State of California
AIR RESOURCES BOARD

PUBLIC HEARING TO CONSIDER THE PROPOSED FUEL CELL NET ENERGY METERING GREENHOUSE GAS EMISSION STANDARDS REGULATION

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EXECUTIVE SUMMARY

California Air Resources Board (CARB or Board) staff is proposing the Fuel Cell Net Energy Metering Greenhouse Gas Emission Standards Regulation (Regulation), as required by Assembly Bill (AB) 1637 (Low, Chapter 658, Statutes of 2016) (AB 1637). This Staff Report presents CARB staff's rationale for the development of the Regulation.

Background on the Fuel Cell Net Energy Metering Program

The Fuel Cell Net Energy Metering (Fuel Cell NEM) Program was established by the Legislature in 2003 and has been extended and expanded over the years, most recently by AB 1637 in 2016. The Fuel Cell NEM Program provides eligible customer-generators with a bill credit for electricity generated and exported from a fuel cell system, and avoids or limits the amount that fuel cell customer-generators ordinarily pay for various utility costs. The Program is overseen by the California Public Utilities Commission (CPUC) and implemented by three California investor owned utilities (IOUs), Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E).

The Fuel Cell NEM Program was most recently extended by AB 1637, which also added the requirement that CARB develop greenhouse gas (GHG) emission standards that fuel cell generation resources must meet in order to be eligible for the Fuel Cell NEM Program. By statute, the GHG emission standards must reduce "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." (Public Utilities Code section 2827.10.) CARB is to "establish a schedule of annual GHG reduction standards..." and "…update the schedule every three years with applicable standards for each intervening year." (Public Utilities Code section 2827.10.)

Fuel Cell NEM GHG Emission Standards

Staff Proposal

CARB staff has been working since 2017 to develop GHG emission standards that meet the legislative direction in AB 1637. CARB staff sought to determine the grid resources that fuel cells displace, and the Regulation is informed by stakeholder feedback. From May 2017 through July 2019, CARB staff held one working group meeting and three workshops to discuss proposed emission standard calculation methodologies and seek stakeholder input. In consultation with California Energy Commission (CEC) staff, and per stakeholder feedback, CARB staff determined that fuel cell resources would displace marginal (as opposed to baseload) generator resources. Further, marginal generators would either be simple-cycle gas turbines, combined-cycle gas turbines, and, for a small percentage of hours in the year, renewable generators like wind and solar power plants.

During the informal public process, CARB staff informally proposed and considered four possible methodologies to set the fuel cell NEM GHG emission standards. The proposed methodologies considered the use of CEC data on marginal generator emissions, an external model used by CPUC, and finally an equation that incorporates data from CEC (CEC 2018) and the California Independent System Operator (CAISO) (CAISO 2019). The current proposal uses this equation to calculate the fuel cell NEM GHG emission standards for 2017.

Using a 2017 baseline calculated using 2017 data from CEC and CAISO, CARB staff developed a methodology to set the GHG emission standards for future years. This methodology is rooted in the idea that fuel cell electrical generating resources should reduce their GHG emissions at the same rate as California's electricity sector. To establish this reduction rate, CARB staff utilized the Integrated Resource Planning (IRP) GHG emission targets that CARB's Board adopted in July 2018 in response to Senate Bill (SB) 350 (de León, Chapter 547, Statutes of 2015), which also set a 2030 Renewables Portfolio Standard (RPS) goal of 50 percent. The IRP emission target utilized in the development of this Regulation also considers the fact that SB 100 (de León, Chapter 312, Statutes of 2018) updated the 2030 RPS to 60 percent.

This reduction in the fuel cell NEM emission standards, and the AB 1637 requirement that Fuel Cell NEM Program eligibility is assessed annually, means that fuel cell electrical general resources must decrease GHG emissions over time. This can occur either through increasing efficiency or through switching to eligible biofuels. This drive towards greater efficiency or a switch to eligible biofuels is also aligned with the goals outlined in the 2017 Scoping Plan Update, which states that while "natural gas is an important energy source, we must move toward cleaner heating fuels…" In proposing a methodology that results in fuel cell NEM GHG emission standards representing reductions relative to the electricity generation being displaced, and reducing consistently over time, the Regulation meets not only AB 1637 requirements but also aligns with the State's legislatively mandated longer-term climate and electricity sector goals. Fuel cells, which utilize but do not combust natural gas, also have the potential to reduce criteria pollutants, which is another critical priority in the State.

The Regulation would establish fuel cell NEM GHG emission standards for the years 2017 through 2022, and lays out the process by which the Executive Officer would update the standards every three years, beginning in 2022. The 2017 through 2022 standards would be 409, 399, 389, 379, 370, and 360 kg CO_2e/MWh, respectively. CARB staff considers the Regulation to be the best method for meeting the requirements of AB 1637 for the following reasons:

- The proposed standards use 2017 public data which reflect actual emissions based on actual electricity grid operation.
- The proposed standards take into account renewables procurement in two ways: 1) by decreasing marginal generator emissions by the amount of time that renewables are on the margin, and 2) by reducing the GHG emission standards by 2.5 percent annually, commensurate with 2030 electricity-sector GHG emission

(IRP) targets set pursuant to SB 350 and taking into consideration the updated RPS target set by SB 100.
- The proposed standards use of the most recently available data for every three-year update, which ensures that future GHG emission standards continue to reflect the operation of the electricity grid, including combined/simple-cycle generator GHG emission rates and the number of hours that renewable generators are operating on the margin.

Evaluation of Regulatory Alternatives

Staff analyzed three regulatory alternatives to the Regulation: (1) a "no project" alternative (meaning this Regulation does not occur); (2) using a CPUC-developed model to set the GHG emission standards; and (3) using the number of hours that renewables are curtailed as a proxy for the number of hours renewable generators are the marginal generator. In evaluating these alternatives, CARB staff found that none were as or more effective than implementing the proposed Regulation for achieving the requirements of AB 1637.

Environmental Analysis

The proposed Regulation has been evaluated for possible environmental impacts and CARB staff has determined that the Regulation is categorically exempt from the requirements of the California Environmental Quality Act (CEQA) under the "Class 8" exemption (14 CCR 15308) because it is an action taken by a regulatory agency for the protection of the environment. While, the Regulation is not anticipated to provide direct GHG or other air pollution emission reduction benefits (it would set a standard for a voluntary program that, by statute, CPUC is tasked with administering), the proposed GHG emission standard is designed to ensure that participating entities have lower GHG emissions than the grid resources they displace. The proposed action is designed to protect the environment, and CARB staff has determined there is no substantial evidence indicating the proposal could adversely affect air quality or any other environmental resource area, or that any of the exceptions to this exemption applies (14 CCR 15300.2). Therefore, this activity is exempt from CEQA.

Economic Assessment

The Regulation would set annual GHG emission standards for fuel cell generating resources participating in the Fuel Cell NEM Program, as required by AB 1637. The Fuel Cell NEM Program is a voluntary, incentive-based program administered by CPUC and implemented by IOUs. The Regulation would not set any requirements that other entities must implement. Therefore, the Regulation is not anticipated to have any statewide economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, the creation or elimination of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California, or on representative

private persons. Staff does not expect a change in employment, business creation, expansion, elimination, or business competitiveness in California.

Staff Recommendation

Staff recommends that the Board adopt the proposed Fuel Cell Net Energy Metering Greenhouse Gas Emission Standards Regulation. The proposed Regulation complies with legislative direction in AB 1637, and provides both relative certainty for potential Fuel Cell NEM Program participants and assured emission reductions by declining steadily every year.

I. INTRODUCTION AND BACKGROUND

This Staff Report presents CARB staff's rationale for the development of the proposed Fuel Cell Net Energy Metering Greenhouse Gas Emission Standards Regulation (Regulation), as required by AB 1637.

The Fuel Cell NEM Program was established by the Legislature in 2003 and has been extended and expanded over the years, most recently by AB 1637 in 2016. The Fuel Cell NEM Program provides eligible customer-generators with a bill credit for electricity generated and exported from a fuel cell system, and avoids or limits the amount that fuel cell customer-generators ordinarily pay for various utility standby, demand, and interconnection costs for the operating life of the fuel cell generation resources. Recent changes to the program, as defined in statute, include moving the expiration date of the program to December 31, 2021, increasing the size of the eligible fuel cell generation system, and expanding the statewide limit to allow an additional 500 Megawatts (MW). The Fuel Cell NEM Program is overseen by CPUC and implemented by PG&E, SCE, and SDG&E.

AB 1637 added the requirement that CARB develop GHG emission standards that fuel cell generation resources must meet in order to be eligible for the Fuel Cell NEM Program. By statute, the GHG emission standards must reduce "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" (Public Utilities Code section 2827.10.) CARB is to "establish a schedule of annual GHG reduction standards..." and "…update the schedule every three years with applicable standards for each intervening year." In developing the proposed GHG emission standards, CARB staff evaluated the potential effects additional fuel cell resources would likely have on the displacement of various grid resources, including the potential displacement of renewable resources, future resource procurement by affected utilities, and operation of the electrical grid.

The purpose of the Regulation is to establish an annual schedule of annual GHG emission standards, to be updated every three years, in accordance with AB 1637 requirements.

A. Fuel Cell NEM Program Overview

The Fuel Cell NEM Program provides eligible customer-generators with a bill credit for electricity generated and exported from a fuel cell electrical generating resource, and avoids or limits the amount that fuel cell customer-generators pay for various utility standby, demand, and interconnection costs for the operating life of the fuel cell facility. The Program was established by Assembly Bill 1214[1] (Firebaugh, Chapter 661, Statutes of 2003), which added section 2827.10 to the Public Utilities Code. In

[1] More information on AB 1214 can be found at:
http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200320040AB1214

establishing this program, AB 1214 required investor-owned utilities (IOU) to file a "standard tariff providing for net energy metering for eligible fuel cell customer-generators" with CPUC. AB 1214 further stated that "a program to provide net energy metering for generation charges for eligible fuel cell customer-generators is one way to encourage substantial private investment in these energy resources, stimulate in-state economic growth, reduce demand for electricity during peak consumption periods, help stabilize California's energy supply infrastructure, enhance the continued diversification of California's energy resource mix, and reduce interconnection and administrative costs for electricity suppliers."

The bill included a minimum efficiency requirement of 60 percent for combustion devices and a criteria pollutant emission requirement based on CARB's Distributed Generation (DG) Certification Program standards for 2007. (CARB 2001a)[2] AB 1214 required electrical corporations to make the tariff available for up to 112.5 MW of capacity on a first-come, first-served basis until January 1, 2006. The bill indicated that "preference shall be given to facilities which, at the time of installation, are located in a community with significant exposure to air contaminants or localized air contaminants, or both, including, but not limited to, communities of minority populations or low-income populations, or both, based on the ambient air quality standards established pursuant to Section 39607 of the Health and Safety Code."

The fuel cell NEM statute has been extended and revised several times since AB 1214. Assembly Bill 67 (Levine, Chapter 562, Statutes of 2005)[3] effectively extended the Fuel Cell NEM Program to fuel cells installed by January 1, 2010, and AB 1551 (Committee on Utilities and Commerce, Chapter 336, Statutes of 2009)[4] extended the program again to cover fuel cells installed by January 1, 2014. Further, AB 2165 (Hill, Chapter 603, Statutes of 2012)[5] amended Public Utilities Code section 2827.10 to extend the Fuel Cell NEM Program to 500 MW cumulative rated generation capacity, made it applicable to fuel cell electrical generating facilities that commence operation prior to January 1, 2015, and included GHG emissions reductions as a qualification for the Fuel Cell NEM Program. AB 2165 states that eligible customer-generators use "…technology the commission has determined will achieve reductions in emissions of greenhouse gases pursuant to subdivision (b), and meets the emission requirements for eligibility for funding set forth in subdivision (c), of Section 379.6." Public Utilities Code section 379.6 references CPUC's Self Generation Incentive Program (SGIP), a voluntary CPUC program that supports DG installations. Therefore, AB 2165 based fuel cell NEM eligibility, in part, on meeting GHG standards established by SGIP.

