



Portland General Electric Company
121 SW Salmon Street • 1WTC0306 • Portland, OR 97204
portlandgeneral.com

October 1, 2021

Via Electronic Filing

Public Utility Commission of Oregon
Attention: Filing Center
P.O. Box 1088
Salem, OR 97308-1088

Re: ADV **XX** - PGE's Smart Grid Testbed Phase II Proposal

Dear Filing Center:

Pursuant to Order 17-386 and in furtherance of the goals outline in Docket ADV 859, PGE Advice 18-14 Attachment A, PGE Testbed Proposal of October 2018, PGE submits PGE Smart Grid Testbed Phase II proposal. An application developed in collaboration with the Demand Response Review Committee for the approval of a five-year extension of PGE's Smart Grid Testbed meant to accelerate the development and demonstration of flexible load technology, program activity and flexible load resource development and capacity acquisition.

Later this year PGE will file its Flexible Load Multi-year Plan 2022-2023 which will include a proposal for cost recovery of its entire Flexible Load portfolio including PGE's Smart Grid Testbed Phase II work.

Should you have any questions or comments regarding this filing, please contact Nidhi Thakar at (503) 464-7627 or Jason R. Salmi Klotz at (503) 464-7085.

Please direct all formal correspondence and requests to the following email address
pge.opuc.filings@pgn.com

Sincerely,

/s/ Nidhi Thakar

Nidhi Thakar
Director, Resource and Regulatory Strategy
And Engagement

Enclosure
cc: Jason R. Salmi Klotz, Tim Treadwell



Smart Grid Testbed Phase II Proposal

October 2021



This page intentionally left blank.

Table of Contents

Executive Summary.....	7
Section 1 Background	11
1.1 Origins of the Smart Grid Testbed	11
1.2 Stakeholder Process for Phase I Development.....	13
1.3 Phase I Goals and Implementation.....	13
Section 2 Phase II	28
2.1 Phase II Planning.....	28
2.2 Phase II Proposal.....	33
Appendices	43
Appendix A Testbed Demonstration Project Activity: Flexible Feeder.....	43
Appendix B Testbed Demonstration Project Activity: Managed Charging/V2X	54
Appendix C Testbed Demonstration Project Activity: Smart Inverter	60
Appendix D Testbed Midterm Evaluation.....	67

Figures, Charts, Tables

Figure 1 – Testbed Survey: Residential Responses..... 16

Figure 2 – Phase II Project Concepts..... 30

Figure 3 – Expanded Siting Options for Testbed Projects..... 31

Figure 4 – Building Type and Vintage, with Distribution Infrastructure Serving Overlook/Arbor Lodge 45

...

Chart 1 – Peak Time Rebate Enrollment..... 17

...

Table 1 – Proposed Smart Grid Testbed Phase II Budget..... 10

Table 2 – Smart Grid Testbed Phase I Budget 25

Table 3 – Phase II Research Areas 33

Table 4 – Grid Services with Service Characteristics..... 47

Table 5 – Example Residential DER, Grid Service Characteristics, and Grid Services 48

Table 6 – Flexible Feeder Budget 49

Table 7 – Flexible Feeder Learning Objectives 52

Table 8 – Managed Charging/V2X Budget..... 56

Table 9 – Smart Inverter Budget..... 63

List of Acronyms

ADR	Automated Demand Response
AER	Automated Emissions Reduction
AMI	Advanced metering infrastructure
AWEC	Alliance of Western Energy Consumers (formerly ICNU)
C&I	Commercial and Industrial
CUB.....	Citizens Utility Board
CVR	Conservation Technology Association
DER	Distributed Energy Resource
DLC	Direct Load Control
DOE	United States Department of Energy
DR	Demand response
DRRC	Demand Response Review Committee
DRMS.....	Demand Response Management System
DRP	Distribution Resource Planning
DSM	Demand-side Management
EE	Energy Efficiency
EV	Electric Vehicle
FERC	Federal Energy Regulatory Commission
FTE.....	Full-time Equivalent
HVAC.....	Heating, Cooling Ventilation, and Air Conditioning
ICNU	Industrial Customers of Northwest Utilities (now AWEC)
IRP	Integrated Resource Plan
kWh.....	Kilowatt Hour
MW	Megawatts
NEEA	Northwest Energy Efficiency Alliance
NWPCC	Northwest Power Conservation Council ("Council")
O&M	Operations and
OEM.....	Original Equipment Manufacturer
OPUC.....	Oregon Public Utility Commission
PGE	Portland General Electric
PNNL.....	Pacific Northwest National Laboratory
PTR.....	Peak Time Rebate
PV	Photovoltaic
RMI.....	Rocky Mountain Institute
SFR.....	Single Family Residence
TOU	Time-of-Use
VPP	Virtual Power Plant

Key Terms and Concepts

Demand Response (DR) - “Changes in [energy]usage by end-use customers from their normal consumption patterns in response to changes in the price of [energy]over time, or to incentive payments designed to induce lower [energy]use at times of high wholesale market prices or when system reliability is jeopardized.”¹

Flexible Load - a more dynamic type of DR identified as a necessary resource in a decarbonization study. Flexible load is a dynamic form of DR capable of providing valuable grid balancing services. Grid balancing services are necessary for integrating high levels of renewable or variable energy resources. To supply grid balancing services, these demand-side resources must be available to grid operators throughout the day and capable of supplying several different types of energy products beyond peak load shifting.

¹ FERC National Assessment and Action Plan on Demand Response,
<https://www.ferc.gov/industries/electric/indus-act/demand-response/dr-potential.asp>

Executive Summary

With the success of Smart Grid Testbed (SGTB) Phase I, having met the goals set out by the Public Utility Commission of Oregon (Commission or OPUC) and the Demand Response Review Committee (DRRC)² and done so under budget, PGE's Testbed team and the DRRC began planning SGTB Phase II. This phase is more focused on resource development, distributed energy resource (DER) deployment, and operationalizing DERs to demonstrate their viability as resources capable of meeting customer and grid needs. Phase II will have six major investigations or project research areas to be rolled out over time, plus a non-wires coordination project:

- 1. Flexible Feeder** - The largest of the proposal research areas, this project involves close collaboration between PGE and Energy Trust of Oregon (also referred to here as "Energy Trust"). The two organizations will learn about co-deployment of DER solutions and the capabilities of a virtual power plant (VPP) by investing in significant DER deployment in a traditionally underserved North Portland community, which has been historically subjected to redlining and gentrification.^{3,4} The purpose of the project is to establish a concentration of resources dense enough to create-or approach-the capabilities of a VPP while helping to reduce the energy burden of low-income customers in this community.

This project will be enhanced if PGE, National Renewable Energy Laboratory (NREL), Energy Trust, Northwest Energy Efficiency Alliance (NEEA), and Community Energy Project's United States Department of Energy Connected Communities Grant application is successfully funded at \$6.8M. If the project is not selected for DOE funding, the project will take place as described in this proposal.

- 2. Commercial and Industrial, Municipal Flexible Load & Resiliency** - This project area seeks to identify pathways and strategies to achieve higher levels of commercial, industrial, and municipal site participation in flexible load and resiliency programs. The team will explore both enhancements to existing programs and the development of new programs, with the goal of better understanding and capturing the value of participating in combined measures for energy efficiency (EE), flexible load, and resiliency. This work will include an evaluation of engagement approaches, as well as how to structure incentives and rates to maximize program, event participation, and customer value.

² The DRRC was created by Commission Order 17-386. The Testbed proposal, which established project goals, was approved in ADV 859 in April 2019.

³ <https://dsl.richmond.edu/panorama/redlining/#loc=12/45.564/-122.758&city=portland-or>

⁴ https://www.portland.gov/sites/default/files/2020-01/gentrification_displacement_typology_analysis_2018_10222018.pdf

- 3. Distributed PV/Smart Inverter** - Projects in this area will assess the value of inverter-based controls to deliver distribution operations value (e.g., Volt/VAR support); address hosting capacity issues, including as an alternative to PGE's two-meter solution; and support orchestration of DERs together with distributed solar and storage to minimize grid export. Work in this area may also include rate design (e.g., fixed price) and transactive energy strategies that incentivize self-consumption and/or distribution-level load balancing.
- 4. Multifamily Bundle** - The multifamily market segment is important from an equity perspective, with disproportionate numbers of low income or other underserved customers occupying this building type. However, multifamily presents significant challenges, with higher turnover rates than the single-family residential segment-which makes customer enrollment and retention challenging-and building designs that can impede device communications. PGE's Multifamily Water Heater team has made key advancements in this segment, providing important learnings on the technical viability of in-unit water heating controls as a flexible load resource in the multifamily space. As PGE assesses how to scale that effort, this work will focus on new products, bundles, and engagement strategies to increase adoption and participation across a broader range of flex load technologies within the segment. The effort will also test whole building load management strategies and rate design options.
- 5. Managed electric vehicle (EV) charging/vehicle-to-everything (V2X)** - Research in this project area will focus primarily on improving understanding of the technical paths for charge management, their costs, performance, and limitations. The work is expected to overlap with other research areas and will include:
 - Evaluation of customer acceptance of charge rate/time and location-based price signals
 - Demonstration of vehicle-to-grid and managed charging use cases, including technical requirements, limitations, and operational considerations of various EV original equipment manufacturers (OEMs) and electric vehicle supply equipment (EVSE)

Research and evaluation will span multiple customer segments including single family, multifamily, commercial, fleets, and right-of-way charging (ROW, e.g., parking strips and other city or utility owned property in public areas).

