JOINT FUEL CELL PARTIES:
NATIONAL FUEL CELL RESEARCH CENTER; BLOOM ENERGY;
DOOSAN FUEL CELL AMERICA; FUELCELL ENERGY; LG FUEL CELL SYSTEMS
Comments on Fuel Cell Net Energy Metering Program February 13, 2018 Working Group Meeting

March 2, 2018

The Joint Fuel Cell Parties (National Fuel Cell Research Center, Bloom Energy, Doosan Fuel Cell America, FuelCell Energy Inc. and LG Fuel Cell Systems, Inc.) submit these comments to the California Air Resources Board (CARB) regarding the February 13, 2018 working group meeting to discuss the California Public Utility Commission's (CPUC) Avoided Cost Calculator (ACC) as the basis for the Fuel Cell Net Energy Metering (NEM) greenhouse gas (GHG) emission standards.

I. Background Information

AB 1637 directed CARB to establish a schedule of annual GHG emission standards for the Fuel Cell NEM program in consultation with the California Energy Commission (CEC). Over the past eight months, CARB staff has held workshops to solicit stakeholder input on what metric(s) should be used to determine the Fuel Cell NEM GHG annual emission standards.

To clarify, the majority of the past stakeholder comments requested that CARB use the CPUC's ACC as a source for annual hourly grid data, and not as a source of the annual standard itself. As CARB states on the workshop meeting notice, the CPUC uses the ACC to determine the effectiveness of long-term demand-side electricity programs, that is, the avoided cost of such programs. Further, in the intervening months since June 2017, when comments were initially filed, E3 updated the ACC as part of a proceeding at the CPUC independent of the ARB's efforts to set a GHG standard for Fuel Cell NEM. The new update shows an emissions calculation in addition to the avoided cost calculation that incorporates a long-run renewable factor of (1-RPS%), to account for future utility demand for renewable power in a long-term analysis of emissions which we refer to as the "RPS Build Margin factor" hereafter. As we describe below, this long-term emissions factor is inappropriate for development of the annual standard for Fuel Cell NEM.

II. Comments

A. <u>The Energy+Environmental Economics Avoided Cost Calculator Well Predicts Grid Marginal Emissions with California Renewable Policies</u>

The fuel cell community believes that the ACC of E3 is an accurate, publicly available tool for understanding and simulating the California electricity market and marginal resource dynamics and their associated emissions. The ACC tool simulates and

estimates the marginal emissions of the electric grid today and uses sound assumptions for projecting the marginal resources and associated emissions rates well into the future, with current California policies that support the increasing installation and operation of renewable power and energy storage. The ACC tool produces electric grid marginal emissions for each hour (8760 total) of the years 2016 – 2046. In each of these years the ACC tool well predicts the expected dynamic operation of the natural gas-fired load-following combined cycle and simple cycle power plants as they operate in concert with all of the expected renewable power generation and energy storage expected in future years. Important to this discussion, the model accounts for renewable capacity and renewable power production and energy storage dynamics sufficient to meet California policy goals (e.g., 33% renewable portfolio standard (RPS) by 2020, 50% RPS by 2030). The model also accounts for renewable power curtailment in future years.[1]

All of the above features of the ACC tool are appropriate and well-suited to use for establishing the schedule of annual greenhouse gas emission reduction standards. In addition, all of the above features well address the legislative requirements and intent of the chaptered Assembly Bill 1637, Section 2 (b) (2):

> *"The greenhouse gas emissions reduction standards shall ensure that each fuel cell electrical generation resource, for purposes of clause (iii) of subparagraph (A) of paragraph (3) of subdivision (a), reduces greenhouse gas emissions compared to the electrical grid resources, including renewable resources, that the fuel cell electrical generation resource displaces, accounting for both procurement and operation of the electrical grid."*

B. Including an RPS Build Margin Factor to Determine Long-Run Marginal Emissions Rate is Not Applicable to the NEM Standard

Because the ACC tool was developed for purposes of evaluating the impacts of energy efficiency measures that are installed in one year and are effective for a period of 20 years (or more), the tool also predicts the "long-run" marginal emissions rate. This long-run marginal emissions rate appropriately accounts for the impacts of an energy efficiency measure upon the long-term utility electricity demand and requirements for purchasing renewable energy in the future. To account for the impacts of the one-time certification of energy efficiency measures upon future utility renewable purchases, a factor was appropriately introduced into the ACC tool. This factor, the "RPS Build Margin factor" is used to produce the ACC results for "Long-Run Marginal Emissions," which are the appropriate standards for evaluating a one-time certification of technology that has a long lifetime.

