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February 2, 2021

Re: Comments on the December 14, 2020 Workshop on Senate Bill 49 Flexible Demand Appliance Standards

Dear Commissioner McAllister and Energy Commission Staff:

On behalf of the Natural Resources Defense Council (NRDC) who is advocating for affordable and equitable decarbonization and clean air policies in buildings to help mitigate the climate crisis, we respectfully submit the following comments in response to the California Energy Commission's (CEC) December 14, 2021 workshop on the SB 49 Flexible Demand Appliance Standards.

NRDC strongly supports the development of Flexible Demand Appliance Standards

Demand flexibility is a critical pillar of a comprehensive strategy to decarbonize the building and electric sectors affordably. Cost-effective decarbonization requires energy efficient buildings, electrification of heat and hot water using high-efficiency heat pump technology powered by zero-carbon electricity, and demand flexibility to shift load from peak to off-peak time periods, helping integrate renewable energy on the grid and keeping the electric system and utility bills affordable.

Achieving a decarbonized energy system requires aligning the time when energy is used with when it is produced. Energy storage and electric transmission infrastructure are important, but they remain expensive for the foreseeable future. Demand flexibility is one of the lowest cost pathways to keep the system balanced and help achieve a decarbonized grid and building stock as rapidly as possible. This requires a transformation of the appliance market from largely non-flexible appliances today, to a market where all the major appliances with demand flexibility

potential have not only the capability to be flexible, but also actively participate in balancing the grid on a daily basis through load shifting.

Market transformation requires a suite of policies, from research and development to spur innovation, to financial incentives to increase adoption and bring costs down to the point where the technology is cost-effective, to standards that scale toward 100 percent market adoption.

We support CEC's approach to setting standards, and encourage CEC, CPUC, and CARB to use all other policy opportunities available to encourage the market development of flexible demand appliances and technologies, paving the way for standards.

In pursuing demand flexibility standards, CEC should consider strategies that can accelerate market adoption of time-of-use responsive demand-flexible appliances until grid connectivity infrastructure and programs are broadly available

At the Dec. 14, 2020 workshop, Pr. Borenstein used a "pricing and response technology chicken-and-egg" analogy to describe the challenge of realizing the promise of demand flexibility: the availability of pricing technology and infrastructure is low due to a lack of demand-flexible technology that can respond to these price signals, and in turn price-responsive technology availability is limited by the lack of pricing infrastructure and value streams to monetize the benefits of price-responsive technologies.

For example, electric water heating has significant demand flexibility potential, but until recently there were no heat pump water heater (HPWH) models on the market that could respond to price signals. And the lack of price-responsive HPWH products has limited market development of price signaling and program infrastructure for HPWHs.

This started to change with CEC's adoption in July 2020 of Title 24 Joint Appendix 13 that sets requirements for both time-of-use response and grid price-response capabilities for HPWH. This broke the chicken-and-egg issue by providing immediate value to users on time-of-use rates, without waiting for pricing infrastructure and services to be available. As the stock of price-responsive HPWHs increases in California, it will build a critical mass of appliances ready to participate in demand flexibility programs.

With all or most investor-owned utilities moving to time-of-use rates by default in 2021, CEC should set standards that will help the appliance industry develop products that can respond both to grid price signals and time-of-use price schedules, saving Californians money from day one and accelerating the transition toward widespread grid-connected demand flexibility.

CEC should develop standards that enable opt-out rather than opt-in participation

One of the main challenges with unlocking the benefits of demand flexibility is achieving large-scale participation: demand flexibility will have limited systemwide benefits if only a small fraction of users participates. Achieving the potential of demand flexibility across all sectors, and particularly in the residential and small-commercial sectors characterized by a large number of users each with modest shiftable loads, requires shifting from a paradigm where a small fraction of users participate because they need to actively choose to do so, to one where most participate by default and can opt-out if desired instead.