- 6. Single Family New Construction Bundle** - This project area seeks to explore the potential value of connected homes in the new construction market to deliver cost effective load flexibility. The work will focus on partnering with residential developers to deploy an all-electric, flexible home bundle. In doing so, we will explore collaboration strategies, pricing structures, and incentive designs that support an increased flexible load offering within this market segment. The Testbed team will

develop and test the effectiveness of product bundles in driving increased demand among new home buyers, as well as test new pricing strategies, tools (e.g., the line extension allowance, or LEA), and rate design options. The overall goal of this effort is to better understand how PGE can work with developers and builders to incorporate flexible load technology into the design/build process, securing low-cost demand flexibility potential before the customer even occupies the home.

Non-Wires Alternative (NWA) - These projects will constitute a significant portfolio of activities, many of them directly addressing or otherwise coordinated with the NWA goals outlined in UM 2005⁵ and being carried out by PGE's Distribution Resource Planning (DRP) team. Where possible and appropriate, the Testbed team will coordinate with DRP on projects that can inform and/or meet the NWA goals of UM 2005, optimizing the lessons, values and benefits of both activities and reducing ratepayer burden. This activity area has no specific budget or enrollment target.

Testbed Phase II is proposed as a five-year project at cost of \$11M or \$2.2M/year, which is lower cost per year less than Testbed Phase I. Just as Testbed Phase I brought about valuable lessons and significant change to PGE's approach to demand response (DR), flexible load, and DERs with a customer solutions, engagement and participation focus, PGE anticipates Phase II will continue producing valuable lessons and provide change management to PGE's approach to planning, resource development and utilizations. The above six research areas represent a collective strategic investment to accelerate community-based DERs development.

This Testbed Phase II proposal request includes:

- Agreement that the six project research areas plus the NWA coordination project are reasonable and worth pursuing,
- Agreement that \$11M is a reasonable cap on the five years of activity, reserving the question of prudence for the Commission, and that PGE will submit detailed, project-based budgets to support the work. PGE understands through this approach the Commission may limit activity and funding to less than what is proposed here.
- Agreement that \$2.857M in start-up costs for the projects included in the appendices are reasonable. These dollars will be requested through the Multi-year Plan.
- Acknowledgement that Schedule 13 should, at a later date, be adjusted to more broadly allow for the six project research activities to be conducted without multiple amendments over the five-year course of the project.

⁵ <https://apps.puc.state.or.us/edockets/docket.asp?DocketID=21850>

After submitting this proposal, PGE will work with Staff and the DRRC to provide a comprehensive detailed project proposal with individual project budgets, the totality of which, over the course of five years and six project areas, will not exceed the proposed \$11M, as summarized below:

Table 1 – Proposed Smart Grid Testbed Phase II Budget

Project Area	Expected Budget	Initial Request
New Construction Bundle	\$500,000	\$0
C&I, Municipal Flexible Load & Resiliency	\$1,500,000	\$0
Distributed PV/Smart Inverters	\$1,000,000	\$1,000,000
Multifamily Bundle	\$1,000,000	\$0
Managed Charging/V2X	\$2,500,000	\$872,200
Flexible Feeder	\$4,500,000	\$985,000
Non-Wires Alternative	\$0	\$0
Total	\$11,000,000	\$2,857,200

Section 1 Background

1.1 Origins of the Smart Grid Testbed

In Docket LC 66, PGE's 2016 Integrated Resource Plan, the Commission recognized the need for PGE to develop a new customer-sited resource capable of meeting seasonal capacity needs and to address seasonal peak energy usage. Staff's opening comments noted the lack of investment in and low adoption rate of DR.⁶ In Appendix A of Staff's final comments, Staff proposed the development of a Demand Response Testbed,

Staff proposes that the Company establish a testbed where the proposition of DR at scale can be tested on a limited population to anticipate penetration rates, test program designs and customer recruitment strategies, establish the required mix of customer types, test the acceptability of dispatching DR with the frequency and duration needed to achieve such large offsets, and project costs at scale with a high level of confidence, etc., while limiting financial exposure on the part of ratepayers.⁷

The Commission's Order 17-386 required PGE to establish a Testbed by July of 2019.⁸ Additionally, the Commission required PGE to establish a subject matter expert group, the DRRC⁹, to advise on the development of the Testbed.

The purpose of the Testbed was to accelerate the development of DR and to acquire it "at scale."¹⁰ PGE's application included a forecast budget for an initial two and a half years of a Testbed project, across three substations, in three cities, collectively representing 20,000 PGE customers.

PGE established the DRRC with key stakeholders in February of 2018. Since its creation, PGE has maintained an open and collaborative relationship with the DRRC, soliciting candid feedback and guidance on the creation of the Phase I plan, implementation of Phase I activities, as well as the development of the Phase II plan included here.

In October 2018, PGE proposed a Smart Grid Testbed project that would leverage multiple business lines across PGE, include every customer type found within the PGE service

⁶ LC 66 Staff's Initial Comments, 1/24/2017, see pages 4, 5, 10-11

⁷ LC 66, Staffs Final Comments, 5/12/2017, Appendix A, Page 41

⁸ Oregon Public Utility Commission, Order 17-386 (October 09, 2018) at p.9. Available at <https://apps.puc.state.or.us/orders/2017ords/17-386.pdf>

⁹ Ibid.

¹⁰ See Oregon Public Utility Commission, Docket LC 66 Final Staff Comments, Appendix A (May 12, 2017)

territory, advance our understanding of the customer value proposition for participation in DR, accelerate DR program development, and accelerate the company's understanding of how to acquire DR. PGE proposed a two-phase concept where the Testbed will first establish high levels of participation in DR programs among Testbed participants:

The PGE Testbed project is proposed in two phases for several reasons. Firstly, PGE realizes that the Commission has given some latitude to conduct research and development work. The Commission should have the opportunity to thoroughly evaluate PGE's efforts and be allowed an opportunity to either continue, halt, or hasten the effort based on said evaluation. The second reason to proceed with a phased approach is that PGE expects Phase I will require two-and-a-half years to demonstrate that an opportunity to scale and accelerate DR exists with the PGE customer base. Much of the first two years is about establishing the right kind of customer relationship. PGE believe that this will be critical as the resource (unlike supply-side generation) is customer-based and requires a level of customer engagement for which there is no precedent. Success can then be evaluated by the retention rate of these customers and their participation rate in DR offerings and events. We also expect participation rates to affect both overall megawatt savings and our understanding of cost effectiveness. PGE expects attendant benefits of the Testbed will include coordination with other DSM service providers, new offerings, new strategies for customer recruitment, participation and outreach, more data on how best to develop DR, and better information about the technical and achievable potential of DR and other demand-side resources whose success is dependent on customer engagement and involvement. PGE originally conceived and presented to the DRRC the idea that the Testbed would have two phases. The first phase, a two-and-a-half-year endeavor to establish the Testbed encompasses this filing. PGE also conceived and discussed the development of Phase II to explore new offerings, assuming Phase I received funding and the activities were deemed worthy to continue. To be explicit: PGE is not asking for approval of Phase II here. However, PGE felt it best to share with the Commission what we believe Phase II activity would look like.¹¹

PGE forecasted costs of roughly \$5.8M over the first 2.5 years. Given the ambitious goal of 66% program participation, PGE believed that at least two years of field activity was needed to validate the strategy being used and collect data necessary to understand the potential of DR as a system resource when acquired "at scale".

¹¹ Adv 859, PGE Testbed Proposal, October 2018, Section 3.10 Two-Phase Concept, pp 56-57.

1.2 Stakeholder Process for Phase I Development

As directed in Commission Order 17-386, PGE established the DRRC and convened the group by July 2018. The Commission required the following entities have membership on the DRRC:

- Energy Trust of Oregon (also referred to here as “Energy Trust”)
- The Northwest Energy Efficiency Alliance (NEEA)
- Pacific Northwest National Laboratory (PNNL)
- Citizens Utility Board of Oregon (CUB)
- Oregon Department of Energy (ODOE)
- Alliance of Western Energy Consumers (AWEC, formerly Industrial Customers of Northwest Utilities, or ICNU)
- Northwest Power and Conservation Council Staff (also referred to here as “the Council”)
- OPUC Staff

PGE added representatives from the cities of Portland, Milwaukie, and Hillsboro to the DRRC, given that Testbed substations are located in these three cities.

