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California Energy Commission
Docket Unit, MS-4
Docket No. 20-FDAS-01
1516 9th Street
Sacramento, CA 95814

Submitted Via Email

RE: Responses of Google LLC to the California Energy Commission’s Request for Information Issued in the Flexible Demand Appliance Standards, Docket 20-FDAS-01

Dear Commission Staff:

Google LLC, on behalf of its Google Nest thermostat division, hereinafter “Google Nest,” appreciates the opportunity to provide the Energy Commission responses to the information requests posed in the Flexible Demand Appliance Standards (“FDAS”) proceeding (Doc. 20-FDAS-01).

Google Nest’s devices include the Google Nest Learning Thermostat, the Google Nest Thermostat E, and the new Google Nest Thermostat. These products are each equipped with occupancy sensors, Wi-Fi capability, and smartphone grade processing, which together help our customers consume less energy. Google Nest thermostats learn occupant preferences, adjust temperatures to reduce energy consumption when the house is empty, and automatically lower air conditioning runtime when humidity conditions permit. All Google Nest thermostats currently on the market allow residential customers to participate in demand response (“DR”) programs and future load flexibility programs administered by utilities or third-party aggregators.

Google Nest intends for its participation in this proceeding to assist the Energy Commission in developing FDAS that further California’s energy efficiency policy and goals, contribute to reductions in residential customer energy demand during the net peak demand period, reduce customers’ cost of heating and cooling their homes, and to provide feedback that results in standards that can be executed by appliance developers, with an eye towards customer privacy, cybersecurity, and usability.

Google Nest is further interested in consistency across federal and state appliance and demand response programs and standards. Accordingly, Google Nest’s participation will be primarily focused on consistency between the Energy Commission’s regulations affecting smart



connected thermostats (“SCTs”), and consistency between the Energy Commission’s appliance standards and the California Public Utilities Commission’s (“CPUC”) provisions for investor-owned utility demand response programs. Google Nest will also use these comments to differentiate the SCT market and technology from the other appliances included in the FDAS.

In summary, Google Nest provides the following recommendations:

1. The Energy Commission should develop FDAS that do not conflict with existing standards and are performance, rather than design, based.
2. The FDAS should not require SCTs to have device-level OpenADR.
3. The incremental cost for FDAS functionality should be commensurate with the relative cost of the device.

Google Nest’s responses to select questions from the Energy Commission’s Request for Information (“RFI”) are provided below. Google Nest has no response on RFI questions not repeated herein at this time.

A. General Appliances Information

1. *For each appliance, are there additional examples that should be considered in scope or out-of-scope? Based on what factors?*

For purposes of this and other RFI questions, the Energy Commission should define a flexible demand thermostat as having the capability to schedule, shift, or curtail the energy consumption associated with the temperature setting of a building through direct action by the customer or through action by a third party, the load serving entity, or a grid balancing authority with the customer’s consent, as defined in Senate Bill 49 (SB 49, Skinner, Chapter 697, Statutes of 2019).¹ Google Nest’s smart connected thermostats meet these flexible demand capabilities.

In further development of the FDAS for SCTs, the Energy Commission should also craft standards that do not conflict with Title 24 Building Energy Efficiency Standards’ (“Building Standards”) requirement for demand responsive controls or the associated Joint Appendix 5 for Occupant Controlled smart communicating thermostats (“OCST”).² The 2022 Building Energy Efficiency Standards provide exceptions to the solar readiness features for residential buildings where thermostats are “demand responsive controls” and other energy efficiency measures are taken. Section 110.12(a) of the 2022 Building Standards requires that demand responsive controls meet the following:

¹ Pub. Res. C. Sec. 25402(f)(7)(A).

² Available at https://www.energy.ca.gov/sites/default/files/2020-02/2019_Part6_Section_110.12_and_Joint_Appendix5_ADA.pdf.