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[2] CARB's 2001 DG Certification Program Regulation established criteria emission requirements for both 2003 and 2007. AB 1214 required fuel cell electrical generation resources participating in the Fuel Cell NEM Program to meet the most stringent emission standards CARB had available at that time, which were the 2007 standards.

[3] More information about AB 67 can be found at: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB67;

[4] More information about AB 1551 can be found at: https://legiscan.com/CA/text/AB1551/2009

[5] More information about AB 2165 can be found at: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120AB2165

In 2016, AB 1637 (AB 1637) amended several parts of Public Utilities Code section 2827.10 and, as part of the amendments, required CARB to develop GHG emission standards for the Fuel Cell NEM Program. AB 1637 amended the definition of an eligible fuel cell customer-generator to a fuel cell sited on the customer's side of the meter with a capacity of not more than 5 MW (an increase from the one MW limit for eligibility under AB 1214). Eligible fuel cell electrical generation resources must also meet the applicable 2007 (fossil-fueled units) or 2013 (waste-gas fueled units) emission standards for criteria pollutants adopted by CARB in 2006 as amendments to CARB's Distributed Generation Certification Program (Section 94203 of Title 17 of the California Code of Regulations). AB 1637 extended the fuel cell NEM tariff to eligible fuel cell customer-generators who commence operation on or before December 31, 2021, on a first-come, first-served basis until the total rated generating capacity within a utility's service area reaches a level equivalent to a proportionate share of a statewide limit of 500 MW of total cumulative generating capacity. The statewide limit of 500 MW established by AB 1637 excludes the 135 MW of fuel cells that were installed under the program as of March 2017.[6]

As amended by AB 1637, Section 2827.10(b)(2) of the Public Utilities Code directs CARB to develop fuel cell NEM GHG emission standards that reduce "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." CARB must "establish a schedule of annual GHG reduction standards..." and "…update the schedule every three years with applicable standards for each intervening year."

Section 2827.10 of the Public Utilities Code limits CARB's role to adopting fuel cell NEM GHG emission standards, including a process to update and publish new standards every three years. Statute does not provide for CARB to take any further role in the Fuel Cell NEM Program. Under Section 2827.10 of the Public Utilities Code, CPUC must apply the GHG emission standards to determine eligibility of fuel cell electrical generation resources to participate in the Fuel Cell NEM Program. CPUC will engage in its own process to determine which fuel cell technology meets the GHG emission standards, including accounting determinations (*e.g.,* what, if any, consideration to provide to fuel cells that utilize combined heat and power (CHP)). Both agencies recognize that CHP can increase energy efficiency and reduce GHG emissions relative to separately using grid electricity and a natural gas boiler. Per CARB and CPUC staff discussions, CARB staff understands that CPUC staff will consider the GHG emissions-reducing benefits of CHP. Once CPUC completes its process to incorporate the standards, PG&E, SCE, and SDG&E will implement the new standards according to CPUC's requirements. Fuel Cell NEM Program eligibility will be assessed each year,

[6] CPUC Net Energy Metering (NEM) website has more information regarding NEM programs and can be found at: https://www.cpuc.ca.gov/General.aspx?id=3800.

meaning that fuel cell electrical generation facilities must meet the corresponding GHG emission standard every year to qualify for program benefits.

B. Overview of the California Electricity Sector

Operation of the electrical grid is highly complicated, as a mix of different types of power generating units contribute to keeping the grid operating. "Baseload generation" is designed to operate as much as possible due the fact that it is costly and inefficient to start, stop, and change electricity output frequently. Baseload generating units include large hydroelectric, nuclear, coal, and natural gas steam boiler generators. "Marginal generation" usually refers to generating units that can be easily started and stopped quickly. As the name "marginal" suggests, marginal generators are the last resources dispatched to serve electricity load—i.e., they adjust the electricity they produce as required by the electricity demand. Historically the generation resources that met marginal electricity demand load were simple-cycle gas turbines (SCGT) and some combined-cycle gas turbines (CCGT). SCGT and newer CCGT units use a natural gas turbine to generate electricity and do not require a significant amount of time to ramp-up to full load. Renewable resources such as solar and wind tend to run whenever the energy source (that is, solar irradiance and wind) is available. However, as demonstrated in CAISO 2018 Annual Report on Market Issues and Performance (CAISO 2019), there have been times over the past couple of years when renewable, zero-emissions resources were operating on the margin. Figure 1 shows the installed in-state electric generation capacity by fuel type since 2001.

In 2002, the California Legislature established the Renewables Portfolio Standard (RPS) by Senate Bill 1078 (Sher, Chapter 516, Statutes of 2002), with the goal that 20 percent of the 2017 electricity retail sales be generated by renewable resources.[7] There were several bills that accelerated and changed the RPS goal including SB 350 (de León, Chapter 547, Statutes of 2015) which set a goal of 50 percent RPS by 2030,[8] and SB 100 (de León, Chapter 312, Statutes of 2018), which increases the RPS goal to 60 percent by 2030 and mandates that the state's electricity generation sector become carbon-free by 2045.[9] CEC certifies electrical generation facilities as eligible renewable energy resources that may be used by utilities to meet their RPS procurement requirements. RPS-eligible resources include but aren't limited to geothermal, solar, wind, tidal current, and small hydroelectric.

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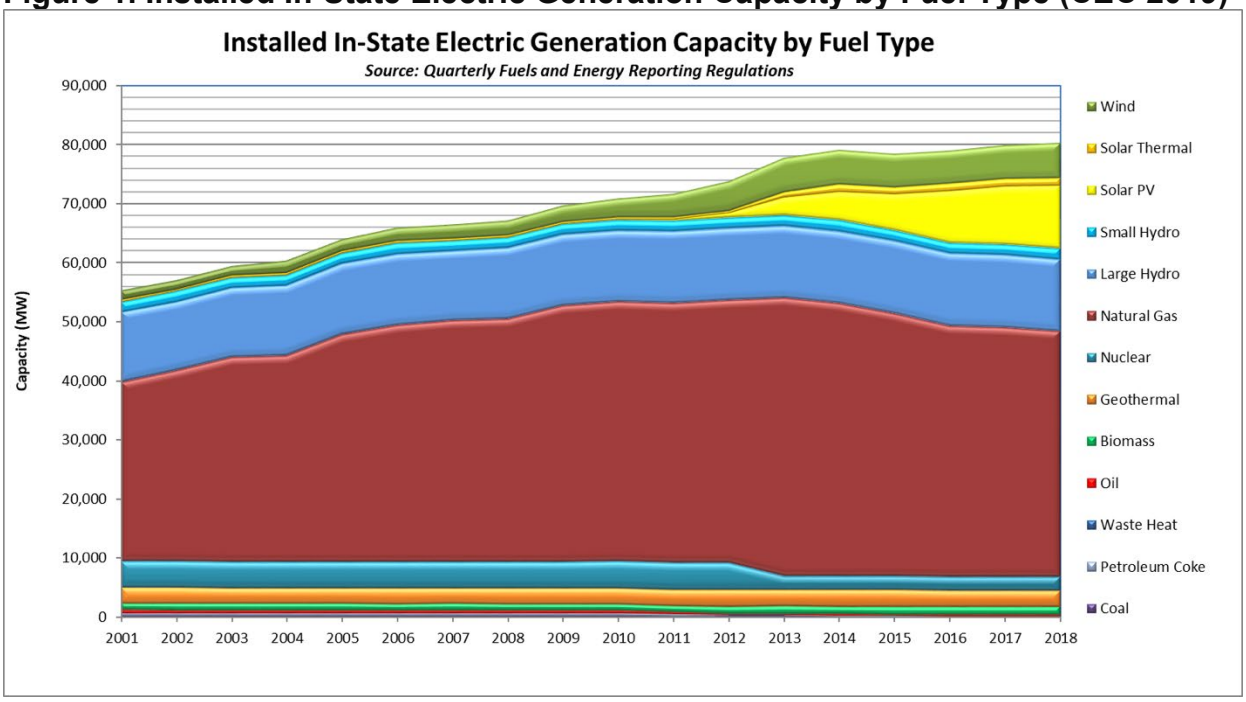
[7] More information about SB 1078 is available at:
https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200120020SB1078
[8] More information about SB 350 is available at:
http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350
[9]More information about SB 100 is available at:
https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100

Figure 1. Installed In-State Electric Generation Capacity by Fuel Type (CEC 2019)



C. Options Evaluated for Setting Fuel Cell NEM GHG Emission Standards

CARB staff has been working since 2017 to meet the legislative direction in AB 1637 to develop GHG emission standards that reduce "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." As a first step, CARB staff sought to determine the grid resources that fuel cell displaces. In consultation with CEC staff, CARB staff determined that marginal generator resources would be the most likely generation that would be displaced by fuel cell resources.

As mentioned in the prior section, California's marginal generators consist of CCGT and SCGT natural gas generators more than 98 percent of the hours in the year because they can ramp electricity output up and down quickly to balance electricity supply relative to demand. CCGT generators use one or more natural gas turbines along with one or more steam turbines, and the waste heat from the natural gas turbine is used to create steam for the steam turbine, making them more efficient than SCGT generators. Reusing the waste heat results in efficiencies of around 60 percent for new CCGT generators. An SCGT generator emits more pollutants and is more expensive to operate than a CCGT generator because they generate fewer MW per unit of fuel. The 2017 GHG average emission rate for an SCGT generator in California was 559 kg CO_2/ megawatt-hour (MWh) and the average CCGT in California emitted 390 kg CO_2/MWh (CEC 2018). CCGT generators' efficiency, reduced fuel costs, and reduced GHG emissions mean that they tend to run more hours in the year than SCGT generators.

With this starting point, CARB staff began an informal public process to solicit input on the methodology to calculate the fuel cell NEM GHG emission standards. From May 2017 through July 2019, CARB staff held a working group meeting and three workshops, and has proposed four possible methods for calculating the emission standards.[10] Table 1 below summarizes the methodologies that have been proposed and considered during this period. Throughout the public process, all proposals have included the assumption that fuel cells would displace marginal generators, and stakeholders have generally agreed with this assumption.[11]

Table 1. Listing of Informally Proposed Fuel Cell NEM GHG Emission Rates for 2017

Method	Basis	Emission Rate (kg CO_2e/MWh)	Proposal date
1	Displacement of CCGT generators	400	May 2017
2	Displacement of CCGT generators with a 25% renewable generator adjustment*	300	May 2017
3a	Avoided Cost Calculator (ACC) Model: interim 2017 version[12]	375	November 2017
3b	ACC Model: 2017 version[13] (E3 2017)	324	February 2018
3c	ACC Model: 2018 version (E3 2018)[14]**	444	Released May 2018
4	Equation considering marginal generator emissions, including renewables	409	July 2019

* To reflect RPS target of 25 percent by January 1, 2017
** Considered, not proposed

On May 30, 2017, CARB staff put forth two proposals as possible methods for calculating the emission standards. Method 1, as listed in Table 1 above, starts with the average GHG emission data from CEC's report Thermal Efficiency of Natural Gas-Fired Generation in California: 2016 Update (CEC 2017). Method 2 reduces the CCGT

[10] See Section X.I. for a description of the public process that preceded this rulemaking.
[11] Stakeholder comments can be found at: https://ww2.arb.ca.gov/our-work/programs/stationary-fuel-cell-net-energy-metering/meetings-workshops.
[12] The interim 2017 ACC model was developed by Energy + Environmental Economics (E3) to explore methodology changes to the ACC model. This model was sent to CARB before the 2017 ACC (E3 2017) methodology was finalized.
[13] This version of the ACC model (E3 2017) is the published version that was made available on the CPUC website.
[14] The 2018 ACC (E3 2018) was published on CPUC's website in May 2018.

generator emission rate by 25 percent to account for the RPS target of 25 percent of electricity retail sales generated by renewable resources by December 31, 2016, as specified in SB X1-2 (Simitian, Chapter 1, Statutes of 2011).[15] In later years, the percent reduction would continue to be equal to the percent RPS as it increased to 50 percent in 2030, the RPS required by SB 350. At the workshop and in public comments,[16] several stakeholders suggested using CPUC's 2017 Avoided Cost Calculator (ACC) (E3 2017) instead of the methodologies proposed by CARB staff.

