

**PUBLIC UTILITY COMMISSION OF OREGON
STAFF REPORT
PUBLIC MEETING DATE: October 6, 2020**

REGULAR X CONSENT _____ EFFECTIVE DATE October 7, 2020

DATE: September 28, 2020

TO: Public Utility Commission

FROM: Kacia Brockman

THROUGH: Bryan Conway, JP Batmale, and Sarah Hall **SIGNED**

SUBJECT: PORTLAND GENERAL ELECTRIC:
(Docket No. ADV 1178/Advice No. 20-23)
Requests Addition of Two Direct Load Control Demonstrations to
Residential Testbed Pilot, Schedule 13.

STAFF RECOMMENDATION:

Approve Portland General Electric Company's (PGE or Company) request to revise Schedule 13 to add direct load control of ductless heat pumps and single family heat pump water heaters to the Residential Demand Response Testbed Pilot (Testbed), with conditions listed in this memo.

DISCUSSION:

Issue

Whether to approve PGE's request to revise Schedule 13 to add direct load control of ductless heat pumps and single family heat pump water heaters to the Testbed.

Applicable Law

Oregon Revised Statutes (ORS) 757.205 requires public utilities file to all rates, rules, and charges with the Commission.

ORS 757.210 establishes a hearing process to address utility filings and requires rates be fair, just, and reasonable.

ORS 757.220 provides that no change shall be made in any schedule, except upon

30 days' notice to the Commission prior to the time the changes are to take effect. Oregon Administrative Rule (OAR) 860-022-0025 requires that filings revising tariffs include statements showing the change in rates, the number of customers affected and resulting change in annual revenue, and the reasons for the tariff revision.

Analysis

Summary

In this advice filing, PGE revises its Residential Testbed Pilot Schedule 13 to expand the Testbed beyond the current behavior-based Peak Time Rebate (PTR) to include two new, small-scale demonstrations of direct load control of two technologies: ductless heat pumps and heat pump water heaters. Staff supports moving forward with these technology demonstrations. Their inclusion is consistent with PGE's approved Testbed proposal and fits within the approved Testbed budget.¹ However, to address several shortcomings with PGE's proposals, Staff recommends specific reporting requirements throughout implementation of these pilots.

This memo describes background on PGE's Testbed, the proposed expansion of the Testbed from behavior to direct load control, details of each proposed demonstration, and recommended reporting requirements.

Testbed Background

PGE's 2016 Integrated Resource Plan (IRP) identified the need for new demand response capacity in 2021 of 77 MW in summer and 69 MW in winter. In its acknowledgement of the IRP in 2017, the Commission directed PGE to establish a Testbed to explore ways to accelerate development of cost-effective demand response to meet PGE's capacity need. The Commission also directed PGE to convene a Demand Response Review Committee (DRRC) to provide guidance in developing the Testbed.² In 2018, PGE formed the DRRC and engaged DRRC members in the development of a Testbed proposal.³ In 2019, the Commission approved a new Schedule 13 that launched the Testbed.⁴ The Testbed has an initial two-and-a-half year duration, through June 30, 2022.

¹ The Testbed proposal was originally filed in Docket No. ADV 859 on October 26, 2018, and allowed by the Commission on April 12, 2019. The Testbed budget was approved by Order No. 19-425 in Docket No. UM 1976, PGE's application for deferred accounting for Testbed expenses.

² See Docket No. LC 66, Order No. 17-386 at 9, filed October 9, 2017.

³ The DRRC membership includes Energy Trust of Oregon, Northwest Energy Efficiency Alliance, Pacific Northwest National Lab, Oregon Citizens' Utility Board, Oregon Department of Energy, Alliance of Western Energy Consumers, Northwest Power Conservation Council Staff, and OPUC Staff.

⁴ See Docket No. ADV 859, PGE Advice No. 18-14, filed October 25, 2018.

The Testbed is geographically limited to approximately 20,000 PGE customers served by three substations – in Milwaukie, Hillsboro, and North Portland. It provides a venue for testing localized participation in demand response offerings that have potential to scale. To date, the Testbed has focused on high penetration of residential participation in a behavioral demand response pilot. Residential customers within the Testbed are automatically enrolled in Peak Time Rebate (PTR), an opt-out pilot in which customers receive a pay-for-performance incentive when they voluntarily reduce load in response to a day-ahead notice from PGE. The PTR behavioral demand response pilot is currently the only customer offering in Schedule 13.