1. All demand responsive controls shall be either:
 - A. A certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), as specified under Clause 11, Conformance, in the applicable OpenADR 2.0 Specification; or
 - B. *Certified by the manufacturer as being capable of responding to a demand response signal from a certified OpenADR 2.0b Virtual End Node by automatically implementing the control functions requested by the Virtual End Node for the equipment it controls (emphasis added).*
2. All demand responsive controls shall be capable of communicating with the VEN using a wired or wireless bi-directional communication pathway.
3. When communications are disabled or unavailable, all demand responsive controls shall continue to perform all other control functions provided by the control.
4. Demand responsive control thermostats shall comply with Reference Joint Appendix 5 (JA5), Technical Specifications For Occupant Controlled smart communicating thermostats.

Joint Appendix 5 to the Building Standards provides the OCST technical specifications. To be considered an OCST, manufacturers must self-certify to the Energy Commission that their device meets the JA5 requirements.

Title 24 is updated on a two-year cycle, and it is possible that proposals for the 2024 Building Standards could further modify the standards for OCSTs and demand responsive controls. Any upcoming revisions to the Building Standards' provisions for OCSTs or demand responsive controls and standards developed for flexible demand appliances should be coordinated, as well.

A SCT that meets the 2022 Building Standard would make redundant any additional costs from functionality described in Table 3. Of note, Joint Appendix 5 already requires effectively the same functionality as the FDAS considered here. JA5 specifications require that OCSTs be capable of controlling temperature by following scheduled temperature setpoints and automatically responding to a demand response signal. The demand responsive control requirements also provide that such a device be capable of communicating with a Virtual End Node using either a wired or wireless bi-directional communication pathway.



B. Flexible Demand Cost Assumptions

4. *What other flexible demand approaches are available for staff to consider? Please include references to publicly available sources.*

Consistent with the Building Standards, the FDAS should not require smart connected thermostats to be the certified OpenADR 2.0a or OpenADR 2.0b Virtual End Nodes (“VEN”) as it would not provide incremental value or additional DR load in the modern SCT demand response market.

In typical smart thermostat demand response programs, a SCT manufacturer contracts with an aggregator, or an entity that provides a distributed energy resources management system (“DERMS”) service, to access these devices for load shifting. The aggregator or DERMS has the ability to communicate with the device using that device’s proprietary application programming interface (“API”). And, crucially, the DERMS platform can be OpenADR compliant, thus enabling SCT communicability as if OpenADR was incorporated at the device-level.

Multiple investor-owned utilities and third-party DR providers currently use this approach to dispatch load connected to a variety of models from different SCT manufacturers with success. The most recent Load Impact Protocol (“LIP”) reports filed by both IOUs and third-parties with the CPUC indicate between 0.54 to 0.68 kW of average reductions per household with a thermostat participating in a demand response program in this manner. This approach is preferred to device-level OpenADR compatibility for a number of reasons:

1. *SCTs are further along the market adoption curve than other nascent demand responsive technologies.* According to the 2019 Impact Evaluation of Smart Thermostats in California, over 100,000 SCTs were installed through utility direct install channels, alone, in 2019.³ As there are currently no OpenADR standards for connected thermostats, any demand response or load flexibility program that required device-level OpenADR would potentially strand these assets and their connected load. Because of the maturity of this technology, large numbers of devices have been deployed and will continue to be deployed that will not incorporate OpenADR at the device-level, and the industry is less likely to change the entirety of their infrastructure to support device-level OpenADR when other methods suffice to enable dispatch and reporting. Accordingly, an OpenADR device-level requirement could preclude substantial numbers of California households from providing critical capacity.

³ “Impact Evaluation of Smart Thermostats. Residential Sector- Program Year 2019.” 10 May 2021. EM&V Group A. DNV GL Energy for California Public Utilities Commission.