PGE convened the DRRC four times prior to the Phase I proposal submittal, including an intensive offsite work session (which included the cities of Hillsboro and Milwaukie) at the Rocky Mountain Institute (RMI) E-Lab Accelerator during the first week of May 2018. The E-Lab Accelerator is an invite-only event whereby RMI chooses from a pool of applicants those projects that they are interested in assisting with development.

The agenda at E-Lab was comprehensive and helped move Phase I of the Testbed forward. Roles of the city were better understood, goals were articulated, and the project began to take shape. The PGE Team discussed two major issues during the RMI E-Lab: 1) the need to make the customer value proposition (CVPs are delineated in Section 1.3.3) a key measure of the project’s success; and 2) the possibility that it may be necessary to use an opt-out program to ensure participation at levels necessary to meet the project’s goals. The enormity of the program lift was articulated and NEEA, the Energy Trust, and PGE committed to work on new program development.

1.3 Phase I Goals and Implementation

1.3.1 Goals and Program Design

The purpose of the Testbed is to accelerate the development of DR capacity resources, acquiring DR “at scale,” and demonstrating its ability to function as a grid resource. In Phase I, PGE’s efforts were guided by seven goals outlined in the Proposal:

1. Identify, develop, and communicate the customer value proposition of DR to PGE’s customers
2. Work with customers to establish and retain a high level of customer participation in DR programs

3. Learn how to recruit and retain customers program participation and translate these learnings for development of cost-effective strategies to be applied to service territory program offerings
4. Collect information on DR potential that can inform resource potential studies
5. Create new program offerings that can quickly translate to broad deployment program offerings
6. Coordinate on new program development with other demand-side measure providers such as the Energy Trust and NEEA, and
7. Study and understand the implications that high levels of flexible load have on system operations

The underlying theme of these goals is to increase understanding of how customers perceive and value DR so that PGE may more effectively engage customers in flexible load efforts. Achieving this outcome requires a customer-centric approach and, for the learnings to be representative, "at scale" participation by Testbed customers. During the planning process, the DRRC determined that "at scale" represented participation of 66% among residential customers, which is significantly higher than average residential participation rate of between 5% and 10% nationally.

To support this proposal for Phase II, PGE provides a brief synopsis of the Phase I activity. This does not replace the third-party evaluation and report to the Commission planned for delivery in Q1 of 2022. A midterm evaluation was submitted to the Commission on January 29, 2021. We have attached that Interim Evaluation Report as Appendix D.

1.3.2 Phase I Implementation

1.3.2.1 Staffing and Program Management

The Testbed is staffed by a mix of full-time employees (FTE), some in PGE base rates and others incremental to the Testbed effort. The incremental employees, as outlined in the Testbed Phase I Proposal, include a program management lead, three community-based Diversity, Equity, and Inclusion (DEI) staff, and a half-time program marketer.

The Testbed team has evolved over the course of the project. The team started as a full time Program Manager and a supporting contract Project Manager. In early 2020, PGE converted the Project Manager position-the cost recovery of which was included in the Testbed Deferral-to a position in PGE's base rates. The SGTB Program Manager role-formerly incremental and covered in a deferral-was likewise moved to base rates. These changes reflect our recognition that these positions are part of larger program development processes and would be needed to support work both within and without the Testbed. The role of the Program Marketer has remained unchanged during implementation of Phase I.

The additional staffing was needed as the scope of the Testbed expanded to include technology demonstration and other cross-cutting activities.¹² The Program and Project Manager responsibilities include the full range of implementation activities, including program management, research, evaluation, operations, stakeholder management tracking, and reporting functions, as well as coordination with other product and program groups such as Energy Storage and EVs.

As with program management, the DEI Community Outreach Consultant role has evolved over time due to a combination of changes in program requirements as well as the operational changes brought on by Covid-19.¹³ Initially embedded within and focused on their respective Testbed communities, the team's focus shifted over time toward engagement work with environmental justice (EJ) -focused community-based organizations, coordination with broader regional DEI efforts, and helping the Testbed/Grid Products Team apply an equity lens to their work.

In addition to incremental staff included in the deferral, the SGTB is supported by an array of employees whose positions are in PGE's base rates. The Testbed project receives support from the broader Grid Products organization, including Product Developers, Distribution System Planning staff, and Program Operations teams. The project is also supported by numerous teams outside of Grid Products, including Market Insights, Data Science, Distribution Planning, Distribution Operations, and Rates and Regulatory Affairs.

The Testbed project team coordinates with the broader team through a series of regular meetings and check-ins. The Testbed team meets weekly with support teams to provide updates and status reports on cross-cutting activities. The agenda rotates through a list of standing topics on a weekly basis, highlighting specific elements of the project throughout the month. One of these weekly agendas is focused on coordination with partners, which Energy Trust attends, providing space to coordinate ongoing activities and work through operational issues. The Program and Project Manager also meet monthly with leadership from across PGE as part of an internal Advisory Committee. These meetings provide line of sight on upcoming project activities and facilitate more effective implementation.

1.3.3 Baseline, Launch and Customer Value Propositions

One of the key aspects of Phase I was to understand customer awareness and perception of DR concepts and programs (Goal 1 above). To benchmark and track changes over the life of the program, PGE fielded a survey of business and residential customers between May 28 and June 11 of 2019. The sample consisted of all customers in Testbed neighborhoods, as well as a random sample of customers in the rest of PGE's service territory (Figure 1). The survey received a total of 4,919 responses, equating to an ~8.5% response rate for residential customers and 3.6% for business customers. Survey responses revealed no significant differences between the SGTB sample and the sample outside the SGTB, which provides a

¹² The net result of these changes is an increased investment by PGE in the Testbed activity, through a reallocation of existing rate-based staffing towards SGTB management and oversight.

¹³ The original job title was Community Relations Manager; it was updated to better reflect the role.

good benchmark for measuring change resulting from the program. The results indicated both an across-the-board need for further education on why DR is important for utility operation, and a low level of familiarity with specific PGE programs. The Testbed team shared these results with the evaluator and has incorporated baseline questions into subsequent survey rounds to gauge the impact of program efforts.

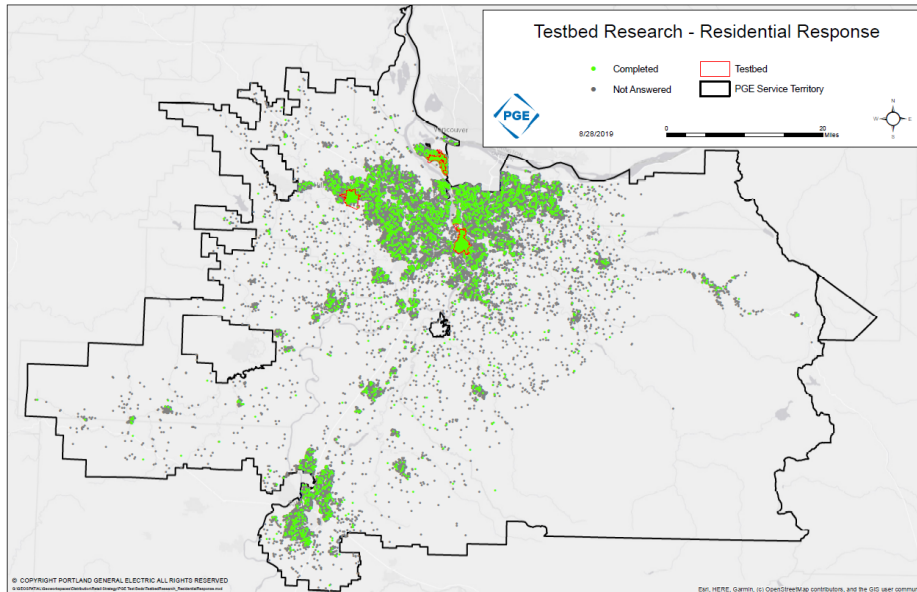
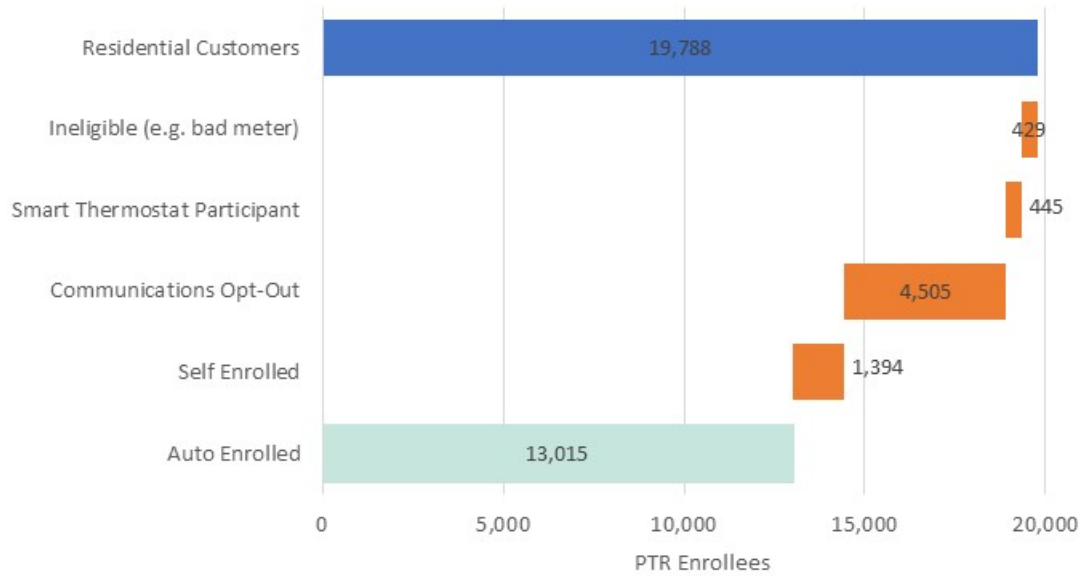


Figure 1 – Testbed Survey: Residential Responses

In July 2019, following completion of the survey, the SGTB Project launched with a coordinated marketing campaign in the three Testbed communities. Welcome mailers were produced in English, Spanish, and Russian, and sent to residential customers based on their language preference of record. The team also purchased billboards and attended neighborhood events, building awareness of the program among community businesses and residents.

