due to the high reliability and resilience of the gas system).

Most backup power demands can be met with fuel cell systems because of the small footprint required for the energy conversion equipment and no need for fuel delivery (when fueled by natural gas). Fuel that is supplied via underground natural gas pipelines is significantly more reliable than the above-ground electric grid. Pipeline natural gas delivery thus effectively has less space required compared to diesel generators and diesel fuel storage. In addition, on-site stored diesel fuel has the potential to leak and contaminate soils and groundwater. If the fuel cell systems are built into the data centers, then they both offset the grid power (and related GHG and criteria air pollutant emissions) and achieve a seamless transition to backup power during grid outages.

Fuel cells are uniquely qualified to serve 24-7-365 power requirements. Due to high operating efficiency and continuous operation, fuel cell systems generate electricity that is cleaner than the utility grid network - resulting in reduced GHG emissions and

[4] 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

current building decarbonization, as proven by substantial data from many jurisdictions and particularly in CPUC reports from the Self-Generation Incentive Program. [5]

Fuel cell systems are fuel flexible. While hydrogen is the ideal fuel for fuel cells, fuel cells can also operate on natural gas, biogas, methanol or propane. While the longer-term goal for California should be to operate fuel cells on renewable hydrogen, a viable approach for now and for the transition, is the clean and efficient utilization of natural gas and the natural gas system. The high availability and reliability of the gas system is commercially delivered at very low cost, and the high efficiency and reduced emissions of fuel cell systems operating on natural gas compared to combustion systems leads to climate and air quality benefits. In addition, over time, the natural gas system will evolve to increasingly deliver renewable fuels (renewable biogas and hydrogen).

Fuel cells are zero-emission with respect to nitrogen oxides, carbon monoxide, sulfur oxides, and particulate matter, and they emit less GHG when operating on natural gas (as compared to the combustion of natural gas), and fuel cells produce zero GHG emissions when operating on renewable hydrogen.

A recent study of the Gas Technology Institute demonstrates six-sigma performance of 0.9999957 average reliability/availability of the natural gas system. Most natural gas outages are due to planned maintenance and gas systems often remain operational during extreme weather events. In most regions, North American natural gas distribution systems should have intrinsic reliability levels equal to, or better than, onsite

[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

liquid fuel storage – a key consideration for emergency and standby generators.[6] The reliability of the natural gas infrastructure thus far outweighs that of the delivery of diesel fuel; delivery that is often not available during an emergency such as a wildfire or grid outage, as was proven during hurricane Katrina.

B. Fuel cell systems utilizing natural gas or hydrogen are often preferred for their small footprint and long safety record.

In response to the statement that fuel cell systems have "inherent storage problems related to space and safety" the NFCRC submits the following information.

- In Korea, Doosan has installed 30.8 MW of fuel cells for district heating and electricity for 71,500 homes in the City of Busan. This system can also operate when the grid goes down and is configured in a tiered structure and sited on only one acre of land; an equivalent 30 MW solar farm could require more than 75 acres and would produce as little as 1/6th the amount of electric energy and zero heat.
- Another example is a 59 MW FuelCell Energy power plant located at Gyeonggi Green Energy south of Seoul, Korea. This system produces 440 million kilowatt-hours of electricity per year and supplies district heating, all on just 5.2 acres of land, proving the high-power density features of fuel cell technology that require little space to meet power and heat demands.

[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

- Plug Power has over 90 installations using stored liquid hydrogen for material handling customers that consume over 24 tons of hydrogen daily. This same type of distribution and storage system will be used in future data center applications. Further, while the actual footprint of the diesel engines alone may be smaller than the footprint of the equivalent power of fuel cell systems, additional space is required for diesel fuel storage. Even if the diesel fuel is stored underground, nothing can be stored above the underground diesel tanks, necessitating additional footprint.

The safety issues alluded to by the CEC are neither defined nor justified. Both hydrogen and fuel cell systems are being widely and safely used globally today at scales ranging from less than 1 kW to close to 60 MW, in both behind-the-meter and utility-side of the meter applications. Fuel cells operating on any fuel meet rigorous certification and safety standards. Building codes and fire codes exist for fuel cell systems operating on any fuel, including National Fire Protection Association (NFPA) Standard 853 (the "Standard for the installation of stationary fuel cells") which was first published in 2000 and which latest edition was released in 2020. All stationary fuel cell systems for primary and backup power are certified to the ANSI/CSA America FC 1-2012, Stationary Fuel Cell Power Systems (FC 1) standard.[7] The required hydrogen setback distances are well-defined by NFPA 52 and NFPA 55.[8] Comprehensive

[7] CSA Group Fuel Cell Power Systems. Available at: https://www.csagroup.org/testing-certification/product-areas/power-generation-energy-storage/fuel-cell-power-systems/

[8] U.S. Department of Energy Alternative Fuels Data Center Setback Distances available at: https://afdc.energy.gov/fuels/setbacks_text.htmll

information on stationary fuel cell codes and standards is both public and readily available.[9]

In addition, the high diffusivity, low density and low volumetric energy density features of hydrogen all contribute to a higher safety margin that can be achieved in a hydrogen storage facility design compared to diesel fuel storage.[10] In addition, hydrogen is non-toxic, making it safer than most fuels for human exposure in the event of a leak.

The CEC recommendation to use diesel generators itself entails a significant safety issue of air pollution and the corresponding negative health and environment impacts that are caused by all such diesel generators; at the 80 to 120 MW scale that data centers are currently being deployed, the emissions and health impacts of these diesel gen-sets would be tremendous. The CEC has a responsibility to accurately consider other technologies and to conduct transparent due diligence before making statements that support the permitting of large-scale polluting generation.

