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NRDC Earthjustice Sierra Club comments on FSSAT tool

Additional submitted attachment is included below.

Comments of the Natural Resources Defense Council (NRDC), Earthjustice, Sierra Club on the Staff Webinar on The Fuel Substitution Scenario Analysis Tool

Docket Number 19-DECARB-01

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The Natural Resources Defense Council (NRDC), Earthjustice, Sierra Club, (the Co-signers) appreciate the opportunity to comment on the Building Decarbonization Assessment Project Scope. NRDC is a non-profit membership organization with more than 95,000 California members who have an interest in receiving affordable energy services while reducing the environmental impact of California's energy consumption and transitioning to a thriving climate-safe society. Earthjustice is the nation's largest nonprofit public interest environmental law organization with approximately 250,000 supporters in California dedicated to creating a sustainable, clean energy future. Sierra Club is a non-profit, member-based California corporation with over 168,000 California members and a mission of promoting the responsible use of the earth's ecosystems and resources, including working to speed California's transition to a clean energy future.

I. Summary

The draft Fuel Substitution Scenario Assessment Tool (FSSAT) presented on February 27, 2020 provides a strong foundation for the AB 3232 building decarbonization assessment. The Co-signers strongly support its objective to help California policymakers and stakeholders better understand how much fuel substitution is necessary to achieve AB 3232's goal of 40 percent greenhouse gas (GHG) reductions below 1990 by 2030, and more broadly Governor Brown's Executive Order B-55-18 that requires economy wide carbon neutrality by 2045. The tool will also help assess which technologies and measures can help achieve these goals in the most cost-effective manner.

The Co-signers believe the draft FSSAT tool is generally headed in the right direction, but we have concerns that the proposed scope and assumptions presented in this draft would fail to provide the most relevant information on the most cost-effective pathways for achieving AB 3232 goals. We offer recommendations for improvements on the following four areas:

1. **Short-Lived Climate Pollutants**: While the Co-signers are strong proponents of regulating and ultimately eliminating hydrofluorocarbon (HFC) emissions, the tool focuses far more on HFC emissions, which fuel substitution for space and water heating has a relatively limited impact on, than on methane emissions which fuel substitution can help dramatically reduce. The FSSAT tool should appropriately cover methane impacts because fuel substitution can have a much larger impact on methane emissions than on HFCs in terms of overall greenhouse gas emissions.
2. **Packaged Rooftop Units in the Commercial Sector**: CEC's Gas Technology Characterization Environment should more clearly include packaged HVAC, such as gas/air conditioning (AC) rooftop units (RTUs), which are a major source of combustion and HFC emissions, and a major opportunity for fuel substitution
3. **Costs**: Cost assessments should include the many cost-effective electrification pathways, as well as the potential for maximizing cost savings and affordability benefits as market transformation and other factors make electrification cost-effective in more and more situations
4. **Assessment time horizon**: CEC should evaluate cost-effectiveness to 2045 in addition to 2030, because market transformation is a long-term process where early investments pay high dividends in the long-run. Focusing on 2030 alone may not drive the most cost-effective pathways to long-term building decarbonization.

II. Background

California has set ambitious goals to reduce greenhouse gas emissions across all economic sectors and achieve carbon neutrality by 2045. Addressing the greenhouse gas impact of residential and commercial buildings is critical to achieve long-term climate goals; residential and commercial buildings account for approximately 25 percent of the state's climate footprint.[1] To advance statewide efforts to address building carbon emissions, the California Assembly passed Assembly Bill 3232 (AB 3232).

AB 3232 requires the California Energy Commission (the Commission) to assess the potential to reduce greenhouse gas (GHG) emissions from residential and commercial buildings

[1] AB-3232 Zero-emissions buildings and sources of heat energy, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232

by at least 40 percent below 1990 levels by January 1, 2030. The Commission will produce a report, "The Building Decarbonization Assessment" ("the Assessment"), to evaluate the cost effectiveness of strategies to decarbonize buildings. This planning effort is critical to enable the transition to a zero-emission building sector in a manner that is the most economically beneficial, equitable, and fair for workers. While numerous policy efforts address the greenhouse gas impact of electricity generation and transportation energy use, the Assessment will serve as the first comprehensive policy analysis of the GHG reduction potential from energy use in buildings, and will guide the transition of California's building sector to clean energy and the necessary grid infrastructure planning to support this transition.

III. The FSSAT tool should appropriately cover methane emissions because fuel substitution has a much larger impact on methane than on HFCs emissions

The vast majority of HFC emissions come from air-conditioning and refrigeration. Even after large-scale market adoption, heat pumps for space and water heating are expected to be responsible for a small share of incremental HFC emissions. This is because the majority of California already is, and increasingly will be, a cooling dominated climate where HVAC systems are sized for peak cooling rather than peak heating load.