In the months prior to these in-market activities, PGE filed the new Schedule 13 tariff with the OPUC. This tariff allows PGE to auto-enroll eligible residential customers in the Testbed in the Peak Time Rebate (PTR) behavioral DR program. This opt-out strategy was key to achieving the “at scale” participation called out in the Testbed proposal. In all, 13,015 customers were auto-enrolled, roughly 66% of the Testbed’s residential customer base (Chart 1).

Chart 1 – Peak Time Rebate Enrollment



Following program launch, the team began preparing for its first CVP campaign. The Phase I plan included five CVPs designed to explore various motivations for and values of participation by residential customers in demand response programs. The five CVPs are:

1. The “Monetary Incentives” Customer Value Proposition

The Monetary Incentives campaign was launched in Q4 2019 and focused on the perceived value of cash rewards for DR program participation. Monetary incentives are the standard tool used in driving customer participation in utility programs and this campaign was designed to understand how various engagement methods could be used to drive customer action. The campaign included a two-pronged strategy aimed at maximizing the participation of customers enrolled in PTR and conversion of customers from PTR to PGE’s direct load control (DLC) thermostat program. To engage customers, the Testbed team employed a multichannel marketing campaign with digital ads, mailers, telemarketing, and email. The team also incorporated outreach into existing field activities of the Asset Planning team, where groundmen on a GIS Data Integrity project distribute door hangers while in Testbed neighborhoods. The direct mail campaign resulted in a 1% conversion rate; telemarketing efforts resulted in a 3% overall conversion rate, and 6% among those customers that were actually spoken to (relative to a 1% conversion rate achieved through a similar effort conducted in 2018); digital ads resulted in a click-through rate of 0.27%, relative to an average rate of 0.08-0.12% for similar campaigns; and the door hanger campaign led to 5% of customers visiting the thermostat webpage and 3.5% of eligible thermostat customers enrolling in the program. The results of these campaign activities provided a useful baseline from which to measure subsequent CVPs.

2. The “Giving Back” Customer Value Proposition

The second CVP, Giving Back, was launched in Q1 2020. In this campaign, Testbed customers were given an opportunity to voluntarily reassign their rewards from program participation to one of three prominent Oregon non-profits: Portland Homeless Family Solutions, Oregon Food Bank, and the Oregon Energy Fund. To help encourage participation, PGE donated an additional \$5,000 to the effort. To drive awareness and participation in this CVP, the team deployed a marketing strategy that included an email campaign, direct mail, social media posts, digital ads, and coordinated outreach with the partner organizations. The results of the campaign were 304 customer signups, a conversion rate of about 3%. While higher than the 2% baseline, the team believes the campaign was hampered by technical issues that limited the ease of enrollment. Specifically, enrollment was limited to customers with an email address on file and the enrollment process could only be completed via a unique link, which could be accidentally deleted or otherwise lost. In addition to the technical limitations, most of the Giving Back enrollments that did occur did not result in donations. This was due to the season’s mild weather and the fact that 84% of enrollments took place after the season’s only PTR event, which occurred in early January 2020 a few days after the enrollment window opened. These limitations were documented and used to inform the subsequent giving back campaign which took place in the 2020/2021 winter season (see below for discussion of this subsequent campaign).

3. The “Carbon” Customer Value Proposition

The Carbon CVP was launched in Q3 2020, during the summer season from July 1 – September. This CVP focused on understanding how framing program participation in terms of avoidance of greenhouse gas emissions would influence customer participation. To make the connection for customers between load shifting and greenhouse gas emissions, the Testbed team used the generation resource most commonly on the margin during periods of peak demand, a combined cycle gas plant contracted from the California Independent System Operator (CAISO).¹⁴ PGE used a multi-channel awareness campaign that aligned “green” values of residential customers with action messaging, linking small steps to shift energy use during Peak Time Events to a clean energy future and carbon emissions reductions. The team also engaged Testbed communities in friendly competition and gamification, offering a community and individual prizes for the neighborhood with the most event participation. The final element of the campaign was customer education, with a video linking load flexibility to grid operations and PGE’s ability to rely on renewable generation. The results of this CVP were mixed, with carbon messaging alone

¹⁴ The avoided emissions methodology developed in this CVP is now being used in the general PTR program to communicate participant impact. This is part of an overall shift towards highlighting the broader value of the program, in order to encourage greater participation and retention.

appearing to have little impact on participation or program/PGE satisfaction. For example, in the A/B testing of rewards vs. carbon, we saw a 28.97% vs. 23.08% open rate for campaign emails. PTR savings results were similar, with no statistically significant difference among those customers who received the carbon messaging; although there were some indications that environmental messaging resonated more in the North Portland community, perhaps driven by customer demographics. Another learning of note was the impact of messages that mentioned customers' neighborhood by name, which outperformed all other outreach done in the previous 18 months.

4. The "Giving Back, with Lessons Learned" Customer Value Proposition

The last CVP completed at the time of this filing was the second round of Giving Back, which took place during the 2020/2021 winter season. Here the Testbed team applied multiple points of learning from the winter 2020 campaign. The first update to the campaign design was a focus on local nonprofits to increase the connection to the Testbed communities. The SGTB team worked with nonprofits located in the communities: Community Energy Project in North Portland, Working Theory Farm in South Hillsboro, and Central City Concern in Milwaukie. Next, the team updated the enrollment process, embedding it in the PGE site under the single sign-on process, eliminating the need to rely on a customer email link to connect enrollments with specific customers. This iteration of the campaign also incorporated business customers, including a promotion in which Sch. 25 smart thermostat customers were featured in a Testbed Chinook Book curated mobile coupon pack. Lastly, the team ran the program throughout the season (November - February), rather than waiting to launch until the new year, as it had in the first campaign.

These results are not yet available as the evaluation is underway. Results will be included in the final report, however, there were a few notable challenges which we anticipate will impact results. The first challenge is related to a PGE-wide website migration that occurred concurrently with the campaign launch, which we believe resulted in broken links related to customer enrollment pages. The size and extent of this issue is under investigation. The second issue was the major snow and ice event that occurred in February 2021, which resulted in PGE suspending the DR season and shifting resources to disaster response and power restoration efforts. Finally, this campaign was launched during the Covid-19 pandemic, which may have impacted customer responsiveness to the campaign.

5. The "Renewables" Customer Value Proposition

The final CVP launched in June of 2021, overlapping with the expected peak of the summer DR season. The Renewables CVP will be the most complex to date and is focused on making the link between flexible loads and the ability to rely on renewable generation and their associated benefits. The campaign will test customer response to three renewable generation benefits enabled by flexible load: reduced environmental impacts, a cleaner environment, and lower costs.

The campaign will also explore the impact of this messaging on three discrete outcomes: increased participation among PTR customers, conversion of PTR customers to DLC thermostats, and increased participation of existing DLC thermostat in events. The marketing campaign strategy for this work is still under development and results will be included in the final program evaluation, scheduled for submission to the Commission in Q1 of 2022.

1.3.4 Small and Medium Business Outreach

During implementation of Phase I, the Testbed team marketed PGE's Energy Partner Smart Thermostat (Sch. 25) program to small and medium businesses (SMBs) via a variety of channels. These include:

- Email campaigns
- Direct mail letters, postcards, and self-mailers
- Telemarketing
- Door to door personal sales outreach, and
- PGE newsletters

Although the COVID pandemic severely limited our ability to reach business customers, who were doing all they could to stay open, results confirmed that the biggest obstacle to increasing enrollments in Energy Partner was the difficulty reaching the business decision maker. Door-to-door outreach mitigates this to some extent but may not be economically scalable market-wide and even then, the decision maker is not always on-site.