DER that emit criteria air pollutants have the potential to introduce new sources of emissions into urban airsheds with large populations and thereby cause risks to human health. Many areas of California currently suffer from poor air quality and face major challenges in achieving clean air for the many citizens that live and work within these areas. This is particularly true for economically disadvantaged communities that are often disproportionately burdened by air pollution. Therefore, DER such as fuel cells that provide clean, efficient energy conversion produce a wide range of energy,

[9] http://www.fuelcellstandards.com/stationary_apps.html
[10] U.S. Department of Energy, Energy Efficiency and Renewable Energy, Fuel Cell Technologies Office, https://www.energy.gov/eere/fuelcells/safe-use-hydrogen

environmental, and economic benefits for many different industries and applications that should be preferentially adopted because of the significant value they provide to the State. Policies that waive air emission permits for fuel cells have existed for over a decade in California in recognition of the superior co-benefits of fuel cells.

C. Fuel cell systems are non-combustion resources with both black start and load-following capability resulting in ultra-high efficiency for primary power and heat as well as resilient backup power.

It is not clear if the above-referenced CEC statement that "engines are too slow to start in such a short time as needed by the data center to prevent loss of data" refers to fuel cell systems – which are technically not combustion "engines." The NFCRC therefore requests that the CEC clarify whether this statement refers to engines or fuel cell systems. In the event that the CEC intended to refer to fuel cell systems with this statement, the NFCRC would like to respond with the following technical information.

Microgrids that use fuel cell systems as baseload power are able to immediately and seamlessly (within ¼ of an alternating current cycle, i.e., 1/240th of a second) disconnect from the grid and island (operate autonomously) from the larger grid when circumstances demand (e.g., a grid outage). Stand-alone fuel cell systems operating as distributed energy resources can also create resiliency outside of a microgrid and provide continuous clean power in addition to islanding connections to critical loads onsite. A fuel cell system can smoothly transition from the grid to fully power the load during a grid outage, without interruption to the end user. Backup diesel gen-sets, on the other hand, always require some start-up time during which power is completely unavailable unless the facility also installs a large battery energy storage system (which many data centers currently do).

Data centers use fuel cell systems for behind-the-meter energy as their primary operation, with the switch to grid independent power as their first line of grid outage backup solution. 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.

In the event of a grid outage, the Doosan fuel cell system is capable of an immediate transition to full grid independent power. FuelCell Energy has the option to incorporate a natural gas generator with a fuel cell system for black start capability; that is, this system uses the fuel cell to provide the master alternating current "grid signal" that allows other generators in the microgrid to synchronize to that signal and together meet demands. The FuelCell Energy systems themselves also seamlessly transition from grid-connected and offsetting power from the grid to grid independent when the grid is down. Plug Power hydrogen PEM fuel cell systems are designed to start in the same amount of time as the current gensets they would replace.

40 data centers in the U.S. are using Bloom Energy fuel cell systems, including at eBay, AT&T, Equinix, Apple, and JP Morgan.[11] Each component in the Bloom Energy Server architecture is built with native redundancy of the component, which assures 99%

[11] Available at: https://resources.bloomenergy.com/data-centers

uptime.[12] eBay installed 6 MW of Bloom Energy fuel cell systems to provide primary, onsite, reliable power matched to the operational requirements of the data center and to meet their sustainability requirements. The system provides 100% of electricity demand while drastically reducing carbon footprint with a redundant, modular architecture. This system architecture replaces large and expensive backup generators and UPS components. During a 2015 grid outage, eBay reported that a utility fault dropped the 138,000V utility grid connection while the fuel cell systems worked flawlessly with no impact to their power supply.[13]

D. Local air quality and greenhouse gas emissions reductions should be valued by the CEC across regulatory processes and programs.

Technologies that increase local air pollution anywhere and especially in disproportionately-impacted disadvantaged communities should be explicitly excluded from CEC programs, consistent with the intent of AB 617[14] and SB 100.[15] All combustion-based technologies have emissions of criteria pollutants, such as NOx, SO_2, and PM. To reduce - but not eliminate - these emissions, many of these combustion-based technologies deploy post-combustion clean-up technologies such as selective catalytic reduction (SCR) to reduce nitrogen oxide emissions or particulate traps to reduce PM

[12] Id.

[13] Available at: http://casfcc.org/PDF/Fuel_Cells_For_Resilience_And_Decarbonization_In_California_050120.pdf

[14] Assembly Bill No. 617, Nonvehicular air pollution: criteria air pollutants and toxic air contaminants. Chaptered July 16, 2017.

[15] Senate Bill No. 100, Chaptered September 10, 2018, Section 2, 399.11: (b) Achieving the renewables portfolio standard through the procurement of various electricity products from eligible renewable energy resources is intended to provide unique benefits to California, including all of the following, each of which independently justifies the program: **(3) Reducing air pollution, particularly criteria pollutant emissions and toxic air contaminants, in the state.**

emissions. However, these technologies must be maintained to be effective and can emit other compounds such as ammonia which is a PM precursor leading to an additional air quality burden; often directly into disproportionately impacted communities. The full lifecycle benefits of fuel cell systems also reduce community impacts; over 90% of fuel cell systems can be recycled at end of life and do not end up in landfills.

III. Closing Comments

The NFRC appreciates the opportunity to comment on the Walsh Data Center Initial Study and Proposed Mitigated Negative Declaration and CEC Responses to Comments Received on the Walsh Study and encourages the CEC to correct the record regarding the potential for fuel cell systems to meet these demands and to recognize the proven safety and reliability of using hydrogen and fuel cells. NFCRC also encourages the CEC to retract the recommendation to permit large-scale use of diesel gen-sets in these applications due to their corresponding egregious environmental and air quality impacts.

Respectfully submitted,

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