However, **the Fuel Cell NEM policy calls for an annual standard which will be applied to a project each year**. Because eligibility is not automatic for the lifetime of a project, a long-run view of marginal emissions is not appropriate for this standard. Rather, the annual NEM standard should ratchet down every year with the actual marginal emissions rates (accounting for load-following combined cycle and simple cycle

[1] "If the implied heat rate is calculated to be at or below zero, it is then assumed that the system is in a period of overgeneration, and therefore the marginal emission factor is correspondingly zero as well."
E3 ACC Overview, p 35.

power plants operating in concert with renewables) for each year. The application of the RPS Build Margin factor to produce the Long-Run Marginal Emissions Rate in the ACC is not applicable to the fuel cell annual standard.

The parties encourage CARB to correctly calculate the fuel cell GHG emission standard by leveraging the data in the ACC tool regarding hourly marginal generation heat rates without applying the Long Run RPS Build Margin factor. This factor is not applicable to an annual standard and should not be included.

The procurement of renewables in the future is incorporated into the marginal resource emissions rates via sophisticated forecasting of how the increasing RPS requirement will affect the operation of the marginal generating resources (i.e., load-following power plants) in each year.[2] Therefore, the marginal emissions rates that are provided by the ACC tool without the RPS Build Margin factor are directly applicable to an annual standard that will progressively include all of the renewables that will operate on the grid each year into the future.

C. Analysis Demonstrating How an Annual GHG Emissions Standard Will Work

The latest version (2017) of the ACC tool produces an accurate estimate of the hourly (8,760 hours per year) carbon dioxide (CO_2) emissions for each year between 2016 and 2046. Figure 1 presents the average annual marginal CO_2 emissions rates produced by the latest ACC tool for the two cases of: (1) marginal emissions, i.e., no application of the RPS Build Margin factor (blue curve), and (2) Long Run emissions, i.e., application of the RPS Build Margin factor (orange curve). Note that the CO_2 emissions for the case of not applying the RPS Build Margin factor (blue curve) are roughly between and sometimes lower than the main load following power plants (combined cycle and simple cycle gas turbines). This accurately reflects the fact that the installation of a fuel cell (which effectively reduces load) primarily results in the reduction of power demand from these load-following power plants operating on the margin. The fact that the marginal emissions (without the Long-Run RPS Build Margin factor applied) are sometimes lower than the most efficient combined cycle load following power plant indicates the effects of renewable power generation on the margin. That is, these average annual marginal emissions rates (without the RPS Build Margin factor applied) already account for the impacts of all of the current and forecasted renewable power generators on marginal emissions rates. In cases of high renewable power use, the installation of a fuel cell primarily results in the displacement of emissions from combined cycle and simple cycle gas turbine power plants and also results in the displacement of some renewable power.

[2] The ACC includes "adjustments to the hourly energy price profile using the CPUC RPS calculator to account for projected increases in renewable generation. RPS calculator implied heat rate changes by month/hour are incorporated into the price shape for 2020. Adjustments prior to 2020 are linearly interpolated, and adjustments after 2020 are held at the 2020 levels." E3 ACC Overview, pp. 34-35.

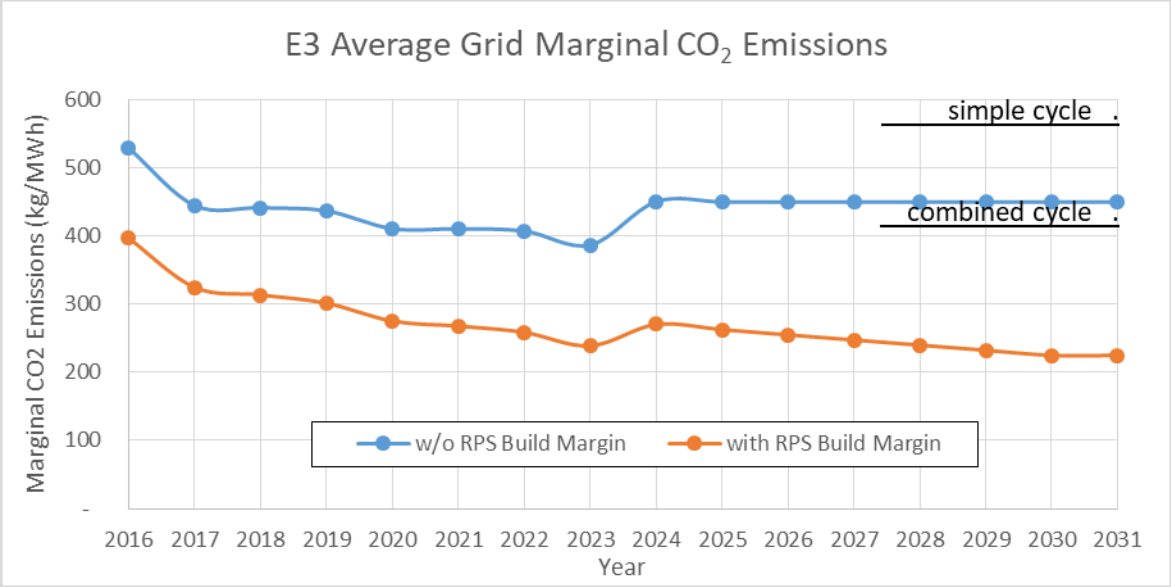

Figure 1. ACC Average Annual Marginal Emissions rates

Also shown in Figure 1 is the Long-Run Marginal Emissions produced by the ACC tool by application of the RPS Build Margin factor (orange curve). This curve multiplies the marginal emissions rate produced by the ACC tool by the RPS Build Margin factor which is 1 minus the expected annual RPS percentage for each year (that is, 33% in 2020, 50% in 2030, and linearly interpolated for all intervening years).