Energy consulting firm Energy + Environmental Economics (E3) developed the 2017 ACC model for CPUC with the purpose of utilizing the model to evaluate how effective energy efficiency programs are at reducing carbon dioxide (CO_2) emissions from electricity generation. The 2017 ACC model evaluates hourly fuel cost, emission data, and other electricity generation attributes to project the generating units that are operating and units that are most likely to be operating on the margin. The 2017 ACC GHG emission eligibility equation uses a "1-%RPS" factor (RPS factor) to account for the impact that distributed sources of generation (including fuel cells) have on the procurement of renewable generation. Because entities operating distributed generation (DG) units would be getting most of their electricity from the fuel cell instead of the electrical grid, the RPS factor was included in the ACC model to represent renewable electricity (and its associated non-emission of GHGs) that would not be procured by the IOUs as a result of the installation of DG units. Said another way, as behind-the-meter generation is added in an IOU's territory, there is a corresponding reduction in electricity retail sales with the result that the amount of RPS-eligible renewable electricity that must be procured by the IOU also drops. A key assumption behind including the RPS factor was that IOUs would not procure renewable generation beyond the RPS requirements. More recent analysis shows that this assumption no longer applies because the IOUs are procuring more renewable generation than is required by the RPS. This is described in more detail below.

After consultation with stakeholders, CPUC, and E3, CARB staff informally proposed using the 2017 ACC model to set the fuel cell NEM GHG emission standards. Because the ACC model had gone through the CPUC public approval process, and because it was the only available model that estimated marginal resources (and associated GHG emissions) on an hourly basis, CARB staff determined that it was the best model available at the time to estimate the marginal GHG emission rate. Therefore, at a November 28, 2017 workshop, CARB staff proposed the use of the 2017 ACC model to set the fuel cell NEM GHG emission standards, shown as Method 3 in Table 1 above.

On February 13, 2018, CARB staff held a working group meeting to discuss the 2017 ACC model. Staff from E3 and CPUC were in attendance to answer stakeholder questions and explain the model. The February 2018 workshop also proposed a

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[15] More information about SB X1-2 can be found at: http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0001-0050/sbx1_2_bill_20110412_chaptered.html

[16] Workshop presentations and other material can be found at: https://ww2.arb.ca.gov/our-work/programs/stationary-fuel-cell-net-energy-metering/meetings-workshops.

revised value for the 2017 GHG emission standards, shown as Method 3b in Table 1, relative to the November proposal. After the November workshop, CARB staff noticed discrepancies in the GHG emission standards between the published version of the 2017 ACC and the version that was provided to CARB staff. CARB staff pointed out the differences to E3 staff, who determined that the model sent to CARB was an interim version used to evaluate different methodologies. The standard presented at the February 2018 workshop was updated to match the values in the 2017 ACC published on the CPUC's website.

Following the February 2018 working group meeting, CARB continued to evaluate the use of the ACC to set the fuel cell NEM GHG emission standards. During this evaluation, in May 2018, CPUC released the 2018 version of the ACC model (E3 2018). In this new version, E3 removed the RPS factor and the corresponding emission rate increased by over 100 kilograms (kg) carbon dioxide equivalent (CO_2e) emissions per megawatt hour (MWh), as shown in Method 3c in Table 1 above. E3 explains the removal of the RPS factor as follows:

> "In prior versions of the avoided cost calculator, the emissions factors were adjusted by the factor (1 minus the RPS%). The rationale was that when a distributed resource saves a kWh of electricity, the utility consequently procures 0.5 kWh less renewable energy (under a 50% RPS). The renewables that the utility no longer procures would have offset GHG emissions, so the resulting net GHG impact must be adjusted by (1 minus the RPS%). However . . . renewable levels are now expected to exceed the RPS goals in the future. With the breakage of the direct link between usage and renewable procurement levels, reductions in usage would not necessarily result in an RPS% reduction in renewable procurement." (E3 2019.) [17]

In the 2018 ACC, E3 found that the RPS factor is no longer warranted, in part because the procurement of renewables by IOUs was above the requirements of the RPS. IOUs were finding renewable generation cost effective enough to go beyond the RPS requirements. In fact, the above-referenced document indicates that carbon constraints in the state, rather than RPS, are driving renewables procurement:

> "With the introduction of the RESOLVE-based GHG adder, the need for CO2 reductions, rather than the need to meet RPS goals, becomes the binding constraint on the electricity sector. Renewable levels are expected to exceed the RPS goals in the future, so there is no longer a firm correspondence between usage reductions and renewable energy reductions."

Soon after the 2018 ACC model release, staff from E3 informed CARB staff that, because of fundamental changes to how the model calculated emissions, the 2018 ACC

[17] The 2019 Avoided Cost Update Documentation (ACC explanatory document) is referenced since the 2018 explanatory document is no longer available on the CPUC website. Both the 2018 and 2019 versions of the ACC do not have the 1-RPS factor.

model was no longer appropriate for the purposes of the development of the fuel cell NEM GHG emission standards. Because the developers of the model advised that the 2018 ACC model was not appropriate for its use, CARB staff did not consider it appropriate for use for the proposed Regulation. Further, though it was possible for CARB staff to utilize the 2017 ACC model for the proposed Regulation, AB 1637's legislative requirement that the GHG emission standards be updated every three years would mean that staff would either have to update the 2017 version of the ACC model themselves or contract with an outside entity (e.g., E3) to do so. CARB staff determined that this model updating effort would be too resource (staff time and/or State funding) intensive to make it worthwhile; therefore, staff explored use of a different method that was more transparent and easier to update. Therefore, CARB staff ended its consideration of the ACC as a basis for the fuel cell NEM GHG emission standards.

D. Proposed Methodology for Establishing Fuel Cell NEM GHG Emission Standards

As evidenced by the process described above, developing technically sound, data-driven GHG emission standards to reflect future GHG reductions from "displaced" electricity has proven to be complicated. Given the factors above, and the availability in 2018 of data reflecting operation of the electrical grid in 2017, CARB staff returned to the consideration of a simpler marginal generator methodology for calculating the emission standards. CARB staff, in consultation with CEC staff, developed this Regulation's proposed fuel cell NEM methodology using California-specific CCGT and SCGT generation data and accounting for the role of marginal renewable generation. This proposal was presented at a public workshop on July 8, 2019, and serves as the basis for the Regulation. The following describes the calculation of the standards proposed in the Regulation:

1. Set 2017 GHG Emission Standard

CARB and CEC staff agree that using CCGT and SCGT generator heat rates from CEC's Thermal Efficiency of Gas-Fired Generation in California: 2018 update (CEC 2018), converted to a GHG emission rate (CEC combined/simple cycle emission rate) results in a good approximation of the average marginal power generation CO_2 emission rate in California.

To account for the effect that renewable generation has on marginal GHG emissions, CARB staff utilized CAISO data from the day-ahead market for the time that the system marginal prices (electricity price) in the day-ahead market is at or below $0 (zero) (CAISO 2019). When the electricity price is zero, renewable generation is likely on the margin because generators that require fuel (e.g., CCGT, SCGT) are not likely to bid into the market when electricity prices are at or below zero. This is because their operational costs are always greater than zero because of the cost of fuel. However, due to subsidies and zero-cost fuel for renewable generation, it can be profitable at an electricity price of zero or less. Further, renewable generators are assumed to have zero GHG emissions because hydroelectric, wind, and solar generators do not produce GHG emissions.

To calculate the baseline 2017 fuel cell NEM GHG emission standards, staff decreased the CEC combined/simple cycle emission rate in proportion to the number of hours that electricity price is at or below zero (i.e., multiply the CEC combined/simple cycle emission rate by the percentage of hours in a year that electricity price is greater than zero). The following equation shows the calculation:

$$FCNEM_y = CSC\ ER_y * \frac{(HR - HR0_y)}{HR}$$

Where:

FCNEM = Fuel cell NEM GHG emission standard

"$FCNEM_y$" = FCNEM emission standard for year "*y*" (kg CO_2e/MWh)

"*y*" = Most recent year for which data are available

"CSC ER_y" = CEC GHG emission rate for combined/simple cycle gas power plants for year "*y*" (kg CO_2e/MWh), calculated using the formula presented below

"HR" = Number of hours in a year (8,760 for years with 365 days)

"$HR0_y$" = Hours the day-ahead market electricity price was at or below zero for year "*y*"

"CSC ER_y" is calculated as follows:

$$CSC\ ER_y = CEC\ SA_y * 0.001 * 53.07$$

Where:

CEC SA_y = State average natural gas-fired electric generation heat rate value, excluding cogeneration plants, from the Thermal Efficiency of Gas-Fired Generation in California: 2018 Update (Btu/kWh) (CEC 2018)

0.001 = Conversion factor Btu/kWh to million Btu (MMBtu)/MWh

53.07 = Conversion factor MMBtu/MWh to kgCO_2e/MWh[18] (CARB 2010) (U.S. EPA 2018)

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[18] The 53.07 kg CO_2e/MMBtu conversion factor is determined by first calculating the CO_2 conversion factor for burning natural gas using the U.S. EPA method shown in the Greenhouse Gases Equivalencies Calculator - Calculations and References document (https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references). Using the U.S. EPA method results in a CO_2 conversion factor of 53.02 kg CO_2/MMBtu. The CO_2e conversion factor is calculated by using the method specified in the 2010 Cap and Trade Regulation, Attachment J, page J 52 (https://ww3.arb.ca.gov/regact/2010/capandtrade10/capv4appj.pdf) and results in a CO_2e conversion factor of 53.07 kg CO2e/MMBtu. The following method is used to calculate the CO_2e conversion for natural gas:

CSC ER_y for 2017 is calculated using the CEC SA_y value of 7,809 Btu/kWh and converting it to kg CO_2e/MWh, yielding a value of 414 kg CO_2e/MWh.

$$\text{CSC ER}_{2017} = 7{,}809 * 0.001 * 53.07 = 414\ kgCO_2e/MWh$$

Using the 2017 CEC combined/simple cycle emission rate of 414 kg CO_2e/MWh, and the number of hours in 2017 that electricity price for the day-ahead market was less than or equal to zero during the year of 110 hours (CAISO 2019) gives the following result:

$$FCNEM_{2017} = 414 * \frac{(8760-110)}{8760} = 409\ kgCO_2e/MWh$$

2. Develop 2018-2022 Annual GHG Emission Standards

With a 2017 baseline calculated with 2017 data, CARB staff developed a methodology to set the GHG emission standards for future years. This methodology is rooted in the idea that fuel cell electrical generating resources should reduce their GHG emissions at the same rate as California's electricity sector according to the GHG emission targets that CARB's Board adopted in July 2018 in response SB 350.