In Q2, 2021 we conducted focus groups with small business owners/decision makers in the Testbed and gained some valuable insights that reinforced some improvements we will be making and testing. These include:

- Sending out marketing messages via the PGE bill in new ways (as opposed to traditional bill inserts)
- Improving our self-service enrollment microsite so customers can self-schedule their thermostat installation at the time of enrollment, reducing the chance of losing the sale between enrollment and installation
- Implementing a PGE-wide effort to establish relationships with our SMB customers by getting a better understanding of their needs

1.3.5 Demonstration Projects

During implementation of Phase I, the Testbed team and DRRC identified numerous opportunities to explore new product and customer engagement concepts within the existing Testbed budget. As these opportunities emerged, project concepts were brought to the DRRC for review. Projects deemed to be in line with the goals and intent of the SGTB plan were further developed using a standardized demonstration project framework developed jointly with

OPUC staff, for consideration by the Commission. This framework forms the basis of the Phase II proposal and approval process and will be discussed in more detail below.

To date, several projects have been approved through this process, including updates to the Schedule 13 tariff and two demonstration projects – a Ductless Heat Pump (DHP) Controls Study implemented in partnership with the Energy Trust and a Water Heater Communications study partially funded through PGE’s R&D program.

Additional projects that underwent this process, but were not approved, include a Low-Income Smart Thermostat demonstration using free public Wi-Fi, a Line Voltage Thermostat demonstration project for multifamily homes, and a Commercial and Industry (C&I) Resiliency demonstration building on Schedule 26. These projects were not approved due to various reasons, including concerns over scope, timing issues, and lack of customer host sites.

The Testbed is also host to the Clean Fuels Program’s Vehicle Telematics project, which evaluates how time-of-use (TOU) incentive structures impact electric vehicle charging patterns and use.

1.3.6 Planning and Cross-Cutting Activities

In addition to the CVP and demonstration project work, the Testbed also serves as a platform for various planning and cross-cutting activities. This work covers a broad array of topics, demonstrating the value of having a dedicated programmatic structure to host projects and research activities that span departments, funding sources, or otherwise do not fit neatly within PGE’s existing organizational structure.

The activities completed in this area include a locational value analysis on Testbed feeders; an asset inventory of single-family residential end uses; the launch of an early adopter community; the establishment and formalization of a DEI framework; a distributed energy resources management system (DERMS) technology pilot; and expanded coordination with the Energy Trust.

Lastly, though not part of any evaluation, the Testbed has operated as a change management mechanism within PGE. The Testbed has provided valuable insight into how efforts to align customer and community energy needs and burdens can be met through a customer-centric approach assisting with overall energy burden, customer bills, as well as community and customer investment. The Testbed has provided a pivot point for the company to focus on customer energy solutions. This has also led to discussions on regulatory alignment to adjust how the company can better serve all our customers more equitably.

1.3.6.1 Locational Value Analysis (Kevala)

The Testbed project launched just before PGE stood up its DRP team. To help ramp up this work, PGE engaged with Kevala to conduct a locational net benefits pilot study within the SGTB, focusing on the Testbed’s three substations and ten feeders. This study provided insight into stacked DER valuation, which combined locational asset dispatch to solve distribution constraints, with bulk system energy and demand savings typically attributed to DERs. In

addition to the report created through this effort, PGE has access to the underlying platform, Network Assessor, and will continue to explore further use cases of the data analysis and visualization capabilities as part of its broader DRP efforts.

1.3.6.2 Customer Asset Inventory (Bidgely)

Early in the implementation of the Testbed, the team identified a significant barrier to successfully achieving project goals—a lack of complete and accurate data on the major mechanical systems existing on the customer premises. These data are critical to addressing fundamental planning, strategy, and program implementation activities like quantifying the DR potential of our residential customer base, identifying gaps in the product roadmap, prioritizing new product development, and determining which customers are eligible for specific program offers. To address this data gap, the Testbed team contracted with a data science vendor to build a predictive model of HVAC, water heating, and electric vehicle charging data. The project used data from the City of Portland’s Home Energy Score program, combined with hourly AMI data to train a predictive algorithm, which was applied to all single-family residential meters in the Testbed. Modeling results were validated against known data set (e.g., PGE and Energy Trust program participation data) and the model performed as expected, with high confidence for major heating and cooling system types. After validation of these results, the modeling was expanded to the service territory’s ~500,000 single family service points. These results are now being analyzed and prepared for upload into the customer research database for use in planning and implementation activities.

1.3.6.3 Early Adopters Community

While conducting solar PV-related research, the team identified a cohort of homeowners with significant levels of DER co-adoption. In addition to solar, many of these customers owned one or more electric vehicles, an air source or ductless heat pump, grid-integrated water heaters and distributed energy storage. In many ways, these early adopters represent the end state that the Testbed efforts are striving to achieve. Given their advanced state of adoption, the team invited them to join an “Early Adopter Community” on the FocusVision Platform.

This community was organized to engage participants in conversations about new technology, products, and program design. This effort now includes an active population of users engaging with the PGE product development team on concepts ranging from water heater controls to cloud-based EV charge management. Once in the community, participants are presented questions, product concepts, and other prompts meant to foster discussion and provide insights that can be used in program and product development. Insights gleaned through this process include feedback on CVP concepts, imagery, and framing; the value and potential use of product features (e.g., smart scheduling in water heaters) and openness to utility use of these features in load management programs; and expectations around comfort, incentives, and equipment availability.

1.3.6.4 Diversity, Equity, and Inclusion

The SGTB project was designed with an explicit recognition that equity remains a significant issue within program design and delivery. In the Phase I Plan, PGE highlighted the need to address “equity considerations and concerns from stakeholders, especially those from community-based and environmental justice organizations, to ensure their voices are represented throughout the administration of the project.”

A core strategy to meeting this need was hiring dedicated staff focused on DEI. The DEI Community Outreach Consultants have focused their efforts on engaging key stakeholder groups, municipal partners, and individual customers to better understand and document the needs of underserved communities, seeking to ensure participation regardless of socioeconomic status, ability to pay, or language spoken.

Specific activities undertaken by the DEI team include: development of an Equity Lens process and checklist to better embed equity considerations into product development and program delivery; launch of a DEI work group to solicit direct feedback from community members and the community-based organizations serving them; participation in the Energy Trust’s Internal DEI team and Diversity Advisory Committee; and dissemination of key findings through quarterly insights meetings with customer-facing PGE teams.

The SGTB Community Workgroup was established as a mechanism to gain insights into barriers to entry and participation in PGE’s energy shifting programs with a particular focus on EJ communities. The group consists of ten individuals that represent and/or serve EJ communities within the SGTB, including representatives from local government and community-based organizations. Participants meet monthly over a twelve-month period and are compensated for their time and contribution through a quarterly and annual stipend. To support meaningful engagement, the workgroup receives information on energy related concepts and topics that are discussed during these meetings and asked to leverage their experience to offer community insights, considerations, and recommendations on how PGE can better serve EJ communities through its pilots, programs, and products. This effort increased accessibility for bidirectional engagement between PGE and EJ communities as well as expanded and enhanced relationships with community-based organizations and non-profits serving environmental justice communities.

1.3.6.5 Distributed Energy Resource Management System Pilot

PGE is undertaking a multi-year grid modernization effort that includes implementation of an Advanced Distribution Management System (ADMS). The ADMS will enable new operational capabilities such as distribution automation (DA), enhanced fault location, isolation, service recovery (FLISR) capabilities and a Distributed Energy Resource Management System (or DERMS). The DERMS serves as the primary point of connection between DERs and grid operation, enabling intelligent dispatch and control based on real time grid conditions data from the ADMS. Utility use of DERs as an operational resource is still relatively nascent and, as such, there are limited DERMS platforms capable of meeting the wide range of use cases sought by grid operators.

To help improve our understanding of this market and explore potential architectural approaches, PGE is conducting a DERMS demonstration that includes assets on SGTB feeders. This activity will enable future work to explore the value of location-based dispatch and control. The team will establish connections between various off-the-shelf DERMS platforms, Testbed DERs, and the newly launched enterprise ADMS. As part of this process, the team will refine use cases, implement integration standards, and test operations. Our work in this area is foundational to PGE's broader integrated grid efforts and will serve as a core component of DER operational testing planned for Phase II. This work launched during Phase I, and key planning and initiation steps will be complete prior to transition to Phase II.

1.3.6.6 Energy Trust Coordination

Phase I of the Testbed called for PGE to coordinate on new program development with other demand-side measure providers such as the Energy Trust and NEEA. Increased coordination bolsters the flexible load portfolio by helping develop new measures, increasing the impact of existing ones, and aligning customer engagement to create a more unified, consistent experience. During Phase I, the team made significant efforts to align with our territory's largest demand-side measure provider, the Energy Trust. At the organizational level, PGE and the Energy Trust have positioned staff on key committees within each other's organization. As mentioned previously, PGE's DEI team members sit on the Energy Trust's Diversity Advisory Committee, helping to share and align around a vision for supporting EJ communities.