2. *Unlike other appliances targeted for FDAS, such as EV chargers or battery storage devices, SCTs have a direct effect on occupant comfort.* SCTs provide valuable DR load, but only to the degree that customers are willing to participate. If load flexibility events become too onerous for customers, or call for too drastic of a change to occupant comfort, customers will no longer participate. SCT manufacturers are best equipped to provide positive customer experiences during demand response events. For example, Google Nest has designed and deployed device-level features, such as pre-event customer mobile notifications, to maintain customer satisfaction with their devices and with load flexibility events. SCTs may be capable of more load shift with or without preconditioning, based on a number of factors related to how individual customers condition their space, communicated via API between the device manufacturer and the DERMS provider.

Further, individuals may have different health and safety requirements related to household temperature. A small percentage of customers may opt-out of an event due to these concerns. In aggregate across tens of thousands of households, this may have a negligible impact on curtailment, but a large impact on customer satisfaction and consequently, demand response enrollment/participation and retention. Without knowing what the OpenADR implementation will look like, Google Nest is concerned that the end result of requiring device-level OpenADR compliance will be a decrease in the necessary customer control.

3. *Smart thermostats have sensitive information that directly implies occupancy.* Google Nest is extremely sensitive about what customer information is shared, with whom, and how it is permitted to be used. One significant way Google Nest maintains customer privacy is by using our systems to translate between a DR partner's signal and what happens in a customer's home — only permitting what our privacy and security principles permit, and only within the guardrails of our system. This further ensures customers do not have information shared unnecessarily and that control strategies outside of our system's definition of acceptable use are not enabled.
4. *DERMS providers offer added value.* The DERMS provider-SCT company arrangement allows the aggregator to control multiple brands of thermostats and other devices, such as clothing dryers or dishwashers, in ways that match customer use cases and device-specific functionality. Customers are then experiencing a whole-home holistic participation in energy markets rather than having to carry the burden of managing all of their different devices themselves. Requiring OpenADR on the device is duplicative and counter-productive to the sophistication that DERMS providers already implement and utilize.



Although Google Nest thermostats do not incorporate OpenADR at the device level, they are capable of responding to a demand response or load flexibility signal from an OpenADR interface through a DERMS provider and providing the available load when called. Device-level (and Cloud-level)⁴ OpenADR compliance would not add any additional load shed since the DERMS provider is receiving the OpenADR signal directly from the utility partner. There is no known program that Google Nest has been precluded from participating or operating in as a result of not having OpenADR at the device-level in our products. The fact that Google Nest is a leader in the residential SCT DR space without OpenADR certification provides further proof that for thermostat technology, this is not a market requirement. Including it going forward would require significant investment in re-engineering thermostat systems, which will add cost to consumers, especially the low to moderate income (“LMI”) customers needed for increased DR program participation, while not adding incremental value from the customer’s perspective. Simply stated, because of the SCTs existing communicability and the OpenADR capabilities of the DERMS providers, Google Nest sees no value in a device-level OpenADR requirement.

5. What inspections or test methods should staff use to verify compliance with each approach?

Google Nest supports a self-certification process for FDAS that is similar to that for OCSTs and other devices under the Title 24 Building Standards. Following FDAS self-certification, continued eligibility as an FDAS is apparent where the device is capable of participating in demand response programs through the established contractual relationship with an aggregator or DERMS provider. Where a thermostat model allows a customer to participate in a demand response or load flexibility program, there is no need for the device to be inspected or tested by the Energy Commission for purposes of showing the device has the flexible demand capabilities established by Senate Bill 49. The pre-rulemaking draft of the proposed FDAS language issued on September 30, 2021 correctly excludes thermostats from a FDAS testing requirement.

C. Appliance Stock Numbers – 2023 estimate and 2033 estimate

6. With consideration to high and low projected stocks for Table 1 Phase 1 appliances, what other sources of information are available to estimate current and project appliance stocks in California?