In October 2015, SB 350 extended California's RPS program by establishing a requirement that 50 percent of California's electricity come from renewable resources by 2030. To help ensure that these goals are met and that GHG emissions reductions are realized, large utilities are required to develop, submit, and periodically update Integrated Resource Plans (IRP). The IRPs detail how each large utility will meet their customers' resource needs, reduce GHG emissions, and ramp up the deployment of clean energy resources. SB 350 also directed CARB, in coordination with the CPUC and CEC, to establish 2030 GHG emissions reduction targets for the electricity sector, each load-serving entity, and applicable local publicly owned utilities. CARB's Board adopted these targets in July 2018, including a 2030 electricity sector GHG emissions target of 30 to 53 million metric tons (MMT) CO_2e (CARB 2018b).

The IRP targets were developed prior to the adoption of SB 100, which changed the 2030 RPS target from 50 percent to 60 percent. As part of the 2017 California Climate Change Scoping Plan (2017 Scoping Plan Update), adopted by the Board in December 2017, CARB staff used the PATHWAYS (CARB 2017a) model to identify emissions pathways, or scenarios, that allow the state to reach the 2030 GHG emissions target. The 2017 Scoping Plan Update identified a technologically feasible and cost-effective path to meet the 2030 target, which included specific electricity sector actions such as

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For burning natural gas the conversion factor is: 14.46 kg C/MMBtu* 44 kg CO_2/12 kg C *1= 53.02 kg CO_2/MMBtu. The conversion factor for methane is: 0.001 kg CH_4/MMBtu*25 /CO_2e/CH_4 = 0.02 kg CO_2e. The conversion factor for nitrous oxide is: 0.0001 kg N_2O/MMBtu*298 CO_2e/N_20 = 0.03 kg CO_2e. Therefore, the CO_2e conversion factor for natural gas is: 53.02 kg CO_2e + 0.02 kg CO_2e +0.03 kg CO_2e = 53.07 kg CO_2e.

implementation of the 50 percent RPS (the mandate at the time under SB 350), doubling of energy efficiency savings, and additional emissions reductions via the Cap-and-Trade Program. The range of GHG emissions reductions in the electricity sector, as modeled for the 2017 Scoping Plan Update, encompass both a 50 and 60 percent RPS. Thus, this range was appropriate for setting the IRP targets as it happened to reflect the SB 100 RPS requirements. Modeling of 60 percent RPS in 2030 projected 2030 electricity sector GHG emissions of 44 $MMTCO_2e$.

As a result of this analysis, and to reflect the new SB 100 RPS 2030 target, CARB staff used 44 $MMTCO_2e$ as the upper bound of the IRP 2030 GHG targets to calculate the emission reduction rate for the fuel cell NEM GHG emission standards. The starting point for California's electricity sector emissions was the State's annual AB 32 GHG Emissions Inventory, which showed electricity sector emissions of 67.1 $MMTCO_2e$ (including in-state and out-of-state generation, excluding 1.48 $MMTCO_2e$ fugitive and process emissions) in 2016 (CARB 2018a). Comparing this value to a 2030 GHG emissions target of 44 $MMTCO_2e$ yields an annual average decrease of 2.5 percent per year. Therefore, given that California's electrical grid is expected to reduce GHG emissions by an average of 2.5 percent per year, the Regulation sets GHG emission standards for 2018 through 2022 that start with the 2017 GHG emission standard of 409 kg CO_2e/MWh and reduce that number by 2.5 percent each year. Table 2 below shows these GHG emission standard rates starting in 2017 and ending in 2022.

Targets are set through 2022 because AB 1637 requires CARB to update the GHG emission standards every three years. Since this Regulation is scheduled to be completed in 2019, emission standards must be updated in 2022.

Table 2. Average Annual GHG Emission Standards for an Eligible Fuel Cell Electrical Generation Resource

Year	Average Annual GHG Emission Standard (kg CO_2e/MWh)
2017	409
2018	399
2019	389
2020	379
2021	370
2022	360

3. Create a Process for Updating the GHG Emission Standards Every Three Years

AB 1637 directs CARB to "establish a schedule of annual GHG reduction standards..." and "…update the schedule every three years with applicable standards for each intervening year." To meet this requirement, beginning in 2022, and every three years

thereafter, the Executive Officer will update the annual GHG emission standards for the next three years and publish them on the CARB website. The Regulation includes the methodology by which the Executive Officer will calculate the new standards, which is similar to the process used to establish the emission standard for years 2017 to 2022, but utilizing the most recent data available at the time of the update.

In the case of the first update, the calculation of the 2023 ("year one") GHG emission standard will use the same equation as presented for 2017, but the CEC combined/simple cycle emission rate and the number of hours that the day-ahead market electricity price is at or below $0 (zero) will be updated to reflect the most recently published CEC and CAISO data, respectively. The standards for the following two years will be calculated by reducing the previous year's emission standard by 2.5 percent.

To ensure a steady decline in the fuel cell NEM GHG emission standard, if at any time the calculated "year one" standard is higher than the prior year's standard, the year one standard will instead be calculated by reducing the prior year's standard by 2.5 percent. The GHG emission standards will therefore continue to decrease, even if the CEC combined/simple cycle emission rate increases or the amount of time the electricity price is zero or less decreases. This is important to provide certainty around the increasing stringency of the standards, and maintain a reduction that is at least commensurate with the reductions caused by the legislatively mandated GHG emission reduction targets for electricity sector.

E. Considerations in Setting the Fuel Cell NEM GHG Emission Standards

As stated above, staff considered several methods for calculating the fuel cell NEM standards and considers the current proposal to be the best method for meeting the requirements of AB 1637 for the following reasons:

- The proposed standards use 2017 public data which reflect electricity grid operation.
- The proposed standards take into account renewables procurement in two ways: 1) by decreasing marginal generator emissions by the amount of time that renewables are on the margin, and 2) by reducing the GHG emission standards by 2.5 percent annually, commensurate with 2030 electricity-sector GHG emission (IRP) targets set pursuant to SB 350 and taking into consideration the updated RPS target set by SB 100.
- The proposed standards use the most recently available data for every three-year update, which ensures that future GHG emission standards continue to reflect the operation of the electricity grid, including combined/simple cycle generator GHG emission rates and the number of hours that renewable generators are on the margin.

Transmitting electricity over transmission and distribution lines results in some of the electricity being lost, a concept known as line losses. Because of line losses the amount of electricity delivered to consumers is less than the electricity generated at the generator's site. The reality of line losses means that a greater amount of electricity

must be generated to meet a certain level of demand, and if the electricity is generated by a generator that uses fossil fuel, more GHG emissions will occur. When the electricity is generated and consumed on-site, as in the case of fuel cell electrical generation resources in the Fuel Cell NEM Program, line losses are zero, and there is a GHG benefit to siting a fuel cell on-site. The CPUC uses a California line loss average of 8.4 percent, including in SGIP. Incorporating this factor in CARB's proposed methodology would result in a 2017 fuel cell NEM GHG emission standard of 443 kg CO_2e/MWh, as opposed to the baseline of 409 kg CO_2e/MWh that staff are proposing. CARB staff have opted not to include a line loss factor in the proposed Regulation in order to ensure that the GHG emission standards represent emission reductions relative to the electricity being displaced, as required by AB 1637."

CARB staff's proposal complies with legislative direction in AB 1637, and provides both relative certainty for potential Fuel Cell NEM Program participants and assured emission reductions by declining steadily every year. As described in the previous section, the GHG emission standards in the Regulation will also decline by at least 2.5 percent every year, and could decline more sharply beginning in 2023 if data show that the average California CEC combined/simple cycle emission rate goes down and/or the number of hours that renewables are on the margin increases. Because fuel cell NEM eligibility is based on meeting the GHG emission standards every year, and because fuel cells will experience expected and normal degradation in efficiency, and hence emissions performance, over time, in order to qualify for fuel cell NEM, GHG emissions from fuel cell electrical generation resources must also decrease over time, meaning they must get more efficient or switch to biofuels.

In addition to aligning with electricity sector IRP targets, this drive towards greater efficiency or a switch to biofuels is also aligned with the goals outlined in the 2017 Scoping Plan Update, which states that while "natural gas is an important energy source, we must move toward cleaner heating fuels…" This includes using more renewable gas and reducing the demand for natural gas to help California achieve its 2030 climate target. In proposing a methodology that results in fuel cell NEM GHG emission standards representing reductions relative to the electricity generation being displaced, and reducing consistently over time, the Regulation meets not only AB 1637 requirements but also aligns with the State's legislatively mandated longer-term climate and electricity sector goals.

Fuel cells, which utilize, but do not combust natural gas, also have the potential to reduce criteria pollutants, which is another critical priority in the State. AB 197 (E. Garcia, Chapter 250, Statutes of 2016)[19] and AB 617 (C. Garcia, Chapter 136, Statutes of 2017)[20] recognized the need for the State to continue to identify and effectively address concerns related to local air quality impacts, especially in the State's most

[19] More information about AB 197 can be found at: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB197
[20] More information about AB 617 can be found at: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617

vulnerable communities, and to provide more direct tools to assist the State and air districts in improving air quality. Per the U.S. Department of Energy's 2015 Quadrennial Technology Review Technology Assessments (Chapter 4), fuel cells emit about 75 percent to 90 percent less NOx and about 75 percent to 80 percent less particulate matter than other CHP technologies on a life-cycle basis. (U.S. DOE 2015) CARB staff compared the published nitrogen oxides (NOx) emissions of the most recently permitted natural gas-fired thermal generating units operating at a steady state to confidential data on fuel cell NOx emissions reported to CARB under as part of CARB's DG Certification Program, and found that up to 200,000 pounds of NOx emissions per year could be avoided by the installation of 500 MW of fuel cells (the total additional cumulative generating capacity for the Fuel Cell NEM Program as authorized by AB 1637). This could be especially beneficial if fuel cells are installed in areas with high NOx emissions (e.g., in ozone nonattainment areas). Therefore, while this Regulation would not directly cause NOx emission reductions, it would enable the implementation of CPUC's Fuel Cell NEM Program, which supports the installation of fuel cells which are likely to reduce NOx emissions relative to the electrical grid resources that the fuel cell electrical generation resource displaces.

II. THE PROBLEM THAT THE PROPOSAL IS INTENDED TO ADDRESS

A. Description of the Public Problem

Climate scientists agree that global warming and other shifts in the climate system observed over the past century are caused by human activities. These recorded changes are occurring at an unprecedented rate (Cook et al. 2016). According to new research, unabated GHG emissions could allow sea levels to rise up to ten feet by the end of this century—an outcome that could devastate coastal communities in California and around the world (California Ocean Protection Council 2017).

California is already feeling the effects of climate change, and projections show that these effects will continue and worsen over the coming centuries. The impacts of climate change have been documented by the Office of Environmental Health Hazard Assessment (OEHHA) in the Indicators of Climate Change Report (OEHHA 2018), which details the following changes that are occurring already:

- A recorded increase in annual average temperatures, as well as increases in daily minimum and maximum temperatures.
- An increase in the occurrence of extreme events, including wildfire and heat waves.
- A reduction in spring runoff volumes as a result of declining snowpack.
- A decrease in winter chill hours necessary for the production of high-value fruit and nut crops.
- Changes in the timing and location of species sightings, including upslope migration of flora and fauna.

In addition to these trends, the State's current conditions point to a changing climate. California's recent historic drought led to land subsidence, pest invasions that killed over 100 million trees, and water shortages throughout the State. Recent scientific studies show that such extreme drought conditions are more likely to occur under a changing climate (Diffenbaugh et al. 2015; Cayan et al. 2010). The total statewide economic cost of the 2013 - 2014 drought was estimated at $2.2 billion, with a total loss of 17,100 jobs (Howitt et al. 2014). In the Central Valley, the drought cost California agriculture about $2.7 billion and more than 20,000 jobs in 2015, which highlights the critical need for developing drought resilience (Williams et al. 2015). Drought affects other sectors as well. An analysis of the amount of water consumed in meeting California's energy needs between 1990 and 2012 shows that while California's energy policies have supported climate mitigation efforts, the performance of these policies have increased vulnerability to climate impacts, especially greater hydrologic uncertainty (Fulton and Cooley 2015).