The Energy Trust is a member of the DRRC and played an active role in developing and guiding the implementation of Phase I and the planning of Phase II. The two organizations also closely collaborated on a DOE "Connected Communities" grant application which, if funded, will bring additional resources to the region through the Flexible Feeder Project (described in Section 2.2.3.6), aimed at co-development and delivery of new measures in a section of the Testbed.

At the program level, Energy Trust staff join the SGTB weekly meeting once a month to learn about ongoing and planned activities, as well as to follow up on and plan other avenues of organizational coordination. The Energy Trust and PGE have collaborated at the project level, on the design and delivery of the DHP controls demonstration and on sharing targeting data for the Testbed's single-family water heater demonstration.

1.3.6.7 DRRC Program Oversight

Throughout Phase I, the Testbed team has maintained close coordination with the DRRC through regular quarterly meetings facilitated by the Testbed Program Manager. The structure and content of these meetings varies based on the needs of the project, but typically include updates on program statistics, a preview of planned in-market activities, and report-outs on project impacts and lessons learned. Quarterly meetings also allow the DRRC to discuss more specialized topics, like the review of major evaluation milestones. In Q4 of 2020, a dedicated series of meetings were set up to brainstorm the content and structure of a SGTB Phase II; a detailed discussion of this series of meetings is presented in Section 2.1.

1.3.7 Approved Budget and Program Spending

For Phase I, the OPUC approved a deferral budget of \$5,865,000 to cover the Program’s anticipated Development and Operation costs (Table 2). At the time of this filing, The Testbed program has incurred roughly \$1,730,000 in expenses against the deferral.¹⁵ A majority of the program underspend is related to incentives and equipment costs associated with pilots that were planned for, but did not launch during the Testbed timeline, as well as lower than expected enrollment in Energy Partner, PGE’s large commercial DR program.

The underspend from unlaunched pilots is primarily related to the single-family water heater pilot which has been impacted by delays in the manufacturer and deployment of compatible (CTA-2045 equipped) water heater models. Without this offer in market, the planned Testbed funded water heater incentives remained unspent. In response, the Testbed team, with Commission approval, reallocated a small portion of the funds to a demonstration project designed to explore communications protocols and deployment strategies that will inform a larger scale program, once the needed equipment is more widely available.

For Energy Partner, the Testbed team has been actively pursuing new enrollees within the project area and has successfully engaged several potential host customers; however, at the time of this filing they have not yet been converted to active participants and had the associated budget resources allocations. Engagement efforts will continue through the end of the program period and cost will be charged against the deferral if incurred during the program period.

Table 2 - Smart Grid Testbed Phase I Budget

Budget Category	Budget
Development Costs	
Marketing	\$ 781,000
Research and Evaluation	\$ 480,000
Staffing	\$ 1,362,000
Subtotal	\$ 2,623,000
Operating Costs	
Materials and Equipment	\$ 2,238,000
Program incentives	\$ 1,004,000
Subtotal	\$ 3,242,000
Testbed Total Costs	\$ 5,865,000

¹⁵ Reported costs include expenses that have been charged to the Testbed deferral through July close. This month end close amount may change as outstanding invoices and cost adjustments are completed.

1.3.8 Lessons Learned and Limitations

1.3.8.1 Customer Participation and Engagement

The SGTB has provided valuable insights regarding effective customer engagement in flexible load programs. The CVPs are delivering important information about the intersection between demographics and motivation and how these factors can be used to drive program design and implementation. The Testbed has also provided critical insights into an opt-out based program design, looking at event performance and levels of survivorship (continued enrollment over time) among these customers relative to opt-in participants outside the SGTB. This program has also provided a population in which to test recruitment (door hangers, telemarketing/outbound calling), program delivery strategies (same day event notification, integrated voice recordings, and event reminders), educational campaigns, and enhanced customer targeting (using asset modeling data to drive engagement). An overview of insights gained to date can be found in the SGTB Interim Evaluation Report; a complete review of program findings will be available in the SGTB Final Report scheduled for release in Q1 2022.

1.3.8.2 Accelerating Product Development

In addition to the customer insights gained through CVPs, the Testbed pilot has also helped enhanced PGE's product lifecycle process, providing an opportunity to systematically explore new technologies upstream of the product development and field test enhancements to existing products. This work has resulted in numerous enhancements to the PTR program, as well as the development of the battery storage pilot, and evaluation of numerous new flexible load product categories. In the final stage of Phase I, the team will be testing enhancements to smart thermostats, PGE's primary direct load control program.

1.3.8.3 Limitations

While effective in focusing resources and building customer awareness of the Testbed effort, the static, geographically constrained boundaries of the project have resulted in various limitations on its effectiveness as a field demonstration platform. Constraints fall into two broad areas: 1) limitations on targeted research for specific customer types, and 2) limitations on research into specific grid operational conditions.

The limitations around customer research are most impactful when it comes to the Testbed's DEI efforts. The three SGTB communities were selected to be demographically representative of the service territory to ensure that findings are representative and replicable across the broader customer base. This, however, has created challenges when research efforts are focused on specific demographic groups, who make up a smaller percentage of the population. This is the case with our DEI-focused research and has created challenges related to the statistical strength of the research findings in EJ and other underserved communities. This challenge also extends to other customer segments, which represent a critical source of potential flexibility, but may not be present in the Testbed area.

The second category of limitations related to the presence of operational challenges on Testbed circuits. The distribution infrastructure serving the Testbed communities are well constructed, with generally good power quality and reliable service. While this creates a stable base on which to test new technology and engagement strategies, it does not provide a useful environment for analyzing real world operational challenges, such as the resiliency needs of public safety power shutoff (PSPS) areas in Mt. Hood, or rural feeders with large qualifying facilities (QFs) and the associated hosting capacity issues.

Based on these limitations, Phase II recommends changes to the SGTB's geographic boundaries that will ensure an approach that is community-focused, but also flexible when it comes to project design and implementation.

Section 2 Phase II

2.1 Phase II Planning

In the lead up to Phase I, stakeholders expressed interest in a more expansive program that went beyond DR to include DERs and other flexible load resources. Ultimately, it was determined that Phase I should focus solely on DR and the associated customer value, leaving programmatic exploration of DERs for a subsequent Phase of the project.

Phase I of the Testbed did, however, contemplate a Phase II:

Phase II is necessarily less defined. Conceptually, Testbed activity will allow PGE to understand the technical and market potential of DR as well as the potential of DERs to serve long term system needs. This conceptualization is in line with results of PGE's Decarbonization Study, which highlighted the need to develop a dynamic form of DR, termed "flexible load", for PGE to reach our carbon reduction goals. The large potential for flexible loads in the Decarbonization Study was driven by high adoption rates of new electric technologies like electric vehicles and heat pumps, coupled with high participation rates in DLC programs. As a result, flexible load programs in the Decarbonization Study comprised 45-70% of the new flexible resources that were added between now and 2050 across the three low-carbon pathways, which helped drive down the costs of meeting the 2050 greenhouse gas target.¹⁶

As shown in the prior sections of this document, Phase I of the SGTB has delivered significant foundational "understanding of the technical and market potential of DR" and the "potential of DERs to serve long term system needs." Yet, based on Phase II planning discussions with the DRRC and internal PGE teams, the Testbed can deliver more value for customers and the system.

2.1.1 DRRC Engagement

The Testbed team engaged the DRRC to plan and define the approach for SGTB Phase II. Ideas and input were gathered during three meetings over Q4 of 2020. The Cadeo Group was hired to facilitate these sessions and encourage more robust feedback from DRRC members.

2.1.2 Meeting One - October

The first Phase II planning meeting was held on Thursday, October 15, 2020. Prior to the meeting, the facilitator interviewed DRRC members to discuss and document their interests and priorities for a potential Phase II. These discussions centered around three main themes:

- **ACCELERATE** - What technologies or program types are you most interested in using Phase II of Smart Grid Testbed to better understand?

¹⁶ ADV 859, Advice Number 18-14, Letter Approval April 12, 2019

- **COORDINATE** - How should Phase II of the Smart Grid Testbed inform or connect with your organization’s work?
- **PARTICIPATE** - What customer segments are you most interested in engaging as part of Phase II? What about specific geographies?

The results of these discussions were summarized and subsequently presented at the planning meeting by the respective organizations. Presenters included PNNL, ODOE, Northwest Power and Conservation Council, OPUC, the Energy Trust, and PGE. Following the meeting, the Testbed team reviewed the presented content and identified major areas identified or shared by DRRC members. These themes served as the jumping off point for the next session.