Adding Direct Load Control Demonstrations to the Testbed

PGE originally proposed to add a direct load control demand response offering to Schedule 13 in Advice No. 20-12 filed on May 29, 2020. On June 8, 2020, PGE previewed the Schedule 13 revisions with the DRRC. That advice filing established pricing for a direct load control offering, but lacked any detail about the direct load control activities being proposed. Therefore, Staff asked PGE to withdraw the filing and refile later with detailed proposals for any planned activities. PGE withdrew the filing on July 13, 2020. PGE subsequently requested feedback from Staff on a draft technology demonstration proposals that would conform to the pilots-to-program guidance that Staff was developing at the time. Staff has since has finalized its pilots-to-program guidance and will share it with PGE in October 2020.

PGE made this current filing, Advice No. 20-23, on August 25, 2020. This advice filing includes the original revisions to Schedule 13 and two proposals to test the demand response potential of two energy-efficient appliances – ductless heat pumps and heat pump water heaters – using direct load control. PGE proposes to identify residential customers within the Testbed who have already installed (1) a ductless heat pump or (2) demand response-capable heat pump water heater and will recruit them to participate. Customers who choose to participate in one of the demonstrations will allow PGE direct control of their appliance during demand response events, and will be compensated with a pay-for-performance incentive based on actual load reduction. The revisions to Schedule 13 define the customers' participation in these direct load control demonstrations.

Whereas the PTR behavioral pilot is focused on encouraging high levels of participation, these two direct load control demonstrations are very limited in scale based on a more limited deployment to date of controllable appliances. PGE intends for the demonstrations to test the effectiveness of the technologies as demand response resources and to identify whether larger-scale pilots are warranted.

The proposed demonstrations are described in the next sections.

Demonstration #1 – Ductless Heat Pump with Smart Thermostat Direct Load Control

- Learning objectives: The goals of the ductless heat pump demonstration are to:
 - Assess the demand response potential of ductless heat pumps through direct load control of smart thermostats; and
 - Determine jointly with Energy Trust of Oregon (Energy Trust) whether the combined benefit of demand response and energy efficiency savings might have the potential to make ductless heat pumps cost-effective, thus warranting a larger future pilot.
- Justification: In Order No. 19-301, the Commission granted Energy Trust a cost-effectiveness exception for ductless heat pumps and directed Energy Trust to collaborate with PGE to conduct a field test of the combined benefit of demand response and energy efficiency.⁵ Data gathered by PGE in this demonstration will help inform Energy Trust's cost-effectiveness analysis.

While PGE did not provide an estimate of the long-term market-wide demand reduction potential from ductless heat pumps, Staff believes that this demonstration is warranted by the technology's significant potential to scale as an energy-efficient heating and cooling solution, especially in multifamily housing units. This demonstration is consistent with PGE's need to develop new demand response measures to help meet its 2021 capacity need as described in the *Testbed Background* section of this memo. Staff recommends that PGE include in its Flexible Load Plan estimates of the long-term market potential of this and other demand response resources, as described in the *Recommended Reporting Requirements* section of this memo.

- Near-term Demand Reduction Potential: PGE anticipates a dual season average peak demand reduction of 0.5 kW per unit, and an estimated current market potential within PGE's service territory of 5 MW, based on current penetration of ductless heat pumps.
- Budget: PGE's portion of the demonstration cost is estimated to be \$100,000 and will be funded from within the existing Testbed budget. The costs will cover purchase and delivery of the smart thermostats, one-time integration with PGE's demand response management system, customer incentives, recruitment, and evaluation.
- Number of Participants: PGE aims to control 150 previously installed residential demand response-ready ductless heat pumps within the Testbed, 50 of which

⁵ See Docket No. UM 1696, Order No. 19-301, filed September 12, 2019.

received Energy Trust incentives, and 100 of which did not qualify for Energy Trust incentives because they have either gas backup heating or no backup heating. The latter group will be identified through permit data and data from PGE's load disaggregation study.⁶

Separately, Energy Trust will conduct its own pilot to determine whether smart thermostats improve the energy efficiency savings and thus cost-effectiveness of ductless heat pumps, per Order No. 19-301.