To better understand energy reduction impacts at net peak demand periods for thermostats, the Energy Commission should distinguish the appliance stock for homes with central air conditioning. The U.S. Census Bureau’s 2019 American Housing Survey estimated

⁴ Cloud-level OpenADR compliance, while technically distinct from device-level OpenADR compliance, would have similar hurdles and similarly lack substantive benefits as device-level OpenADR compliance.



approximately 8.1 million homes with central air conditioning in California, up from approximately 7.5 million in 2017.⁵ If the Energy Commission does not account for smart thermostat penetration for only these homes, then the Energy Commission's estimated penetration rate could overstate energy reductions from SCTs during summer net peak demand periods.

D. Changes in GHG Emissions Calculation Methodology

17. For long-term projections on changes in GHG emissions due to load shifting, will estimates of hourly marginal emissions or hourly system average emissions be the best metric?

The Energy Commission should measure the GHG value of demand flexibility using marginal GHG emissions rather than average emissions. The Energy Commission should also investigate methods for calculating marginal emissions at an appropriate scale for widespread demand flexibility.

Marginal emissions are those associated with real-time dispatch of electricity generating resources rather than the average emissions of all resources generating in a time interval. Because changes in demand influence real-time dispatch, the value of load shifting is best measured with the marginal emissions of the resources dispatched or curtailed due to load shifting. The California Public Utilities Commission currently uses a marginal emissions signal as part of the self-generation incentive program for managing storage resources. This program's emission signal may assist in the Commission's evaluation of the value of FDAS.

E. Cybersecurity

21. What other documents should staff review regarding cybersecurity standards?

Google Nest believes that cybersecurity should be paramount for SCTs, and this is why a reliance on Google Nests' demand response API over an OpenADR approach is so important. In addition to the standards listed Table 8 of the RFI, Google Nest recommends Commission Staff become familiar with the [Internet of Secure Things \(ioXt\)](#) security profile requirements and certification process. The ioXt security profile is a growing industry standard, applicable to energy appliances.⁶ However, the North American Electric Reliability Corporation's Critical

⁵ American Housing Survey Table Creator (2017-2019): https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=00000&s_year=2019&s_tablename=TABLE3&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=1&s_filtergroup2=1.

⁶ See <https://www.ioxtalliance.org/>.



Infrastructure Protection (“CIP”) standards do not apply to SCTs as the actual functioning of the grid is unaffected by smart thermostats.

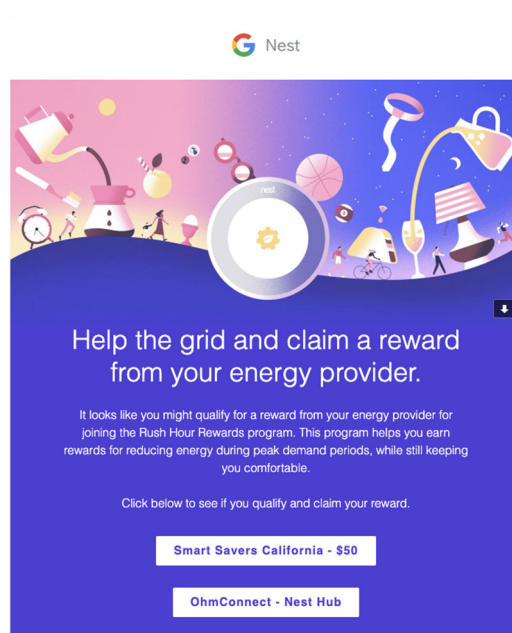
22. What minimum standards are needed for cybersecurity of flexible demand appliances?

Google LLC, and in particular Google Nest, support the Internet of Secure Things Alliance, identified in our response to question 21. Google Nest certifies many of our products against the ioXt profiles. Flexible demand appliances, including thermostats, should be capable of meeting the minimum bar set by the ioXt base profile.⁷

F. Customer Consent

23. Information on appliance packaging materials and manufacturer websites describing the appliances’ flexible demand capabilities.

Google Nest considers customer consent to be an essential part of a successful demand response program. Google Nest sends an invitation to participate in a utility or third-party demand response program via email to customers within 7 days of a new thermostat being activated, as well as at the start of every season.