2.1.3 Meeting Two - November

The second meeting was held on Thursday, November 19, 2020, at which, DRRC members explored in detail the following six recurring areas of interest from the first session:

1. **Demand Flexibility** - Operationalizing DR to achieve locational benefits and leverage, EV adoption
2. **Electrification** - Movement toward decarbonization
3. **Resiliency** - Public safety power shut offs, response to fires
4. **Diversity, Equity, and Inclusion** - Participation by Black, Indigenous, and people of color, focus on energy burden
5. **Non-Residential** - Increased focused on multi-family and C&I
6. **Supply-Side Factors** - Determine if market actors are ready to support a program, co-measure development

The group discussed how Phase II could be used to operationalize and advance each theme, as well as how success should be measured in each area. Following the meeting, PGE used the notes from this discussion to begin creating a framework for Phase II, which was then reviewed and discussed at the third session.

2.1.4 Meeting Three - December

The third and final planning meeting was held on Monday, December 14, 2020. In this session, the Testbed team presented an initial Phase II framework based on the information and discussions that came out of prior meetings, with the goal of seeking a “temperature check” on basic concepts:

- Is PGE on the right track with a given project?
- Should PGE continue to build out the project?
- Are any pivots/changes necessary?
- Are there any projects that PGE is missing?

In laying out the framework, DRRC members were first provided with an overarching goal for Phase II, which represents a shift from the Phase I goal of developing flexible load resources and exploring customer values to a Phase II goal of operationalizing flexibility as a grid resource and understanding its use in grid management.

Following the goal discussion, the team outlined ten cross-cutting considerations. These considerations are not requirements for every activity, but rather features that Phase II projects should strive to include to help increase the impact on the flexible load market. Concepts presented include:

1. Investigation of Pricing Structures and Tariff Design
2. Application of the equity lens
3. Exploration and accelerated development of joint EE/DR measures, including co-benefits
4. Refinement of Program Structures (e.g., cost-effectiveness pathways, communications, etc.)
5. Making anonymized program data publicly available
6. Driving market development/market transformation (e.g., Trade Ally, Midstream, Workforce)
7. Building out DER Valuation (use cases, Distribution, and Transmission Ops)
8. Refining behind the meter asset modeling (space heating/cooling, water heating, EV charging)
9. Using Open Protocols for DER dispatch and control
10. Focusing on the customer (e.g., experience, journey mapping, education)

The team then reviewed key project elements sought by the DRRC members during previous planning sessions. These project elements fell into one of four broad categories: Customer, Operations/Dispatch, Planning, and Product Development, and served as the building blocks for the Phase II project concepts outlined below (Figure 2).

Customer	Operations/Dispatch	Planning	Product Development
<ul style="list-style-type: none"> • Behavioral with DLC • Rate Design Options • Transactive Control • Customer Preference/Experience 	<ul style="list-style-type: none"> • Microgrids • Operationalizing DERs • Vehicle to Grid • EV Charge Management 	<ul style="list-style-type: none"> • Electrification/Decarb • Multifamily EV Ownership Support • Non-Wires Alternatives • DER Value Streams • DR/EE Co-Benefits 	<ul style="list-style-type: none"> • New Construction • New Measure Dev/Tech Demo • Product Bundles • Resiliency • Solar Smart Inverters

Figure 2 – Phase II Project Concepts

The next point of discussion was the issue of Testbed boundaries. Phase I of the Testbed has a fixed geographic boundary, which is meant to concentrate resources and effort, driving greater awareness in the targeted communities, and achieving higher levels of DER saturation. However, the static boundary has created challenges in program implementation, limiting the potential host customer pool for specialized project types, as well as the ability to test the use of DERs to address operational challenges that may not exist in the selected circuits.

To address this, the Testbed team presented criteria the DRRC could consider in reviewing projects located outside of the existing SGTB boundaries:

1. The presence (or lack) of specific operational conditions required for project demonstration
2. The lack of availability of host customer(s), and/or
3. The cost

When one or more these conditions are present, and if appropriate for specific research questions, the Tested team proposes allowing the project to expand from the original, Phase I Testbed boundary in this order:

1. To an adjacent feeder
2. A Phase I SGTB jurisdiction
3. The broader PGE service territory (Figure 3).

This approach is meant to focus Phase II resources and flexible load deployment within the original Phase I communities, while at the same time providing the DRRC greater flexibility in approving projects outside that boundary when a project would not otherwise be viable.

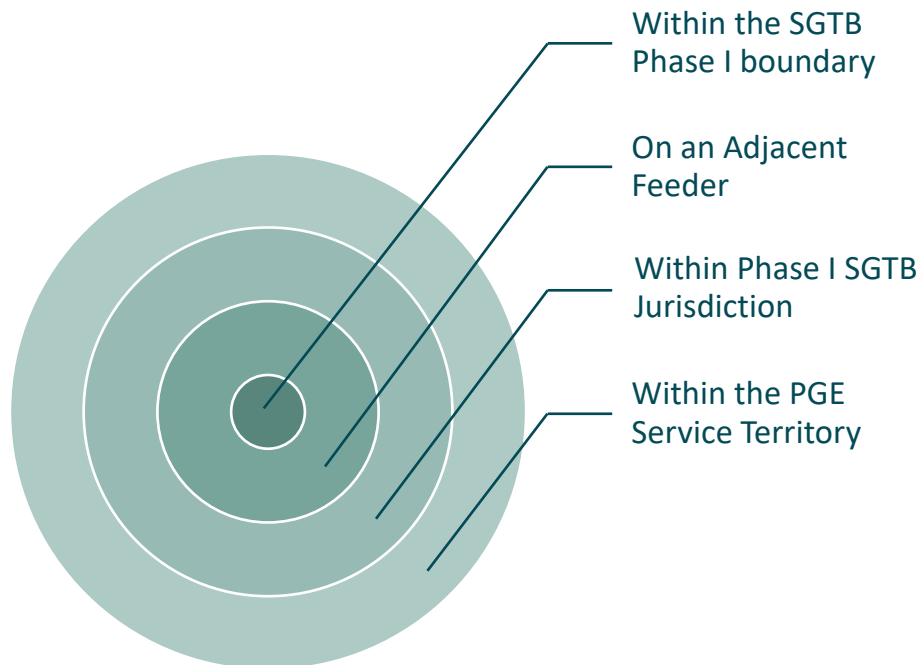


Figure 3 – Expanded Siting Options for Testbed Projects

The final topic was the research areas that would guide the Phase II effort. The Testbed team developed six specific research areas, each related to gaps and/or opportunities in PGE's existing flexible load product portfolio. These groupings are intentionally broad and interrelated, providing the DRRC with the flexibility needed to allocate resources constituting a portfolio approach that is both flexible and directed towards high value activities. The team proposed that Phase II projects be organized in one or more of the following areas:

1. New Construction Bundle
2. C&I, Municipal Flexible Load & Resiliency
3. Distributed PV/Smart Inverters
4. Multi-family Bundle
5. Managed Charging/V2X
6. Flexible Feeder
7. Non-Wires Alternative(s)

These research areas were scoped to ensure maximum coverage of the project areas called for by the DRRC (Table 3). For each area, the team presented a concept overview, expected learnings, estimated budget and participants, potential technologies/strategies that would be explored and links to the flexible load portfolio (these details are outlined in the Phase II Proposal below).

During the presentation, DRRC members engaged the Testbed team, asking questions, challenging assumptions, and redirecting the focus to better align with their understanding and interest in a follow-on Phase II program. Following the meeting, DRRC members were surveyed to gauge overall thoughts and interest in the proposed work, funding levels and priority; results indicated broad alignment among DRRC members with the plan as presented. This feedback was further substantiated through follow-up phone calls with DRRC members.

Table 3 – Phase II Research Areas

Group	Project Elements	Flex Feeder	SFR New Con	C&I / Resi	PV / Smart Inv	Multi Family	V2 X
Customer	Behavioral with DLC	X				X	X
	Rate Design	X	X	X	X	X	X
	Transactive Control				X		
	Customer preference/experience	X	X	X	X	X	X
Operations/ Dispatch	Microgrids			X			
	Operationalizing DERs	X	X	X	X	X	X
	Vehicle to Grid						X
	EV Charge Management	X	X	X		X	X
Planning	Electrification/Decarb		X				X
	Multifamily EV Ownership	X				X	X
	Non-Wires Alternatives	X		X	X		X
	Testing DERs Value Streams	X	X	X	X	X	X
	DR/EE Co-benefits	X	X	X		X	
Product Dev	New Construction		X				
	New Measure Development	X	X	X	X	X	X
	Product Bundles	X	X	X		X	
	Resiliency		X	X		X	
	Solar Smart Inverters	X	X		X	X	

2.2 Phase II Proposal

2.2.1 Program Scope and Goals

For Phase II of the SGTB, PGE proposes a five year, roughly \$11M program that builds on successes achieved in Phase I. This proposal will leverage the high levels of customer awareness, engagement and brand equity achieved over the last two years to develop a diverse portfolio of technology and market demonstration projects. These projects spread across seven research areas and will help expand and enhance PGE’s flexible load product portfolio while exploring the additional use cases and value streams of DERs.