- Incentives: Participants will receive a free smart thermostat and a participation incentive of \$1.00/kWh of actual energy reduction that will total an estimated \$50 per year. Additionally, PGE may offer up to \$50 as an enrollment incentive.
- Implementation: PGE and Energy Trust have already collaborated on selecting Flair as the thermostat vendor, planning to identify and recruit participants, and planning to share evaluation results. PGE has developed a communications strategy to keep customers engaged throughout the pilot to maximize participation in demand response events. The strategy incorporates lessons learned from PGE's direct load control Multifamily Water Heater Pilot.
- Timeframe: The demonstration will launch in Q3 2020, run for 21 months, and include at least two full event seasons: part or all of winter 2020-21, summer 2020, and part of winter 2021-22. The evaluation will occur Q1-Q2 2022.
- Reporting: PGE will provide quarterly updates at the regular DRRC meetings, and will file an evaluation report with the Commission in 2022.

Demonstration #2 – Heat Pump Water Heater Direct Load Control

- Learning objectives: The goals of the heat pump water heater demonstration are to:
 - Compare the costs, benefits, and user satisfaction of three different communications protocols;
 - Assess the demand response potential of single family heat pump water heaters;
 - Understand the technical requirements of the ANSI/CTA-2045 standard communications interface; and

⁶ PGE worked with a data science vendor to analyze the AMI data of approximately 16,000 single family residential customers in the Testbed in order to identify specific space heating, cooling and water heating end uses. This analysis took place in first half of 2020 using AMI data from May 2018 through December 2019.

- Assess the ease of customer self-installation of the communication modules.
- Justification: PGE's market research identified direct load control of smart water heaters as a promising demand response technology based on its potential cost effectiveness, peak load reduction, and ability to provide ancillary services.⁷ While PGE did not provide an estimate the long-term market-wide demand reduction potential from controllable heat pump water heaters, Staff believes that this demonstration is warranted by the technology's significant potential to scale as an energy-efficient water heating solution in single family homes. This demonstration is consistent with PGE's need to develop new demand response measures to help meet its 2021 capacity need as described in the *Testbed Background* section of this memo. Staff recommends that PGE include in its Flexible Load Plan estimates of the long-term market potential of this and other demand response resources, as described in the *Recommended Reporting Requirements* section of this memo.

PGE's Multifamily Water Heater Pilot has revealed the challenge and importance of high connectivity rates between PGE and the water heater's communication module for a successful direct load control program. Therefore, this Testbed demonstration will compare three different communications methods: customer Wi-Fi (same as used in the Multifamily Water Heater Pilot), cellular using the CTA-2045 standard interface, and two-way radio frequency mesh network using CTA-2045.

The CTA-2045 technical specification defines a standard communication interface, similar in concept to a USB port, for appliances that can be controlled as flexible load. Oregon's appliance standard now requires that heat pump water heaters manufactured beginning in 2022 are equipped with a CTA-2045 standard interface.⁸ This Testbed demonstration will give PGE experience with CTA-2045 in preparation for broader market adoption of the standard interface on heat pump water heaters and other potential flexible loads, such as electric vehicle chargers, ductless heat pumps, and pool pumps.

This demonstration also provides an opportunity for PGE to coordinate product and program offerings with Energy Trust and the Northwest Energy Efficiency Alliance, which is a goal of the Testbed.

⁷ See Demand Response Market Research: Portland General Electric, 2016 to 2035, prepared by The Brattle Group, January 2016.

⁸ See OAR 330-092-0015(17) and 330-092-0020(17).

- Near-term Demand Reduction Potential: PGE anticipates a per-unit load shifting potential of 0.09 kW in summer and 0.17 kW in winter, with a current market potential within PGE's service territory at 0.22 MW based on current penetration of heat pump water heaters in single family homes. While the current potential is small, smart water heaters were identified as a significant future demand response resource for PGE, as stated earlier.
- Budget: PGE has budgeted \$270,000 for this demonstration, of which \$150,000 will be funded from within the existing Testbed budget. The remaining \$120,000 will be covered by PGE's research and development (R&D) budget. The R&D budget will cover engineering and manufacturing of CTA-2045 Universal Communication Modules, and installation of a limited-area mesh radio network. The Testbed budget will cover integration with PGE's demand response dispatch platform, customer incentives, recruitment, evaluation, and new heat pump water heaters for testing the mesh radio network.
- Number of Participants: PGE aims to control 130 heat pump water heaters, of which 50 will communicate over the customer's Wi-Fi, 50 over cellular using a CTA-2045 communications module, and 30 over a new two-way radio mesh network using a CTA-2045 module. PGE will build the limited-area radio mesh network around 30 single family homes owned by University of Portland. Those homes will be equipped with new CTA-2045-enabled heat pump water heaters, and the residents will be automatically enrolled, with the option to opt-out.
- Incentives: Wi-Fi and cellular communication participants will receive a free communication module to self-install on their existing heat pump water heater. All participants will receive a participation incentive of \$1.00/kWh of actual energy reduction, totaling an estimated \$70 per year. PGE will install new CTA-2045-enabled heat pump water heaters in each of the 30 university-owned houses.
- Implementation: PGE has already selected vendors to provide the CTA-2045 communications modules and to construct the radio mesh network around the university housing. PGE will recruit Wi-Fi and cellular participants based on state tax credit and Energy Trust Energy Performance Score data. PGE will control the heat pump water heaters with the same dispatch methodology being used successfully in the Multifamily Water Heater Pilot. Dispatch will occur through the end of 2021.
- Timeframe: The demonstration will launch in Q3 2020, and will run for 21 months. Load control of water heaters can occur throughout the year, not just during heating and cooling seasons. Wi-Fi participants will be recruited