Default, or "opt-out" participation means that a product operates in demand flexible mode without requiring customer action at installation. For example, a refrigerator would automatically shift defrost cycles away from peak times. A HPWH would automatically preheat water in the middle of the day and middle of the night and limit electrical demand on peak to times where it is necessary to meet customer needs. Smart thermostats would pre-cool and pre-heat by default without requiring the customer to enable this function.

There are precedents for this behavior: most thermostats are shipped with pre-programmed schedules and setpoints. JA13-compliant HPWHs are designed to be installed to operate in demand flexible mode without requiring users to take action. When moving into a new or existing home, most consumers have other priorities than thinking about which of their appliances are demand flexible, and how to set them up for demand flexibility. Most will not participate if it requires active setup or enrolment.

Requirements necessary to enable default/opt-out participation include both technical and customer requirements. Some of the technical requirements were addressed in Title 24 Joint Appendix 13 for HPWH, including time keeping so the appliance is on the right time even after a prolonged loss of power, default setup of a regionally-appropriate time-of-use schedule, customer protections to ensure no reduction in service, etc.

Customer acceptance requirements should be developed in collaboration with consumer advocates. They may generally require the following:

1. Saving money on customer bills;
2. No perceptible reduction in customer service or performance;
3. Not requiring changes in customer behavior; and
4. An easy way to opt-out, temporarily and permanently, to be defined more precisely.

Default participation is particularly important for low-income families and small businesses who are disproportionately renters: landlords who don't pay utility bills have no incentive to get a new appliance setup for demand flexibility or enroll it in a program. And tenants are most of the time not actively involved in the appliance replacement process which makes it even more difficult or impossible for them to choose a demand flexible appliance, be aware of demand flexibility capabilities of their appliances, or enroll in a program. Default participation will break

this agency problem, allowing tenants broader access to the bill savings benefits of demand flexibility.

While default participation raises technical and customer questions, it is an important area of consideration in the development of demand flexibility appliance standards.

California agencies should align policies toward the goals of SB 49 and in particular CPUC should update the Avoided Cost Calculator to appropriately value flexible demand appliances

Load flexibility resources have an important role to play in cost-effective decarbonization of the electric sector. These flexible resources can shift load from times when the grid is strained and fossil resources are on the margin to hours when renewable energy is abundant and electricity prices are low (e.g., middle of the day when solar is the marginal resource). As more solar comes online, driven by California's renewable portfolio standard requirements and greenhouse gas reduction goals, the value of flexible resources to utilize available clean energy during the day, and therefore reduce demand for electricity generation after sundown will only increase.

The CPUC's avoided costs, published through the Avoided Cost Calculator (ACC), represent all the benefits of reducing marginal energy demand that accrue to the energy system (including environmental policy benefits). These avoided costs drive what distributed energy resources, including flexible resources, are considered cost-effective. Accurate avoided costs signal the scale of benefits of hitherto untapped demand flexibility opportunities and can thus help the CEC determine what flexible demand appliance standards are cost effective and should be included in upcoming Title 20 updates.

Unfortunately, the most recent avoided costs, per the 2020 Avoided Cost Calculator (ACC), erroneously underrepresents the need for load flexibility. The 2020 ACC incorrectly indicates that some fossil generation is always on the margin; the marginal carbon dioxide emissions rate varies between 0.6 and 0.3 tonnes CO_2/MWh on average (See Figure 1 below). These estimates of marginal emissions are very different from the previous ACC versions and unreflective of real electric grid conditions. The 2019 ACC, in-part developed using recent wholesale electricity prices, correctly estimates that the marginal resource in the middle of the day is often solar and thus the average marginal emissions rate in the middle of the day is almost zero. The marginal emissions rate increases in the evening to ~0.7 tonnes CO_2/MWh when the sun sets, as shown by Figure 2.