Several publications carefully examined the potential role of climate change in the recent California drought. One study examined both precipitation and runoff in the Sacramento and San Joaquin River basins and found that 10 of the past 14 years between 2000 and 2014 have been below normal, and that recent years have been the driest and hottest in the full instrumental record from 1895 through November 2014 (Mann and Gleick 2015). In another study, the authors show that the increasing co-occurrence of dry years with warm years raises the risk of drought and highlight the critical role of elevated temperatures in altering water availability and increasing overall drought intensity and impact (Diffenbaugh et al. 2015). Generally, there is growing risk of unprecedented drought in the western United States driven primarily by rising temperatures, regardless of whether or not there is a clear precipitation trend (Cook et al. 2015). Even more recently, California has been experiencing the deadliest wildfires in its history. Climate change is making events like these more frequent, more catastrophic, and more costly.

A warming climate also causes sea level to rise; first, by warming the oceans which causes the water to expand, and second, by melting land ice which transfers water to the ocean. Even if storms do not become more intense or frequent, sea level rise itself will magnify the adverse impacts of storm surges and high waves on the California coast. Some observational studies report that the largest waves are already getting higher and winds are getting stronger (National Research Council of the National Academy of Sciences 2012). Further, as temperatures warm and GHG concentrations increase, more carbon dioxide dissolves in the ocean, making it more acidic. More acidic ocean water affects a wide variety of marine species, including species that people rely on for food. Recent projections indicate that if no significant GHG mitigation efforts are taken, the San Francisco Bay Area may experience sea level rise between 1.6 and 3.4 feet, and in an extreme scenario involving the rapid loss of the Antarctic ice sheet, sea levels along California's coastline could rise up to 10 feet by 2100 (California Ocean Protection Council 2017). This change is likely to have substantial ecological and economic consequences in California and worldwide (Chan et al. 2016).

While more intense dry periods are anticipated under warmer conditions, extremes on the wet end of the spectrum are also expected to increase due to more frequent warm, wet atmospheric river events and a higher proportion of precipitation falling as rain instead of snow. In recent years, atmospheric rivers have been recognized as the cause of the large majority of major floods in rivers all along the U.S. West Coast and as the source of 30–50 percent of all precipitation in the same region (Dettinger 2013). These extreme precipitation events, together with the rising snowline, often cause devastating floods in major river basins (e.g., California's Russian River). It was estimated that the top 50 observed floods in the U.S. Pacific Northwest were due to atmospheric rivers (Warner et al. 2012). Looking ahead, the frequency and severity of atmospheric rivers on the U.S. West Coast will increase due to higher atmospheric water vapor content that occurs with rising temperature, leading to more frequent flooding (Hagos et al. 2016; Payne and Magnusdottir 2015).

Looking globally, climate change can drive extreme weather events, such as coastal storm surges, drought, wildfires, floods, and heat waves, and disrupt environmental systems including our forests and oceans. As GHG emissions continue to accumulate and climate disruption grows, such destructive events will become more frequent. Several recent studies project increased precipitation within hurricanes over ocean regions (Easterling et al. 2016; National Academy of Sciences 2016). The primary physical mechanism for this increase is higher water vapor content in the warmer atmosphere, which enhances moisture convergence in a storm for a given circulation strength. Since hurricanes are responsible for many of the most extreme precipitation events, such events are likely to become more extreme. Anthropogenic warming by the end of the 21st century will likely cause tropical cyclones globally to become more intense on average. This change implies an even larger percentage increase in the destructive potential per storm, assuming no changes in storm size (Sobel et al. 2016; Kossin et al. 2016). Thus, the historical record, which once set expectations for the range of weather and other natural events, is becoming an increasingly unreliable predictor of the climate conditions we will face in the future. Consequently, the best available science must drive effective climate policy.

It is imperative that California continue to work to reduce GHG emissions in order to decrease the probability of these impacts. In 2005, Governor Schwarzenegger issued Executive Order S-3-05 (EO S-3-05), which set, among other things, targets of reducing statewide GHG emissions to 1990 levels by 2020 and to 80 percent below 1990 levels by 2050. In 2006, California enacted AB 32 to address this public problem by requiring cost-effective reductions in GHG emissions and by codifying the 2020 target. AB 32 directed CARB to continue its leadership role on climate change and to develop a scoping plan identifying integrated and cost-effective regional, national, and international GHG reduction programs. In 2015, Governor Brown issued Executive Order B-30-15 (EO B-30-15), which set a goal of reducing statewide GHG emissions to 40 percent below 1990 levels by 2030. In 2016, the Legislature passed, and Governor Brown signed, SB 32, which codified the 40 percent reduction goal from 1990 levels by 2030.

In July 2017, Governor Brown signed a legislative package clarifying the role of the Cap-and-Trade Program in achieving the 2030 GHG reduction target (AB 398; Chapter 135, Statutes of 2017) and establishing a new program to improve air quality in local communities (AB 617; Chapter 136, Statutes of 2017). The legislation helps ensure California continues to meet its ambitious climate change goals while addressing air pollution in communities with the dirtiest air. AB 398 also provided direction on the 2017 Scoping Plan Update and required its adoption by January 1, 2018. This rulemaking process will implement the requirements of AB 398 pertaining to the Cap-and-Trade Program. With respect to AB 617, CARB has begun work to implement a new community-focused air quality program including monitoring and emission reduction plans.

On December 14, 2017, the Board unanimously approved the 2017 Climate Change Scoping Plan (CARB 2017b), which sets out specific measures to accomplish California's plan to reduce climate-changing gases an additional 40 percent below 1990 levels by 2030 pursuant to SB 32.

III. THE SPECIFIC PURPOSE AND RATIONALE OF EACH ADOPTION, AMENDMENT, OR REPEAL

The proposed Regulation is intended to meet the requirements of Assembly Bill 1637 (Low, Stats. 2016, ch. 658) (AB1637) which extended the Fuel Cell NEM Program that would have otherwise expired at the end of 2016. Sections 2827.10(b)(1) and (2) of the Public Utilities Code, as amended by AB 1637, provides that:

(1) Not later than March 31, 2017, the State Air Resources Board, in consultation with the Energy Commission, shall establish a schedule of annual greenhouse gas (GHG) emissions reduction standards for a fuel cell electrical generation resource for purposes of clause (iii) of subparagraph (A) of paragraph (3) of subdivision (a[21]) and shall update the schedule every three years with applicable standards for each intervening year.

(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.

[21] Public Utilities Code section 2827.10(3)(A) states "Eligible fuel cell customer-generator" means a customer of an electrical corporation that meets all the following criteria…" and section 2827.10(3)(A)(iii) states "Uses technology the commission has determined will achieve reductions in emissions of greenhouse gases pursuant to subdivision (b)."

The bill requires CARB to set annual GHG emission standards, and to update the standards every three years. The proposed Regulation specifies standards for calendar years 2017 through 2022, which are the first six years of the extended program.

In developing the Regulation, CARB has relied upon its expertise under its governing statute and its understanding of GHG emissions reduction goals of AB 1637 to interpret the Legislature's statutory directions.

This chapter provides a summary of the specific purpose of each proposed section and the rationale for CARB staff's determination of why the Regulations are reasonably necessary to carry out the purpose of the provisions of law. The proposed amendments are shown in Appendix A: Proposed Regulation Order.

Section 95408. Purpose.

Purpose of Section 95408
This section states the purpose of the Regulation.

Rationale for Section 95408
This section is necessary to describe the purpose of the Regulation.

Section 95409. Applicability.

Purpose of Section 95409
This section describes the applicability of the proposed GHG emission standards, which is to eligible fuel cell electrical generation resources that participate in CPUC's fuel cell Net Energy Metering, as specified in Public Utilities Code section 2827.10.

Rationale for Section 95409
This section is necessary to specify that the Regulation would apply to fuel cell electrical generating resources that participate in the Fuel Cell NEM Program. This is required in order to comply with AB 1637, which directs CARB to "establish a schedule of annual greenhouse gas (GHG) emissions reduction standards for a fuel cell electrical generation resource…"

Section 95410. Definitions and Acronyms.

Purpose of Section 95410(a)
This section specifies definitions and acronyms for the terms used in this regulation**.**

Rationale for Section 95410(a)
This section is necessary to define the terms as they apply to the regulation.

Purpose of Section 95410(a)(1)
This section defines the meaning of "British Thermal Unit" or "Btu"**.**

Rationale for Section 95410(a)(1)
This section is necessary to define a standard unit of energy measurement that is used to in section 95412(a) in the Regulation to describe the amount of energy used by power generating equipment. This definition is consistent with the definition used in CARB's Mandatory Reporting of Greenhouse Gas Emissions Regulation.

Purpose of Section 95410(a)(2)
This section defines the meaning of "Carbon dioxide" or "CO_2".

Rationale for Section 95410(a)(2)
This section is necessary to specify what elements make CO_2 and identify CO_2 as a greenhouse gas to support the definition of "Carbon dioxide equivalent" or "CO_2e," which is defined and used as a unit of measure in the Regulation. This definition is consistent with the definition used in CARB's Mandatory Reporting of Greenhouse Gas Emissions Regulation.

Purpose of Section 95410(a)(3)
This section defines the meaning of "Carbon dioxide equivalent" or "CO_2e".

Rationale for Section 95410(a)(3)
This section is necessary to define a unit of measure that is used in the fuel cell NEM GHG emission standards that are specified in section 95411 and calculated in section 95412 of the Regulation. This definition is also consistent with the definition used in CARB's Mandatory Reporting of Greenhouse Gas Emissions Regulation.

Purpose of Section 95410(a)(4)
This section defines the meaning of "Global warming potential" or "GWP".

Rationale for Section 95410(a)(4)
This section is necessary to define a term that is used in section 95410(a)(3) to specify the source of GWP values, to specify what sources to use for specific time periods, and to incorporate those sources by reference. This is needed so that the Regulation is consistent with CARB's Mandatory Reporting of Greenhouse Gas Emissions Regulation so that accounting for GHGs in this Regulation will use consistent methods as the Mandatory Reporting of Greenhouse Gas Emissions Regulation.

Purpose of Section 95410(a)(5)
This section defines a set of gases that are called greenhouse gases or GHGs.

Rationale for Section 95410(a)(5)
This section is necessary to define a term that is used in sections 95410(a)(2) and 95410(a)(3). This definition is also consistent with the definition used in CARB's Mandatory Reporting of Greenhouse Gas Emissions Regulation.

Purpose of Section 95410(a)(6)
This section defines a unit of measure for electrical energy.

Rationale for Section 95410(a)(6)
This section is necessary to define a unit of measure that is used in the fuel cell NEM GHG emission standards that are specified in section 95411 and calculated in section 95412 of the Regulation. This definition is also consistent with the definition used in CARB's Mandatory Reporting of Greenhouse Gas Emissions Regulation.

Section 95411. Greenhouse Gas Emission Standards

Purpose of Section 95411
This section specifies the average annual fuel cell NEM GHG emission standards that an eligible fuel cell electrical generation resource must meet each year to be eligible for CPUC's Fuel Cell NEM Program, as required by AB 1637. This section specifies the GHG emission standards for the years 2017 through 2022.