immediately, since they will be using communications modules already available in the Multifamily Water Heater Pilot and already integrated into PGE's demand response dispatch platform. CTA-2045 cellular participants will be engaged by the end of 2020, allowing time for manufacture and procurement of the communications modules and integration into the demand response dispatch platform. PGE anticipates that the new radio mesh network infrastructure will be built and the new CTA-2045-enabled heat pump water heaters installed by the end of 2020, as well. The evaluation will occur Q1-Q2 2022.

- Reporting: PGE will provide quarterly updates at the regular DRRC meetings, and will file a final evaluation report with the Commission in 2022.

Recommended Reporting Requirements

PGE's proposals for these direct load control demonstrations include learning objectives, scope, cost breakdown, and an implementation plan including timeline and milestones. Importantly, PGE incorporates learnings from its other demand response pilots into the design of these new demonstrations. Staff appreciates PGE's efforts in this regard.

However, the proposals still lack a level of rigor that Staff will expect going forward in accordance with its pilots-to-programs guidance. There are four outstanding questions about these pilots that Staff recommends be addressed with the following actions by PGE.

1. Infrastructure investments and integration and administrative costs: In its Flexible Load Plan, PGE must describe the investments made to date in smart grid technologies including Advanced Metering Infrastructure (AMI) and Demand Response Management System (DRMS), and how those investments enable demand response activities. At the next DRRC meeting, prior to launching these direct load control activities, PGE must explain what is required to integrate these new direct load control technologies into the existing DRMS platform and the associated integration costs and administrative costs, such as those associated with accessing individual customer AMI data to substantiate savings.
2. Market potential: In its Flexible Load Plan, PGE must estimate the long-term potential for demand reduction and grid services resulting from direct load control of different technologies that PGE proposes to test in demand response pilots.
3. Strategy for calling events: At the next DRRC meeting, PGE must present and invite feedback on its strategy for calling demand response events in these two demonstrations, and its rationale for the frequency, duration, and timing of events.
4. Coordination with Energy Trust: At the next DRRC meeting, PGE must invite Energy Trust to describe its pilot of smart thermostats with ductless heat pumps

and describe coordination between Energy Trust and PGE to implement and evaluate their respective pilots to determine the potential for combined benefit of demand response and energy efficiency.

Conclusion

Staff has reviewed the Schedule 13 revisions and finds that they accurately describe the proposed direct load control activity. Staff finds that PGE's proposed direct load control demonstrations of ductless heat pumps and heat pump water heaters are justified, consistent with the Testbed proposal, and designed to incorporate lessons learned from the Multifamily Water Heater Pilot. Staff supports the relatively short-term, small-scale, and low-cost nature of these demonstrations, and their inclusion in the Testbed as a way to test technologies with potential to scale.

Staff is also encouraged by the collaboration with Energy Trust and the potential for combined benefits of energy efficiency and demand response offered by these measures.

However, Staff finds that PGE's proposals for these two demonstrations lack some important detail that should be included in all pilot proposals going forward. Staff recommends that the Commission approve this advice filing and impose four requirements for PGE to report additional information in the Flexible Load Plan and to the DRRC, as described above in the *Recommended Reporting Requirements* section.

Cost recovery for Testbed expenditures is established through Schedule 135. PGE anticipates filing an update to Schedule 135 in November 2020.

PROPOSED COMMISSION MOTION:

Approve PGE's request to revise Schedule 13 to add direct load control of ductless heat pumps and single family heat pump water heaters to the Testbed, with conditions for PGE to provide additional reporting in the Flexible Load Plan and to the DRRC.