This error will not only under-count the value of flexible resources but will also wrongly promote those distributed energy resources that save energy in the middle of the day at the expense of more valuable distributed resources such as those that can shift load from peak to off-peak time periods. As the heat wave in August 2020 showed, the grid most needs distributed resources that can reduce electric demand during summer evenings cost-effectively. As the state implements SB 49, it is important that all relevant state policies align toward the

goals of SB 49, and in particular that CPUC update the ACC to accurately represent the value of load shifting, so that potential cost-effective savings from demand flexibility can be accurately estimated, and utilities have the information they need to implement cost-effective incentive programs to achieve these savings.

Currently the 2020 ACC estimates that the marginal emissions rate in 2045, when California is meant to achieve SB100's goals of zero carbon retail sales, are greater than the marginal emissions rate in 2020.

Figure 1 Average Hourly Marginal Emissions Rate for Each Month in 2024 per the 2020 ACC

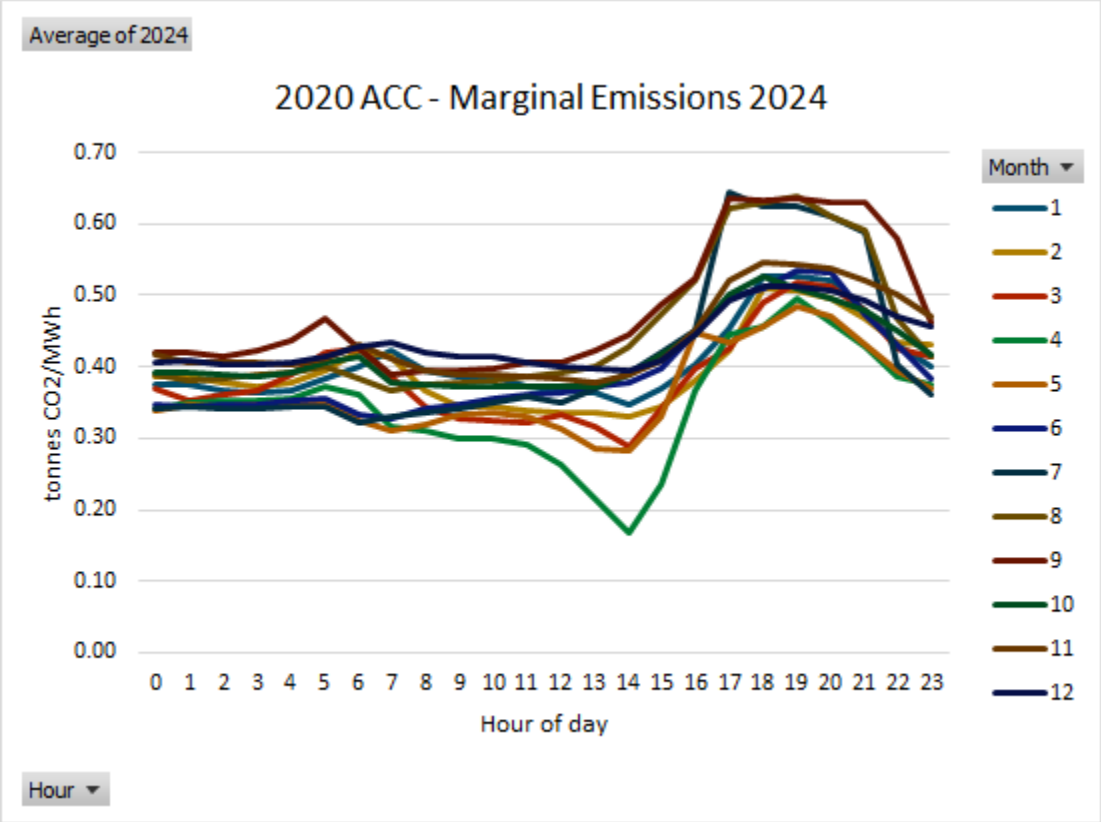
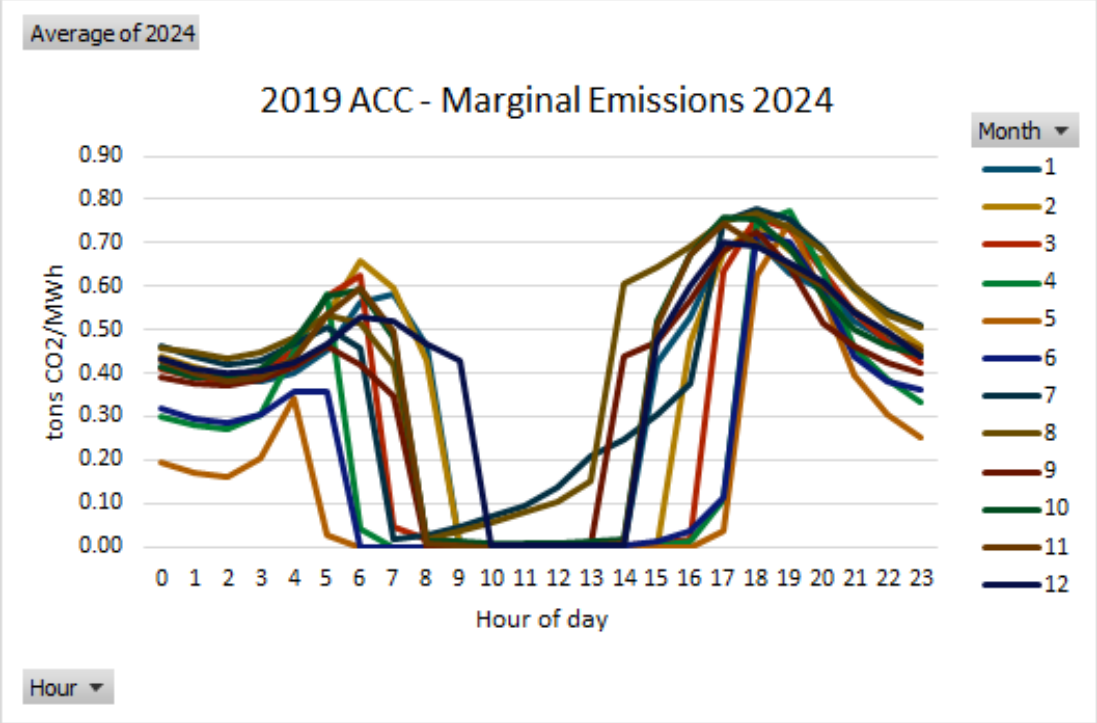