Rationale for Section 95411
This section is necessary to specify the standards that entities must meet for Fuel Cell NEM Program eligibility in the specified calendar years as required by AB 1637. AB 1637 requires that CARB "…establish a schedule of annual GHG reduction standards..." The standards start in 2017 due to the fact that that is the first year of eligibility for the Fuel Cell NEM Program as extended by AB 1637. The standards extend through 2022 to meet AB 1637's requirement that CARB "…update the schedule every three years…" given that the current standards are anticipated to be finalized in 2019, and 2022 is three years after 2019. The 2017 standard was set using the formula and data described in section I.D.1. of this ISOR. The standards for 2019 through 2022 were developed through the process described in section I.D.2. of this ISOR.

Section 95412. Greenhouse Gas Emission Standards Methodology

Purpose of Section 95412(a)
This section sets forth the methodology for the Executive Officer to calculate the fuel cell NEM GHG emission standards beginning in 2022, and every three years thereafter until 2047. The section also specifies when the GHG emission standards will be calculated (second Monday of November) and posted to the CARB website (five days later).

Rationale for Section 95412(a)
This section is necessary to specify the methodology for calculating the GHG emission standards that entities must meet for program eligibility to meet AB 1637 requirements that CARB "Shall establish a schedule of annual GHG reduction standards..." and "…update the schedule every three years with applicable standards for each intervening year"). The GHG emission standards will be updated starting in 2022 (three years after 2019, when the current GHG emission standards are anticipated to be finalized). The 2022 update will cover the calendar years 2023 through 2025 to ensure that standards are available for use by the Fuel Cell NEM Program before the next required three-year update, to take place in 2025 for the calendar years 2026 through 2028. AB 1637

extended the fuel cell NEM tariff to eligible fuel cell customer-generators who commence operation on or before December 31, 2021, and fuel cells are expected to have a lifetime of 15 to 20 years. The updates are scheduled to occur through 2047 to ensure that the GHG emission standards update process extends a long enough period of time to cover any fuel cells installed in 2021 or earlier. The specified CEC and CAISO data that must be used for each three-year update are generally, but not always, updated by October each year. The Regulation specifies a day in November (second Monday of November) to 1) maximize the chance that the most recently available data that is used in the update (per section 95412(a)(1)) is from reports published in the same year that the update is occurring, and 2) balance this with providing enough advance notice of what the standard will be in the following year (e.g., the 2022 update sets the 2023 GHG emission standard). A date is also specified to avoid the appearance that CARB staff is choosing what data to use in the update, given the irregular dates in which the CEC and CAISO data are updated. The updated standards are then published five days after, which allows CARB staff time to review and publish the standards on the CARB website.

Purpose of Section 95412(a)(1)

This section provides the equation, equation term definitions, and references to the source of the most recent available data for some of the terms that the Executive Officer will use to calculate the fuel cell NEM GHG emission standard update for the calendar year following the year in which the triennial update is occurring.

Rationale for Section 95412(a)(1)

This section is necessary to specify the methodology for calculating the standard for the calendar year following the year in which the triennial update is occurring. AB 1637 requires that CARB set GHG emission standards that reduce "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." CARB and CEC staff agree that using combined-cycle gas turbine (CCGT) and simple-cycle gas turbine (SCGT) generator heat rates published by CEC converted to a GHG emission rate (CEC combined/simple cycle emission rate) results in a good approximation of the average marginal power generation CO_2 emission rate in California. To account for the effect that renewable generation has on marginal GHG emissions, CARB staff utilized CAISO data from the day-ahead market for the time that the system marginal prices (electricity price) in the day-ahead market is at or below $0 (zero). When the electricity price is zero, renewable generation is likely on the margin because generators that require fuel (e.g., CCGT, SCGT) are not likely to bid into the market when electricity prices are at or below zero. This is because their operational costs are always greater than zero because of the cost of fuel. However, due to subsidies and zero-cost fuel, renewable generation can be profitable at an electricity price of zero or less. Further, renewable generators are assumed to have zero GHG emissions because hydroelectric, wind, and solar generators do not produce GHG emissions.

The proposal in this section to use CEC and CAISO data to calculate the fuel cell NEM GHG emission standards every three years is analogous to the annual emission factor calculations performed per section 95111(b)(2) of CARB's Mandatory Reporting of Greenhouse Gas Emissions Regulation, which relies on annual updates of data reported to the International Energy Agency via Form EIA-923 (CARB 2019). Similarly, the CEC data proposed for use in this Regulation "…incorporates power generation and fuel use data collected by the Energy Commission under the authority of the California Code of Regulations, Title 20, Division 2, Chapter 3, Section 1304(a) (1)-(2)….The Energy Commission compiles and posts the power plant data on its website." (CEC 2018) Similarly, CAISO electricity price information for the day-ahead market is compiled and published by CAISO, reflecting actual market information for the electricity market processes that they run.

Purpose of Section 95412(a)(2)

This section provides the equation and equation term definitions that the Executive Officer will use to calculate the fuel cell NEM GHG emission standard update for the calendar year two years after the year in which the triennial update is occurring. This calculation uses the output from section 95412(a)(1), and reduces it by 2.5 percent to calculate the second year (y+2) standard.

Rationale for Section 95412(a)(2)

This section is necessary to specify the methodology for calculating the standard for the calendar year two years after the year in which the triennial update is occurring. Specifying this methodology provides certainty to participating entities regarding the calculation of future standards, and meets AB 1637 requirements. The proposed methodology allows future updates to the fuel cell NEM GHG emission standards to use the most recently available public data which reflect electricity grid operation, as required by AB 1637. Reducing the GHG emission standards by 2.5 percent annually, commensurate with 2030 electricity-sector GHG emission (IRP) targets set pursuant to SB 350 and taking into consideration the updated RPS target set by SB 100, also meets AB 1637's requirement that the standards take into account renewables procurement. CARB staff's proposal complies with legislative direction in AB 1637, and provides assured emission reductions by declining steadily every year.

Purpose of Section 95412(a)(3)

This section provides the equation and equation term definitions that the Executive Officer will use to calculate the fuel cell NEM GHG emission standard update for the calendar year three years after the year in which the triennial update is occurring. This calculation uses the output from section 95412(a)(2), and reduces it by 2.5 percent to calculate the third year (y+3) standard

Rationale for Section 95412(a)(3)

This section is necessary to specify the methodology for calculating the standard for the calendar year three years after the year in which the triennial update is occurring. Specifying this methodology provides certainty to participating entities regarding the calculation of future standards, and meets AB 1637 requirements.

The proposed methodology allows future updates to the fuel cell NEM GHG emission standards to use the most recently available public data which reflect electricity grid operation, as required by AB 1637. Reducing the GHG emission standards by 2.5 percent annually, commensurate with 2030 electricity-sector GHG emission (IRP) targets set pursuant to SB 350 and taking into consideration the updated RPS target set by SB 100, also meets AB 1637's requirement that the standards take into account renewables procurement. CARB staff's proposal complies with legislative direction in AB 1637, and provides assured emission reductions by declining steadily every year.

Purpose of Section 95412(a)(4)
This section provides the equation and equation term definitions that the Executive Officer will use to calculate the fuel cell NEM GHG emission standard update for the calendar year following the year in which the triennial update is occurring if the value calculated per section 95412(a)(1) is greater than the GHG emission standard value in the calendar year in which the update is occurring.

Rationale for Section 95412(a)(4)
This section is necessary to ensure that the fuel cell NEM GHG emission standards continue a steady decline over time. If at any time the calculated "year one" standard is higher than the prior year's standard, the year one standard will instead be calculated by reducing the prior year's standard by 2.5 percent. This is necessary to provide some level of certainty around the standards, and maintain a reduction that is commensurate with the reductions caused by the legislatively mandated GHG emission reduction targets for the electricity sector. Reducing the GHG emission standards by 2.5 percent annually, commensurate with 2030 electricity-sector GHG emission (IRP) targets set pursuant to SB 350 and taking into consideration the updated RPS target set by SB 100, also meets AB 1637's requirement that the standards take into account renewables procurement. CARB staff's proposal complies with legislative direction in AB 1637, and provides assured emission reductions by declining steadily every year.

IV. BENEFITS ANTICIPATED FROM THE REGULATORY ACTION, INCLUDING THE BENEFITS OR GOALS PROVIDED IN THE AUTHORIZING STATUTE

Government Code section 11346.2(b)(1) requires enumeration of the anticipated benefits of the regulatory action, including the benefits and goals of the authorizing statute. The objective of the proposed Regulation is to ensure that eligible fuel cell generation resources participating in CPUC's Fuel Cell NEM Program emit fewer GHG emissions than the grid energy they displace. The Regulation establishes a schedule of annual GHG emission standards for the continued operation of the Fuel Cell NEM Program, as required by AB 1637. The Fuel Cell NEM Program is a voluntary, incentive-based program administered by CPUC and implemented by IOUs. Even if a fuel cell electrical generation resource meets the fuel cell NEM GHG emission standards established in this Regulation, there are numerous other factors, beyond the scope of this Regulation, that would determine whether the resource is eligible for fuel cell NEM and/or whether the fuel cell is installed.

Generally speaking, fuel cell installations have the potential to reduce GHG, NOx, and particulate matter (PM) emissions relative to the grid electricity that they displace. However, the Regulation is not anticipated to provide any direct GHG, NOx, or PM emission reduction benefits because it would only set numeric standards for a voluntary program that, by statute, is implemented by CPUC. By statute, CPUC is also tasked with determining what fuel cells meet those standards and administering the voluntary Fuel Cell NEM Program.

The Regulation is not anticipated to provide any direct benefits to the protection of public health and safety, worker safety, or the environment.

V. AIR QUALITY

The Regulation would not directly result in any improvement or decline in air quality. As with GHGs, the Regulation is not anticipated to provide any direct NOx or PM emission reduction benefits because it would only set numeric GHG emission standards for a voluntary program that, by statute, is implemented by CPUC. By statute, CPUC is also tasked with determining what fuel cells meet those standards and administering the voluntary Fuel Cell NEM Program. However, improvements to local air quality and the reduction of GHG emissions are included among the stated reasons and goals for the extension of the CPUC's Fuel Cell NEM Program under AB 1637, and it can be assumed that the Regulation would indirectly support the stated goals of this legislation.

VI. ENVIRONMENTAL ANALYSIS

A. Introduction

This chapter provides the basis for CARB's determination that the proposed Fuel Cell Net Energy Metering Greenhouse Gas Emission Standards Regulation is exempt from the requirements of the California Environmental Quality Act (CEQA). A brief explanation of this determination is provided in section B below. CARB's regulatory program, which involves the adoption, approval, amendment, or repeal of standards, rules, regulations, or plans for the protection and enhancement of the State's ambient air quality, has been certified by the California Secretary for Natural Resources under Public Resources Code section 21080.5 of CEQA (14 CCR 15251(d)). Public agencies with certified regulatory programs are exempt from certain CEQA requirements, including, but not limited to, preparing environmental impact reports, negative declarations, and initial studies. CARB, as a lead agency, prepares a substitute environmental document (referred to as an "Environmental Analysis" or "EA") as part of the Staff Report prepared for a proposed action to comply with CEQA (17 CCR 60000-60008). If the Fuel Cell Net Energy Metering Greenhouse Gas Emission Standards Regulation is finalized, a Notice of Exemption will be filed with the Office of the Secretary for the Natural Resources Agency and the State Clearinghouse for public inspection.

B. Analysis

CARB has determined that the proposed Fuel Cell Net Energy Metering Greenhouse Gas Emission Standards Regulation is categorically exempt from CEQA under the "Class 8" exemption (14 CCR 15308) because it is an action taken by a regulatory agency for the protection of the environment. The Regulation sets GHG emission standards for the Fuel Cell NEM Program, as required by AB 1637. Generally speaking, fuel cell installations reduce GHG and other air emissions relative to the fossil fuel-derived grid electricity that they displace. While, the Regulation is not anticipated to provide direct GHG or other air pollution emission reduction benefits (as noted above it would set a standard for a voluntary program that, by statute, CPUC is tasked with administering), the proposed GHG emission standard is designed to ensure that participating entities have lower GHG emissions than the grid resources they displace. The proposed action is designed to protect the environment, and CARB has determined there is no substantial evidence indicating the proposal could adversely affect air quality or any other environmental resource area, or that any of the exceptions to this exemption applies (14 CCR 15300.2). Therefore, this activity is exempt from CEQA.