Figure 2 presents a high estimate (for the case that marginal grid emissions meet the 2017 E3 predictions) and low estimate (a hypothetical case in which marginal grid emissions are found to be lower over time as E3 updates the ACC tool) of realized marginal emissions over time and the corresponding annual Fuel Cell NEM standard that would be developed for each case. Note that for an annual standard, the standard for emissions from the fuel cell systems that will qualify for the Fuel Cell NEM tariff will always ratchet down with the realized marginal emissions rates of the utility grid network. In addition, in future years, the emissions of all NEM qualifying fuel cell systems installed under this GHG standard will be forced to be below those that the grid would otherwise produce with all of the deployed renewable power generation systems. Thus, for an annual standard, application of a Long-Run RPS Build Margin factor (which is only applicable for a lifetime type (one-time) certification process) is erroneous and must not be applied. <u>The annual standard by itself will always force NEM qualifying fuel cell systems to produce less emissions than the grid would otherwise have produced if the fuel cell system was not installed.</u>

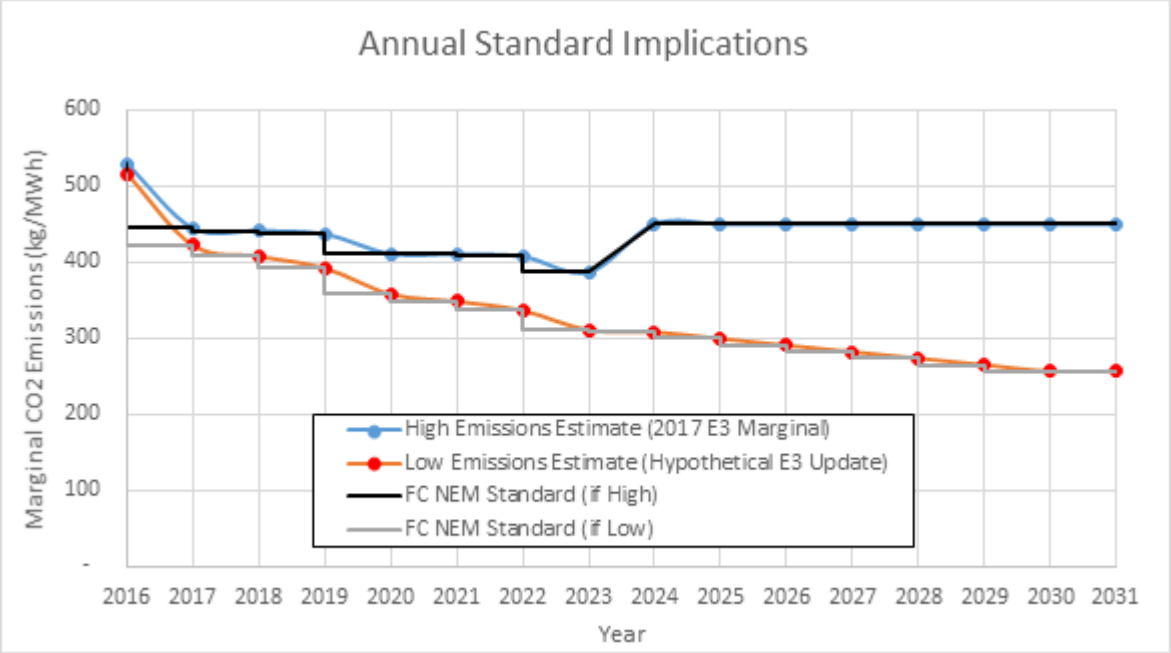

Figure 2. Implications of an annual NEM standard for a case that actual marginal grid emissions follow the 2017 E3 Marginal Emissions rate in ACC tool (blue), and a case that actual marginal grid emissions are found to be lower as E3 updates the ACC tool over time (red).

III. Conclusion

Establishing an accurate GHG standard for the net energy metering of fuel cell systems in the near-term is critically important for a resilient and clean grid today. The Joint Fuel Cell Parties appreciate the opportunity to comment on the development of a Fuel Cell Net Metering GHG Standard through the above recommendations to facilitate this evolution and look forward to continued productive conversations with staff to ensure that an appropriate, technically justified and correct standard is set.

Sincerely,

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