Figure 2 Average Hourly Marginal Emissions Rate for Each Month in 2024 per the 2019 ACC



CEC should prioritize appliances that can help not just with summer peak load but also with winter morning peak load.

While the summer 2020 reliability events are fresh on Californians' minds and demand flexibility can play an important role in helping mitigate them in the future, it is important to not lose sight of the other looming challenge and opportunity for load shifting in California: mitigating the growing winter morning peak load from space heating electrification.

Some areas of the state, particularly coastal areas with little air conditioning load, are already winter morning peaking today or close to be. And this is before significant space heating electrification. Space heating electrification will add winter morning-coincident load because space heating energy use is highest on winter mornings before sunrise when temperatures are lowest and there is little solar or wind energy generation. This can be aggravated by low-efficiency heat pumps that may use backup resistive elements to supplement the compressor when temperatures drop below 30 F or when they are used with inappropriate thermostat setbacks.

Demand flexibility can play a critical role in mitigating these issues by pre-heating homes and businesses ahead of the morning peak so that heat pump only needs to maintain setpoint

instead of having to recover from a setback during a peak period. Water heating can also be controlled to be fully charged ahead of morning peaks and to shed through peak.

We encourage CEC to prioritize setting demand flexibility standards for appliances that can shift significant load away from winter morning peaks in order to enable building electrification while limiting grid upgrades and keeping electric rates affordable, including commercial and residential space heating and residential water heating.

Sincerely,

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