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Docket Number:	24-FDAS-03
Project Title:	Flexible Demand Appliance Standards for Low-Voltage Thermostats
TN #:	260348
Document Title:	SMUD Comments Re FDAS-03_RFI Smart Thermostats
Description:	SMUD Comments Re FDAS-03_RFI Smart Thermostats
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Organization:	Sacramento Municipal Utility District
Submitter Role:	Public Agency
Submission Date:	11/27/2024 3:25:37 PM
Docketed Date:	11/27/2024

SMUD®

November 27, 2024

California Energy Commission
Docket Unit, MS-4
715 P Street
Sacramento, CA 95814

Re: SMUD's Response to Request for Information (RFI) for Low-Voltage Thermostat Flex Demand (Docket 24-FDAS-03)

SMUD appreciates this opportunity to provide input to the Commission's Flexible Demand Appliance Standards (FDAS) as they relate to low-voltage thermostats. SMUD has a great deal of experience with thermostat demand response (DR) programs beginning with an extensive pilot in 2014. Currently, SMUD's "My Energy Optimizer: Partner" program has been running for three summer seasons and detailed measurement and verification has been conducted on the program. Based on this experience, SMUD offers the following comments for the Commission's consideration as it develops these flexible demand standards. SMUD notes that many of these comments do not fit neatly within the specific questions posed by the RFI; however, it is critical that the Commission has a full understanding of the current state of thermostat DR performance and needed improvements to fully realize the value these devices can bring to the grid.

Question #8: Provide Information on any demand response programs currently used in California or other locations for HVAC loads that use thermostat for load control, including the following.

a. How many low-voltage thermostats are used in these demand response programs?

SMUD currently has approximately 23,000 customers enrolled in the "My Energy Optimizer Partner" program, representing more than 4% of our total residential customer base.

b. How much energy load in kW is each low-voltage thermostat shifting?

The answer to this question is much more complicated than it might appear at first glance, because of the dramatic variation in performance depending on the duration of the event call. SMUD strongly urges the Commission to not rely on a single "average" load shift figure when considering the impact of thermostat DR performance, as these averages bely meaningful and significant variation by hour. Specifically, SMUD has observed the following kW impacts by hour during 4-hour events:

- Hour 1: 1.23 kW
- Hour 2: 0.69 kW
- Hour 3: 0.4 kW
- Hour 4: 0.31 kW

c. What is the time shift duration?

See SMUD response to "b." above.

d. What are the participation rates with an opt-in and opt-out framework?

SMUD does not have experience with an "opt-out" framework for thermostats, and it is unclear how such a program could utilize a true opt-out program design (e.g., customers being defaulted into the program without explicit permission), since customers must actively agree to allow their thermostats to be controlled. As noted above, SMUD currently has ~23,000 active participants in its thermostat DR program; however, event-level participation rates when taking opt-outs into consideration are substantially lower. For example, SMUD commonly experiences customer opt-out rates between 30 and 40% during events, which dramatically reduces the achieved load reductions relative to what is potentially available from the program.

Additional Comments from SMUD Experience

a. Flexible demand functionality:

As described above, the current functionality provided by thermostats during DR events does not provide sustained, consistent load reductions over the necessary number of consecutive hours to cost-effectively displace Resource Adequacy (RA) purchases (i.e. 4 hours). Current RA prices are at historic highs, which enables these programs to be cost-effective in the short term; however, as additional capacity becomes available, the long-term cost-effectiveness is uncertain. Taking SMUD's performance data during a 4-hour event as noted above, the utility is only able to count on a fraction of the oft-cited average of "1 kW/participant" for purposes of displacing RA purchases, since RA is looked at on a 4-hour basis at SMUD.

The shape of thermostat DR load reductions clearly demonstrates the challenges presented by suboptimal thermal envelopes in participating homes. Put simply, many residential customers' homes cannot "coast" through 3- or 4-hour events without the temperature of their home reaching the adjusted setpoint (e.g., 4 degrees higher), and when that new setpoint is reached, their air conditioners activate, thereby attenuating the load reduction in hours 2, 3, and 4.

In order to address this issue, third-party vendors/aggregators have attempted to employ staggering dispatch strategies by creating groupings of participating customers that are dispatched at different times throughout an event. This approach has been moderately successful at flattening the shape of the load reductions; however, this comes at a severe cost in terms of the magnitude of the load reduction. For example, staggered dispatch events at SMUD yield lowest-hour reductions of approximately 0.45 kW/participant. While there may yet be improvements over time in staggered dispatch strategies, SMUD suggests the Commission consider the concept of AC "cycling" as a key functionality required of low-voltage thermostats under FDAS. Whereas the standard "setback" strategy of raising thermostat setpoints by 3-4 degrees relies upon a tight thermal envelope for sustained load reductions, traditional "cycling" of AC systems (e.g., on for X minutes, off for

Y minutes each hour) may provide participating households with substantially higher comfort during 3 and 4 hour events such that they do not opt out and their new setpoints are not reached. This cycling approach has been employed for decades by traditional AC switch programs, and the performance of such programs far exceed that of thermostat DR. For example, SMUD recently began deploying 2-way AC load control switches, and longer duration events show a worst-hour load reduction of ~0.8 kW/participant - more than double the load reduction provided by thermostat DR as currently dispatched.

b. Low-voltage thermostat compatibility with variable-speed heat pump systems

SMUD is deeply committed to decarbonization and electrification, as well as load flexibility, and as such, there is growing concern around conflicting objectives and specifications in some of the technologies currently being incentivized by various programs, such as TECH and SGIP. Specifically, variable-speed heat pump HVAC systems appear to be incompatible with the vast majority of wi-fi smart thermostats on the market today (e.g., Nest, Ecobee). However, a significant portion of the heat pump HVAC systems being installed in SMUD territory are variable-speed heat pump HVAC systems. This means that many new heat pump systems are neither compatible with after-market wi-fi thermostats, nor the 2-way AC control switches that SMUD offers as part of its "Peak Conserve" DR program. Programs like SGIP and TECH carry requirements that customers enroll in a utility DR program, which puts customers in a challenging situation. SMUD is bringing this to the Commission's attention in hopes that either FDAS or other appliance standards might bring these technologies into harmonization. Absent any action, the state will be working at cross-purposes by incentivizing HVAC systems whose flexibility potential cannot be tapped into.

Conclusion

SMUD thanks the Commission for the opportunity to provide input into these flexibility standards and hopes that these comments are useful in the development of FDAS for low-voltage thermostats. SMUD is also hopeful that some of the long-standing challenges in realizing the full load flexibility potential of these technologies can be alleviated through FDAS. SMUD specifically urges the Commission to think beyond MIDAS integration and bulk price signal response, as the highest avoided cost value available is resource adequacy, and there is work to be done on the duration of load reductions for thermostats to be able to maximize this value.

/s/

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cc: Corporate Files (LEG 2024-0143)