VII. ENVIRONMENTAL JUSTICE

State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (Government Code, section 65040.12, subdivision (c)). CARB is committed to making environmental justice an integral part of its activities. The Board approved its Environmental Justice Policies and Actions (Policies) on December 13, 2001, to establish a framework for incorporating environmental justice into CARB's programs consistent with the directives of State law (CARB 2001b). These policies apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low-income and minority communities.

Improvements to local air quality and the reduction of greenhouse gas emissions are included among the stated reasons and goals for the extension of CPUC's Fuel Cell NEM Program under AB 1637. Public Utilities Code section 2827.10(d) states, "In determining the eligibility for the cumulative rated generating capacity within an electrical corporation's service territory, preference shall be given to [fuel cell] facilities that, at the time of installation, are located in a community with significant exposure to air contaminants or localized air contaminants, or both, including, but not limited to, communities of minority populations or low-income populations, or both, based on the ambient air quality standards established pursuant to Division 26 (commencing with Section 39000) of the Health and Safety Code."

VIII. ECONOMIC IMPACTS ASSESSMENT

The economic impacts assessment described in this ISOR was conducted to meet current legal requirements under the Administrative Procedure Act and California Government Code. In this chapter, staff provides the estimated potential economic

fiscal impacts that would result from implementation of the Regulation, including costs to businesses and public agencies.

The Regulation would set annual GHG emission standards for fuel cell generating resources participating in Fuel Cell NEM, as required by AB 1637. The Fuel Cell NEM Program is administered by CPUC and implemented by IOUs. Though the proposed regulation sets standards, statute (AB 1637) requires that other entities must implement those standards. Businesses are not anticipated to act as a result of the proposed regulation alone, therefore, the Regulation is not anticipated to have any statewide economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, the creation or elimination of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California, or on representative private persons.

Staff does not expect a change in employment, business creation, expansion, elimination, or business competitiveness in California. CARB will incur a minor cost every three years, through 2047, to update the GHG emission standards and post the updated GHG emission standards on the agency's website. The cost impact associated with the use of CARB staff time is expected to be approximately six hours and this minor cost would be absorbed by CARB. Since CPUC would have to update their documentation with the new standards provided by CARB, CARB staff estimates that there would be a minor fiscal impact of approximately six hours of staff time.

The creation or elimination of jobs within the State of California.
In accordance with Government Code section 11346.3, CARB staff do not anticipate that the proposed Regulation would affect the creation or elimination of jobs within the State of California.

The creation of new business or the elimination of existing businesses within the State of California.

CARB foresees that there would not be any economic impacts that a representative business would incur due to the proposed Regulation because the proposal does not contain any requirements for action. The proposed standards, by themselves, would not have any statewide economic impact directly affecting businesses.

The expansion of businesses currently doing business within the State of California.

CARB staff do not anticipate that the proposed Regulation would affect the expansion of businesses currently doing business within the State of California.

Significant Statewide Adverse Economic Impact Directly Affecting Business, Including Ability to Compete.

CARB staff do not anticipate that there would be any economic impacts that a representative business would incur due to the proposed Regulation because the proposal does not contain any requirements for action. The proposed standards, by themselves, would not have any statewide economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states.

The benefits of the regulation to the health and welfare of California residents, worker safety, and the state's environment.

The Regulation would not directly reduce criteria pollutant or GHG emissions as the regulation only involves the development of a standard for a voluntary CPUC program. As such, there would not be any direct impacts, either negative or positive, on health or welfare to California residents, worker safety, or California's environment due to the Regulation.

IX. EVALUATION OF REGULATORY ALTERNATIVES

Government Code section 11346.2, subdivision (b)(4) requires CARB to consider and evaluate reasonable alternatives to the proposed regulatory action and provide reasons for rejecting those alternatives. This section discusses alternatives evaluated and provides reasons why these alternatives were not included in the proposal. As explained below, no alternative proposed was found to be less burdensome and equally effective in achieving the purposes of the regulation in a manner than ensures full compliance with the authorizing law. The Board has not identified any reasonable alternatives that would lessen any adverse impact on small business.

The Executive Officer analyzed three alternatives to the proposed amendments and determined that all of the alternatives would be less effective in carrying out the requirements of AB 1637, as described below.

Take No Action Alternative for Complete Regulation. An overall "no action" alternative means that CARB would not develop GHG emission standards for the Fuel Cell NEM Program. If CARB were to take "no action," CARB would not be complying with the requirements of AB 1637 to set GHG emission standards for the Fuel Cell NEM Program. For this reason, the take "no action" alternative is neither practical nor beneficial.

Set GHG Emission Standard Based on the ACC Model. Under this alternative, CARB would use either the 2017 ACC model or 2018 ACC model to calculate the fuel cell NEM GHG emission standards. The ACC model was developed by Energy + Environmental Economics (E3) for CPUC to evaluate how effective energy efficiency programs are at reducing power generation carbon dioxide emissions. The 2017 ACC model was suggested by stakeholders during the informal public process preceding this rulemaking. Use of the 2017 ACC would result in lower GHG emission standards than those of the proposed regulation (2017 ACC model result: 324 kg CO_2e/MWh in 2017; proposed regulation: 409 kg CO_2e/MWh in 2017). After the 2017 ACC model was

revised in 2018, CARB was advised by E3 staff that, because of fundamental changes to how the model calculated emissions, the 2018 ACC model was no longer appropriate for the purposes of the fuel cell NEM GHG emission standards. Because the developers of the model advised that the 2018 ACC model was not appropriate for its use, CARB staff did not consider it appropriate for use for the proposed Regulation. Further, though it was possible for CARB staff to utilize the 2017 ACC model for the proposed Regulation, if CARB were to use it, when CARB staff update the fuel cell NEM GHG emissions standards in 2022, staff would either have to update the 2017 version of the ACC model themselves or contract with an outside entity (e.g., E3) to do so. CARB staff determined that this model updating effort would be too resource (staff time and/or State funding) intensive to make it worthwhile; therefore, staff explored use of a different method that was more transparent and easier to update.

Use Curtailment Hours as a Proxy for the Number of Hours Renewables Are on the Margin. Under this alternative, CARB would begin with the same general approach to developing the GHG emission standards as proposed. This begins with calculating GHG emission rates for combined and simple cycle gas generation using CEC data from the Thermal Efficiency of Gas-Fired Generation in California report: 2018 Update (CEC 2018). In the Regulation, this number is then adjusted by the number of hours that electricity prices in the day-ahead market was $0 (zero) or below according to the CAISO 2018 Annual Report on Market Issues and Performance (CAISO 2019) to reflect the percentage of time that renewables are on the margin. The alternative described here would instead adjust the combined and simple cycle gas generation emission rate by the number of hours renewable generation is curtailed, for the relevant year, as can be found at the CAISO Managing Oversupply webpage. (CAISO 2018) (CAISO 2017) Using curtailment hours in the fuel cell NEM GHG emission standards calculation results in a fuel cell NEM eligible emission rate of approximately 308 kg CO_2/MW for 2017. Curtailment can occur at times of low demand and high “must take” power generation, which is not necessarily indicative that renewables are the marginal generator. Also, on CAISO’s managing oversupply webpage it is noted that “Congestion occurs when available, least-cost energy cannot be delivered to some loads because transmission facilities do not have sufficient capacity to deliver the energy.” Therefore, congestion can also cause renewable generation curtailment for generation that is not marginal. Using curtailment hours in the fuel cell NEM GHG emission standards calculation results in a 2017 fuel cell NEM GHG emission standard of 308 kg CO_2e/MWh. The proposed 2017 fuel cell NEM GHG emission standard is 409 kg CO_2e/MWh. CARB staff believes that using the curtailment data would not reflect the amount of time renewables are on the operating margin and is therefore not the most accurate way to meet statutory requirements.

The proposed method for calculating the fuel cell NEM GHG emission standards is based on operational data of electricity generating units in California, accounts for the impact that renewable electricity generation has on the GHG emissions of marginal generation, and takes into account GHG emissions reductions that are required of the electricity sector pursuant to SB 350, including the updated 2030 RPS target set by SB 100. Therefore, CARB staff believes this is the best method for calculating the

marginal California generator emission rate for use in the fuel cell NEM GHG emission standards.

CARB has not identified any alternatives that would lessen any adverse impact on small businesses. The Regulation does not meet the major regulation threshold as specified in section 57005 of the Health and Safety Code; therefore, CARB did not include any major regulation alternatives in the analysis.

Small Business Alternative

As noted in the Economic Analysis, the Regulation is not anticipated to have adverse economic impacts on small businesses. Therefore, staff has not identified any reasonable alternatives that would lessen any adverse impact on small business.

Performance Standards in Place of Prescriptive Standards

CARB is not setting prescriptive standards in this Regulation.

Health and Safety Code Section 57005 Major Regulation Alternatives

The Regulation will not result in a total economic impact on state businesses of more than $10 million in one or more years of implementation. Therefore, this proposal is not a major regulation as defined by Health and Safety Code section 57005.

X. JUSTIFICATION FOR ADOPTION OF REGULATIONS DIFFERENT FROM FEDERAL REGULATIONS CONTAINED IN THE CODE OF FEDERAL REGULATIONS

The Regulation would only apply in California and would neither affect nor conflict with any federal regulations. There are no federal regulations that address the same issues as this Regulation.

XI. PUBLIC PROCESS FOR DEVELOPMENT OF THE PROPOSED ACTION (PRE-REGULATORY INFORMATION)

Consistent with Government Code sections 11346, subdivision (b), and 11346.45, subdivision (a), and with the Board's long-standing practice, CARB staff held public workshops and had other meetings with interested persons during the development of the Regulation. These informal pre-rulemaking discussions provided staff with useful information that was considered during development of the Regulation that is now being proposed for formal public comment. A summary of the workshops is provided below. Additional detail regarding each proposal is in section I.C.

- May 30, 2017: This workshop kicked off CARB's informal public process, and CARB staff put forth two proposals as possible methods for calculating the fuel cell NEM

GHG emission standards. Both methods were intended to start a discussion with stakeholders and solicit input and comments on the preferred approach.

- November 28, 2017: In this workshop, CARB staff presented another alternative for calculating fuel cell NEM GHG emission standards using the 2017 ACC, as suggested by stakeholders following the May 30, 2017 workshop.

- February 13 2018: In response to stakeholders' interest in learning more about 2017 ACC, CARB staff held a working group meeting to discuss the 2017 ACC model. Representatives from E3, the developer of the ACC model, were present at this meeting to answer technical questions regarding the 2017 ACC, and CPUC staff were present to answer questions about CPUC's process and use of the 2017 ACC model.

- July 8, 2019: CARB staff held a final workshop to present another proposed methodology for calculating the fuel cell NEM GHG emission standards, as a result of CARB's decision to move away from the previous the proposed methodology. This workshop proposed use of actual 2017 data to calculate the first year of the standard, a methodology for developing annual standards, and a process for updating the standard every three years.

Each of these workshops was announced approximately two weeks prior to its occurrence by posting a notice to the fuel cell NEM public email service list and by putting a notice on CARB's fuel cell NEM website. Each workshop was open to all members of the public and was also made available for participation via webcast. Workshop information and materials, along with written public comments that were submitted during the informal public comment period, are posted on the CARB's Fuel Cell NEM Public Meetings webpage.[22] All of the workshop materials, including presentations, are also included in Appendix B: Public Process.