In buildings that do not have AC, fuel substitution would add new refrigerant. However, more and more buildings are adopting air conditioning because of the increasing frequency and severity of heat waves due to the changing climate. For buildings that would have adopted AC anyway, fuel substitution does not increase refrigerant leakage in most cases. Therefore, fuel substitution should only have limited impact on HFC emissions, especially as more buildings adopt AC beyond 2030.

The fuel substitution tool should not attribute HFC refrigerant leakage to fuel substitution in buildings that would have adopted AC anyway, because those refrigerant emissions would occur anyway absent fuel substitution. CEC should correct this incorrect attribution assumption. Refrigerant emissions from AC and refrigeration must be reduced, but fuel substitution policy is not an effective mechanism to support this goal.

The FSSAT tool should instead primarily focus on emissions that can be most impacted by space and water heating, as directed by AB 3232: "*The assessment shall include consideration of all of the following: … The cost-effectiveness of strategies to reduce emissions*

*of greenhouse gases **from space heating and water heating** in both new and existing residential and commercial buildings.*" (emphasis added). To this end, the **tool should appropriately cover fugitive methane emissions associated with gas space and water heating**. Methane has a high global warming potential (28 to 36 times that of CO2 over 100 years, 86 times over 20 years). The draft FSSAT tool only includes methane emissions that occur behind the meter. While those are significant, they are dwarfed by "upstream" emissions, from production, processing, transmission, and distribution. **CEC should include all upstream emissions, both in-state and out-of-state**, since California imports 90 percent of the gas it uses. The electricity sector's out-of-state emissions are accounted for in CARB's GHG inventory, they should be included for gas as well. If all California buildings were electrified, and the gas infrastructure decommissioned, this would clearly result in fewer gas wells drilled, gas processed and distributed and therefore lower methane emissions from leakage. Not including upstream emissions fails to account for the major fugitive methane emissions reductions that come from fuel substitution.

IV. CEC's Gas Technology Characterization Environment should more clearly include packaged HVAC, such as gas/AC rooftop units, which are a major source of combustion and HFC emissions, and a major opportunity for fuel substitution

It is unclear from the information presented at the webinar if the tool covers packaged HVAC, such as gas/AC rooftop units (RTUs). Packaged RTUs heat and cool nearly **60 percent of California's commercial building heating systems**, particularly in the office, school and retail sectors.[2] Those systems present large gas combustion emissions savings opportunities through electrification, as well as large HFC emissions reduction potential because of the high HFC emissions rates (from their AC function), that US EPA estimates have operational HFC leakage rates around 8 percent annually.[3] Modern electric alternatives such as high-efficiency heat pumps (VRFs or packaged heat pumps) combined with high efficiency heat recovery ventilation, can lead to dramatic energy efficiency improvements, and gas combustion and fugitive emissions reductions from fuel substitution.

[2] California Commercial Saturation Survey, table 9-4, Package single-zone systems.
[3] US EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018, page A-276, Table A-148, "Commercial Unitary A/C" end use, https://www.epa.gov/sites/production/files/2020-02/documents/us-ghg-inventory-2020-annexes.pdf

The Northwest Energy Efficiency Alliance (NEEA) conducted pilot projects on seven small commercial buildings throughout the Pacific Northwest and found that pilot participants saw an average 60% HVAC savings and 35% whole building energy savings.[4,5] These pilots are essentially high-efficiency HVAC electrification projects. PG&E is conducting similar pilot projects in California.

Market transformation of packaged RTUs is a major building decarbonization opportunity in California. Its combustion and methane leakage reduction potential should be included in the FSSAT tool.

V. Cost assessments should include the many cost-effective electrification pathways, as well as the potential for maximizing cost savings and affordability benefits as market transformation and other factors make electrification cost-effective in more and more situations

The marginal abatement cost curves presented in the webinar show largely positive abatement costs, implying that few measures are cost-effective over their lifecycle; i.e. the measures do not save more in reduced utility bills over their life than in incremental upfront costs relative to the baseline technology. This is surprising and doesn't match the reality of many building electrification opportunities:

1. **New construction**: building all-electric avoids the cost of connecting the building to the gas main in the street, and of gas piping, combustion venting and safety equipment within the building. Several studies have demonstrated the cost-effectiveness of electric new construction relative to mixed fuel.[6,7,8]
2. **AC to heat pump replacements and new installations**: A central split heat pump costs little more than a central AC system, as the heat pump is effectively an AC system with a reversing valve. Replacing all central AC systems with heat pumps at the end of their life, or installing heat pumps instead of AC in buildings

[4] Northwest Energy Efficiency Alliance, "Very High Efficiency Dedicated Outside Air Systems," https://betterbricks.com/solutions/hvac/dedicated-outside-air-system-doas
[5] Ventacity, "High Performance HVAC Pilot Project Whitepaper," https://tpkhhcn8.pages.infusionsoft.net/
[6] Energy and Environmental Economics, "Residential Building Electrification in California", April 2019, https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf
[7] Synapse Energy Economics, "Decarbonization of Heating Energy Use in California Buildings", October 2018, https://www.synapse-energy.com/California-Building-Decarbonization
[8] California Energy Codes and Standards Cost-Effectiveness Studies, https://localenergycodes.com/content/2019-local-energy-ordinances/

installing AC for the first time is akin to getting the heat pump nearly for free and is extremely cost-effective compared to installing an AC system and a separate gas furnace.