Having an opt-out or revocation option is an important element of customer consent, and Google Nest provides that opportunity in the demand response and energy saving solutions we provide or support.

⁷ See, e.g., the ioXt certification for Google’s Nest thermostat at <https://compliance.ioxtalliance.org/product/251>.



24. Electronic consent functions, opt-in or opt-out features, and error notifications.

Google Nest requires that customers opt-in to demand response programs by providing a check box stating that the customer has read the DR provider's terms and conditions.

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With Rush Hour Rewards, CPS Energy will pay you to use less energy when everyone else is using more. Make sure your Nest Thermostat is connected to Wi-Fi, then just sign up.

Sign up for Rush Hour Rewards and Seasonal Savings.
Confirm a few details of your CPS Energy account.

First name Last name
jhuribert@google.com
Account number xxx-xxxx-xxx
Confirm the address of your CPS Energy home
101 Hillview Ave Unit (optional)
Los Altos CA 94022
 I have read and understand CPS Energy's [Terms and Conditions](#).

Sign up

26. Policies for acceptable use of customer data.

Google Nest publishes our Rush Hour Rewards Terms & Conditions here:
<https://nest.com/legal/customer-agreements-for-rush-hour-rewards/>.

G. Equity

28. What considerations should inform staff analyses on the projected equity impacts of proposed standards, to ensure flexible demand appliance sold or leased in California benefit all Californians?

SCTs are an affordable solution for millions of Californians that otherwise would not have the means to finance and install other distributed energy resources, such as rooftop solar, home battery storage, or electric vehicles with charging control. The affordability is a critical consideration as California grapples with how to drastically increase capacity to counter extreme weather events. Google Nest recently introduced a \$129 thermostat, a price point \$40 lower than the previous version, and nearly half the price of the top-of-the-line model. With proper energy efficiency and demand response incentives in place, these thermostats can be offered to customers at little or at no cost when those customers participate in a demand response program.



In 2018 Google Nest began a broad multi-year initiative designed to raise awareness of and provide help to people struggling with high energy costs, via innovative energy efficiency technology and solutions, called the Power Project. As part of that initiative, Google Nest provides special pricing on Nest thermostats for Low to Moderate Income programs, including in a variety of California Energy Savings Assistance (“ESA”) programs today.

Based on these cost considerations, Google Nest encourages the Energy Commission to adopt incremental costs for FDAS functionality that is commensurate with the current market price for the devices. This is particularly crucial for SCTs, which are presently the only affordable means for LMI customers to participate in demand response or load flexibility programs. At Google Nest’s current price point for our most affordable model, these devices are often free or near-free for customers. However, if the FDAS requires thermostat features for Google Nest products that add incremental costs, prices could more than double the effective cost of the thermostat, without adding meaningful load flexibility. In turn, this would significantly decrease the uptake of these devices in LMI and/or disadvantaged communities, which we believe is counter to the intent of the Commission’s proposed FDAS program.

H. Appliance-Specific Questions -- Thermostats

30. What percentage of thermostats have a scheduling function for automating thermostat operation?

All of Google Nest’s thermostats have a scheduling function for automating thermostat operation.

31. What percentage of thermostats sold or leased in California have an ability to connect to the internet?

All of Google Nest’s thermostats have the ability to connect to the internet.

32. What percentage of thermostats sold or leased in California have an ability to receive and act upon simple OpenADR commands to alter the thermostat operating schedule?

Households in California have begun to transition to smart thermostats, with estimates that there is enormous market potential in California to scale SCTs and enroll them in effective DR programs. As noted above, and consistent with the Building Standards Section 110.12(a), all of Google Nest thermostats are able to integrate with DERMS providers to enable OpenADR functionality and act on a demand response signal from an OpenADR Virtual End Node; and there are over 7.5 million homes with central A/C in California – the exact systems where installing a thermostat could enable meaningful demand flexibility by providing load reductions during periods of peak demand and load shifting to periods of high renewable generation. Based