XII. REFERENCES

Assembly Bill No. 1637 (AB 1637). 2016. California State Legislature. Assembly Bill No. 1637, Low. Energy: greenhouse gas reduction. Approved by Governor September 26, 2016. Filed with Secretary of State September 26, 2016. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB1637.

California Air Resources Board (CARB). 2001a. Distributed Generation Certification Program Regulation. November 15, 2001. https://ww3.arb.ca.gov/regact/dg01/finreg.pdf?_ga=2.169517992.842146019.1569254106-639606054.1491435880.

[22] For more information, workshop comments, presentations and other materials can be found on the fuel cell NEM website at https://ww2.arb.ca.gov/our-work/programs/stationary-fuel-cell-net-energy-metering/meetings-workshops.

California Air Resources Board (CARB). 2001b. Policies and Actions for Environmental Justice. December 13, 2001. https://www.arb.ca.gov/ch/programs/ej/ejpolicies.pdf.

California Air Resources Board (CARB). 2010. Proposed Regulation to Implement the California Cap-and-Trade Program, Staff Report: Initial Statement of Reasons, Part I, Volume IV, Appendix J: Allowance Allocation. https://ww3.arb.ca.gov/regact/2010/capandtrade10/capv4appj.pdf.

California Air Resources Board (CARB). 2017a. California PATHWAYS Model Framework and Methods. Model Version 2.4. January 2017. https://ww3.arb.ca.gov/cc/scopingplan/california_pathways_model_framework_jan2017.pdf.

California Air Resources Board (CARB). 2017b. California's 2017 Climate Change Scoping Plan. November 2017. https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

California Air Resources Board (CARB). 2018a. California Greenhouse Gas Inventory for 2000-2016 — by Category as Defined in the 2008 Scoping Plan. June 22, 2018. https://ww3.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_sum_2000-16.pdf.

California Air Resources Board (CARB). 2018b. Staff Report: Senate Bill 350 Integrated Resource Planning Electricity Sector Greenhouse Gas Planning Targets. July 2018. https://ww3.arb.ca.gov/cc/sb350/staffreport_sb350_irp.pdf

California Air Resources Board (CARB). 2019. Unofficial Electronic Version of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions. April 2019. https://ww3.arb.ca.gov/cc/reporting/ghg-rep/regulation/mrr-2018-unofficial-2019-4-3.pdf?_ga=2.136151608.842146019.1569254106-639606054.1491435880.

California Energy Commission (CEC). 2017. Thermal Efficiency of Natural Gas-Fired Generation in California: 2016 Update. February 2017. Publication # CEC-200-2017-003. Posted: February 22, 2017. PDF file, page 5, table 1. https://ww2.energy.ca.gov/2017publications/CEC-200-2017-003/CEC-200-2017-003.pdf.

California Energy Commission (CEC). 2018. Thermal Efficiency of Natural Gas-Fired Generation in California: 2018 Update. October 2018. Publication # CEC-200-2018-011. Posted: October 30, 2018. PDF file, page 5, table 1. https://efiling.energy.ca.gov/GetDocument.aspx?tn=225562&DocumentContentId=56229.

California Energy Commission (CEC). 2019. Electricity Generation Capacity spreadsheet. May 6, 2019. https://ww2.energy.ca.gov/almanac/electricity_data/Electric_Generation_Capacity.xlsx

California Independent System Operator (CAISO). 2017. Production and Curtailments Data - May 1, 2014 - May 31, 2017. Posted June 16, 2017 at http://www.caiso.com/informed/Pages/ManagingOversupply.aspx. Accessed September 23, 2019.

California Independent System Operator (CAISO). 2018. Production and Curtailments Data - Jun 1, 2017 - Dec 31, 2017. Posted January 7, 2018 at http://www.caiso.com/informed/Pages/ManagingOversupply.aspx. Accessed September 23, 2019.

California Independent System Operator (CAISO). 2019. 2018 Annual Report on Market Issues and Performance. May 2019. http://www.caiso.com/Documents/2018AnnualReportonMarketIssuesandPerformance.pdf. page 1.

California Ocean Protection Council. 2017. Rising Seas in California: An Update On Sea-Level Rise Science. April 2017. www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf.

Cayan, D., Das, T., Pierce, D. W., Barnett, T. P., Tyree, M., and Gershunov, A. (Cayan et al.). 2010. Future Dryness in the Southwest US and Hydrology of the Early 21st Century Drought. *Proceedings of the National Academy of Sciences* 107(50): 21272–21276. December 14, 2010. http://www.pnas.org/content/107/50/21271.full.pdf.

Chan, F., Boehm, A.B., Barth, J.A., Chornesky, E.A., Dickson, A.G., Feely, R.A., Hales, B., Hill, T.M., Hofmann, G., Ianson, D., Klinger, T., Largier, J., Newton, J., Pedersen, T.F., Somero, G.N., Sutula, M., Wakefield, W.W., Waldbusser, G.G., Weisberg, S.B., and Whiteman, E.A. (Chan et al.). 2016. The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions. California Ocean Science Trust, Oakland, California, USA. April 2016. http://westcoastoah.org/wp-content/uploads/2016/04/OAH-Panel-Key-Findings-Recommendations-and-Actions-4.4.16-FINAL.pdf.

Cook, B. I., Ault, T. R., and Smerdon, J. E. (Cook et al.). 2015. Unprecedented 21st century drought risk in the American Southwest and Central Plains. *Science Advances* 1(1), e1400082, doi:10.1126/sciadv.1400082. February 12, 2015. http://advances.sciencemag.org/content/1/1/e1400082.full.pdf.

Cook, J., Oreskes, N., Doran, P.T., Anderegg, W.R.L, Verheggen, B., Maibach, E. W., Carlton, J. S., Lewandowsky, S., Skuce, A.G., Green, S.A., Nuccitelli, D., Jacobs, P., Richardson, M., Winkler, B., Painting, R., Rice, K. (Cook et al.). 2016. Consensus on consensus: A synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters* 11:048002 doi:10.1088/1748-9326/11/4/048002. April 13, 2016. http://iopscience.iop.org/article/10.1088/1748-9326/11/4/048002/pdf.

Dettinger, M. D. 2013. Atmospheric rivers as drought busters on the U.S. West Coast. *Journal of Hydrometeorology* 14:1721-1732, doi:10.1175/JHM-D-13-02.1. December, 2013. http://journals.ametsoc.org/doi/pdf/10.1175/JHM-D-13-02.1.

Diffenbaugh, N. S., Swain, D. L., and Touma, D. (Diffenbaugh et al.). 2015. Anthropogenic warming has increased drought risk in California. Proceedings of the National Academy of Sciences of the United States of America. 10.1073/pnas.1422385112. March 31, 2015. www.pnas.org/content/112/13/3931.full.pdf.

Easterling, D.R., Kunkel, K.E., Wehner, M.F., and Sun, L. (Easterling et al.) 2016. Detection and attribution of climate extremes in the observed record. Weather and Climate Extremes, 11, 17-27. January 18, 2016. https://www.sciencedirect.com/science/article/pii/S2212094716300020.

Energy and Environmental Economics, Inc (E3). 2017. 2017 Avoided Cost Calculator. "Emissions" tab. Available at: https://ww3.arb.ca.gov/energy/nem/2-13-18/calculate_ghg_emission_std_2-13-18.pdf. Accessed September 23, 2019.

Energy and Environmental Economics, Inc (E3). 2018. 2018 Avoided Cost Calculator. "Emissions" tab. ww3.arb.ca.gov/energy/nem/2018acc/2018acc.xlsm.

Energy and Environmental Economics, Inc (E3). 2019. Avoided Costs 2019 Update. June 26, 2019. Available at https://www.cpuc.ca.gov/General.aspx?id=5267. Accessed September 23, 2019.

Fulton, J. and Cooley H. 2015. The Water Footprint of California's Energy System, 1990–2012. *Environmental Science & Technology* 49(6):3314–3321. February 26, 2015. https://pubs.acs.org/doi/pdf/10.1021/es505034x.

Hagos, S. M., Leung, L. R., Yoon, J. H., Lu, J., and Gao Y. (Hagos et al.). 2016. A projection of changes in landfalling atmospheric river frequency and extreme precipitation over western North America from the Large Ensemble CESM simulations. Geophysical Research Letters, 43 (3), 357-1363. February 6, 2016. http://onlinelibrary.wiley.com/doi/10.1002/2015GL067392/full.

Howitt, R., Medellin-Azuara, J., MacEwan, D., Lund, J., and Summer, D. (Howitt et al.). 2014. Economic Impacts of 2014 Drought on California Agriculture. July 23, 2014. https://watershed.ucdavis.edu/files/biblio/DroughtReport_23July2014_0.pdf.

Kossin, J. P., Emanuel, K. A., and Camargo, S. J. (Kossin et al.). 2016. Past and projected changes in western North Pacific tropical cyclone exposure. *Journal of Climate*, 29 (16), 5725-5739. August 15, 2016. http://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-16-0076.1.

Mann, M. E., and Gleick, P. H. 2015. Climate change and California drought in the 21st century. Proceedings of the National Academy of Sciences of the United States of America, 112(13):3858–3859. March 31, 2015. http://www.pnas.org/content/112/13/3858.full.pdf.

National Academy of Sciences. 2016. Attribution of Extreme Weather Events in the Context of Climate Change. The National Academies Press, Washington, DC, 186 pp. DOI: 10.17226/21852. 2016. http://dx.doi.org/10.17226/21852.

National Research Council of the National Academy of Sciences. 2012. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. National Academies Press. 2012. https://www.nap.edu/resource/13389/sea-level-rise-brief-final.pdf.

Office of Environmental Health Hazard Assessment (OEHHA). 2018. Indicators of Climate Change in California. May 2018. https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf.

Payne, A. E., and Magnusdottir, G. 2015. An evaluation of atmospheric rivers over the North Pacific in CMIP5 and their response to warming under RCP 8.5. Journal of Geophysical Research: Atmospheres, 120 (21), 11,173-111,190. November 13, 2015. http://onlinelibrary.wiley.com/doi/10.1002/2015JD023586/epdf.

Sobel, A.H., Camargo, S.J., Hall, T.M., Lee, C.-Y., Tippett, M.K., and Wing, A.A. (Sobel et al.). 2016. Human influence on tropical cyclone intensity. *Science,* 353, 242-246. July 15, 2016. http://science.sciencemag.org/content/353/6296/242/tab-pdf.

United States Department of Energy (U.S. DOE). 2015. Quadrennial Technology Review 2015. Chapter 4: Advancing Clean Electric Power Technologies. https://www.energy.gov/sites/prod/files/2015/12/f27/QTR2015-4Q-Stationary-Fuel-Cells.pdf

United States Environmental Protection Agency (U.S. EPA). 2018. Greenhouse Gases Equivalencies Calculator - Calculations and References document. December 18, 2018. https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references. Accessed 09/16/2019.

Warner, M. D., Mass, C. F., and Salathé, E. P. (Warner et al.). 2012. Wintertime extreme precipitation events along the Pacific Northwest coast: Climatology and synoptic evolution. *Monthly Weather Review* 140:2021–43. July 2012. http://journals.ametsoc.org/doi/pdf/10.1175/MWR-D-11-00197.1.

Williams, A. P., Seager, R., Abatzoglou, J.T., Cook, B.I., Smerdon, J.E., Cook, E.R. (Williams et al.). 2015. Contribution of anthropogenic warming to California drought

during 2012–2014. *Geophysical Research Letters*. August 20, 2015. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2015GL064924.

IX. APPENDICES

Appendix A. Proposed Regulation Order

Appendix B. Public Process