3. **Electrification, energy efficiency, and solar combo packages**: Combining electrification with energy efficiency and solar improves the cost-effectiveness of electrification tremendously because efficiency reduces heating capacity requirements and self-consuming solar electricity is lower cost than using grid electricity from a lifecycle perspective, and electric heating and hot water systems provide an opportunity to better utilize this lower cost energy source. The FSSAT tool should evaluate electrification, efficiency, and onsite solar combination packages if it doesn't already.

4. **Load management**: Heat pump water heaters (HPWH) can shift load from peak to off-peak time periods. CEC is currently considering the adoption of a HPWH demand management compliance credit, manufacturers have announced products supporting the requirement, and the CPUC has approved $45 million in Self-Generation Incentive Program funding for flexible HPWH. It is reasonable to assume that within a few years, most or all HPWH installed in California will arbitrage time-of-use rates to reduce user bills and grid upgrade needs, improving their cost-effectiveness relative to gas alternatives. Similar opportunities exist on the HVAC side with pre-heating with smart thermostats.

5. **Rates**: gas rates are expected to increase rapidly over the next decades, driven by major safety investments following the San Bruno gas pipeline explosion, and the decline in gas throughput that will put upward pressure on rates. The FSSAT tool should include scenarios that match the gas rates modeled in the Future of Gas study.[9]

6. **Market learning rates and technology innovations**: heat pumps currently have very low market shares in California, less than 1 percent for HPWH and less than 10 percent for space heating heat pumps. As the market develops, economies of scale in manufacturing and efficiencies in installation are expected to bring these costs down dramatically, as is happening with other new technologies like solar and batteries. Technology innovations such as 120-volt plug-in HPWH can avoid the need for installing a new electrical circuit, and potentially upgrading the electrical panel and service. The faster the market develops, the steeper market learning and innovation cost reductions curves will be. The FSSAT model should account for market learning and tie learning rates to market adoption, to help assess the potential for large upfront investments in market transformation to

[9] https://ww2.energy.ca.gov/2019publications/CEC-500-2019-055/index.html

reduce the overall transition costs, as happened with the California Solar Initiative and rooftop solar.

7. **Stranded asset costs**: Any new investment in gas infrastructure made from now on is likely to have a shorter useful life than expected, burdening gas customers and perhaps taxpayers with costs associated with stranded (unrecovered) investments. Any of those customer and societal costs that can be avoided through electrification, particularly in new construction, should be included in FSSAT modeling, because they would not occur in the fuel substitution scenario, so are clearly associated with the non-electrification baseline scenario.

When considering all opportunities to start with cost-effective electrification projects, we expect that much of the marginal abatement cost curve would be negative. The FSSAT tool output cost curves should reflect the significant opportunities for cost-effective electrification, and should assess how ambitious market transformation policies can expand these cost-effective opportunities to most or all of the market as they build scale and capacity in the market, from volume manufacturing, contractor familiarity and efficiency, and technologies that cost less to purchase and install.

VI. CEC should evaluate cost-effectiveness to 2045 in addition to 2030, because market transformation is a long-term process where early investments pay high dividends in the long-run. Focusing on 2030 alone may not drive the most cost-effective pathways to long-term building decarbonization.

While 2030 is the primary focus of AB 3232 and is an important milestone to ensure building decarbonization action starts early and at the right pace, the ultimate and most critical goal is to achieve the Paris Agreement's mid-century temperature goals of 1.5 degrees warming by 2050, and California's own economy wide carbon neutrality by 2045 goal. CEC should take advantage of FSSAT's capability to evaluate cost-effectiveness to 2045, as the cost-effectiveness of technology pathways that require long-term market transformation such as fuel substitution will be significantly higher over a 2030 horizon than a 2045 horizon. Conversely, some measures may not provide an affordable and scalable path to 2045 goals irrespective of their 2030 cost.

FSSAT provides a scalable capability which should make it relatively easy for CEC to extend the assessment timeline, and doing would provide major additional value compared to a strict 2030 focus.

The Co-signers appreciate the opportunity to provide comments on the Fuel Substitution Scenario Assessment Tool.

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