The goals of Phase II are threefold:

1. Carry forward, and apply “at scale,” the customer-centric strategies learned in Phase I
2. Demonstrate enhanced value of flexible load/DER technologies as a grid resource, including planning and operations
3. Support the development of the product portfolio through testing of new technologies and program design, including pricing strategies, gamification, transactive control, etc.

2.2.2 Budget and Timeline

Unlike Phase I, which sought authorization to a fixed program budget for a predetermined set of program activities, the Phase II plan is structured to give the Commission, Staff and stakeholders greater oversight and control over expenditures. This approach will be more dynamic, evolving in real time alongside learnings and market developments. As such, PGE is not seeking a firm budget for Phase II, but rather providing a budget estimate and funding cap, with project level expenditures to be authorized during the review process outlined below.

Based on the Phase II planning process with the DRRC, the Testbed team estimates that the five-year effort will cost approximately \$11M (a 2% reduction in annual spending relative to Phase I). As with Phase I, the budget includes incremental limited duration staffing, incentives, and customer engagement expenditures particular to Testbed, activities that will be funded as projects begin and close, all of which will be detailed to the DRRC, Staff and the Commission through the process outline below.

If approved by the end of 2021, the program will launch in January 2022, ensuring brand continuity among Testbed customers.

2.2.3 Project Research Areas

Based on the positive feedback received during the planning process, PGE proposes building the Phase II portfolio around the research areas developed for and reviewed by the DRRC during the Q4 planning process: Single Family New Construction Bundle; C&I, Municipal Flexible Load & Resiliency; Distributed PV/Smart Inverters; Multifamily Bundle; Managed Charging/V2X; Flexible Feeder; and Non-Wires Alternative(s). As outlined previously, the specifics of projects to be pursued in these areas will be developed and approved by the DRRC; however, an overview of each area is outlined below.

2.2.3.1 Single Family New Construction Bundle

The new construction market presents unique challenges and opportunities for developing a flexible load resource. Project developers have the buying power and scale to drive down costs and the ability to incorporate the price premium associated with grid-enabled devices into the overall financing of a new home purchase. However, they also operate in a business with tight margins and will require a return on investments in grid-integrated appliances. PGE can reduce risk to the developer through upfront incentives to project developers based on future participation by the occupants of the new housing stock. Payment based on participation from future customers transfers the risk of having fronted the incentives to the developer and future occupant nonparticipation, to the utility.

This project area seeks to explore the potential value of connected homes in the new construction market to deliver cost effective load flexibility, and the associated program design that can adequately manage the risks associated for developers and PGE. The work will focus on partnering with residential developers to deploy an all-electric, flexible home bundle. In doing so, we hope to explore partnership strategies, pricing

structures and incentive designs that support an increased flexible load offering within this market segment.

The Testbed team will develop and test the effectiveness of product bundles in driving increased demand among new home buyers, as well as test new pricing strategies, tools (e.g., the line extension allowance) and rate design options. The overall goal of this effort is to better understand how PGE can partner with the Energy Trust of Oregon, developers, and builders to incorporate flexible load technology into the design/build process, securing low-cost demand flexibility potential before the customer even occupies the home.

The estimated budget for this portion of the portfolio is \$500,000, targeting up to three residential developer partners, and a goal of 200-300 participating homes. The technologies evaluated may include:

- Smart thermostat/DHP controls
- Heat Pump Water Heater
- Solar PV with smart inverter
- Battery Storage
- Home energy management system (HEMS)

2.2.3.2 C&I, Municipal Flexible Load and Resiliency

Commercial, industrial, and municipal customers have a keen focus on operational efficiency, engaging with utilities in EE and self-generation programs to reduce costs while taking advantage of incentives and other financial inducements. PGE has tapped into this model to a limited extent with its Energy Partner program, providing cash incentives for load flexibility. Now, with the continued decline in the cost of self-generation, the emergence of low-cost energy storage and a newfound focus on resiliency, there is a new opportunity for a combined offering that can bring together these business drivers to deliver customer value and grid benefit.

This project area seeks to identify pathways and strategies to achieve higher levels of commercial & industrial and municipal site participation in flexible load and resiliency programs. The team will explore enhancements to existing programs and the development of new programs with the goal of better understanding and capturing the value of participating in combined measures for EE, flexible load, and resiliency. This work will include an evaluation of engagement approaches and how to structure incentives and rates to maximize program and event participation, as well as customer value.

The estimated budget for this portion of the portfolio is \$1,500,000, targeting five large C&I sites, five municipal sites, and a hundred small-medium business sites. The technologies to be evaluated may include:

- Building Management Systems
- Self-generation
- Energy storage
- EE and DR strategies and measure installation

2.2.3.3 Distributed PV/Smart Inverters

Customer investment in distributed solar has been growing steadily in the PGE service territory. These distributed generation projects, combined with larger QF sites, have created operational challenges on certain segments of the distribution system. As the market has matured, so too has the technology embedded in the inverter. Integration and control of distributed PV through these “smart inverters” (those equipped with the IEEE 1547-2018 standard) can provide insights and support to system operation, distribution planning, and asset valuation.

Projects in this area will assess the value of inverter-based controls to deliver distribution operations value (e.g., Volt/VAR support); address hosting capacity issues, including as an alternative to PGE’s two-meter solution; and support orchestration of DERs together with distributed solar and storage to minimize grid export. Work in this area may also include rate design (e.g., fixed price) and transactive energy strategies that incentivize self-consumption and/or distribution level load balancing.

The estimated budget for this portion of the portfolio is \$1,000,000 and will target participation from 200-400 customers.

2.2.3.4 Multifamily Bundle

Multifamily is a critical customer segment, making up 33% of PGE’s residential meters, and a key source of flexible load potential. Multifamily units are generally heated with electricity via in-unit sources, and many buildings also use electricity for water heating. Multifamily is also important from an equity perspective, with disproportionate numbers of low income or other underserved customers occupying this building type. However, multifamily presents significant challenges, with high turnover rates that make customer enrollment and retention challenging and building designs that can impede device communications.

Projects in this area will assess how to scale PGE’s existing multifamily water heater offering while exploring new products, bundles, and engagement strategies to increase adoption and participation across a broader range of flexible load technologies within the segment. The effort will also test whole building load management strategies and rate design options.

The estimated budget for this portion of the portfolio is \$1,000,000 and will target three-to-five buildings, representing approximately 500 multifamily units.

2.2.3.5 Managed Charging/V2X

Electric vehicle adoption is expected to increase rapidly in the coming years, increasing electricity sales and improving the economic efficiency of grid investments. These efficiency gains, however, could be offset by the need for increased infrastructure investment if charging coincides with peak demand. Identifying effective pathways to manage EV load is essential to controlling system costs and meeting flexibility targets. A series of nimble, responsive demonstration efforts are necessary to keep pace with EV adoption and a rapidly changing marketplace.

Research in this project area will focus primarily on improving understanding of the technical paths for charge management, their costs, performance, and limitations. The work will evaluate customer acceptance of charge rate/time and location-based price signals and demonstrate vehicle-to-grid and managed charging use cases, including technical requirements, limitations, and operational considerations of various the electric vehicle OEMs and EVSE. These efforts will span multiple customer segments, including single family, multifamily, commercial and ROW charging, and fleets, overlapping with numerous other research areas. Research in this area will also explore advanced use cases, such as vehicle to grid and the associated rates structures.

The estimated budget for this portion of the portfolio is \$2,500,000 and will target 300-500 vehicles.

2.2.3.6 Flexible Feeder

As PGE's flexible load portfolio expands and its DERMS capabilities mature, there is a growing need to understand how DERs can be integrated into distribution operations and the value they provide. In this research area, projects will be developed to explore the values of DERs as an operational asset, by driving high levels of dispatchable load on a single feeder, using targeted incentives for new equipment, controls, storage, distributed solar and EE. This work will involve close collaboration between PGE and Energy Trust of Oregon, as the two organizations learn about co-deployment of DER solutions and the capabilities of a virtual power plant by investing in significant DER deployment in a traditionally underserved North Portland community historically subjected to redlining and gentrification.^{17,18} The purpose of the project is to create a concentration of resources dense enough to create or approach the capabilities of a virtual power plant.

¹⁷ <https://dsl.richmond.edu/panorama/redlining/#loc=12/45.564/-122.758&city=portland-or>

¹⁸ https://www.portland.gov/sites/default/files/2020-01/gentrification_displacement_typology_analysis_2018_10222018.pdf

This project area is closely linked to the DOE Connect Communities grant recently submitted by PGE with Energy Trust, NEEA, National Renewable Energy Laboratory and Community Energy Project. That proposal focuses its efforts on the Overlook/Arbor Lodge portion of the SGTB, a historically underserved community in North Portland. If funded, the team seeks to build a 1.4 MW flexible load resource in the community, consisting of efficiency measures, connected devices, distributed solar, energy storage, and smart charging. This community resources will then be integrated into PGE's ADMS/DERMS and optimized by NREL to demonstrate a series of bulk services, including energy, capacity, and frequency response, as well as distribution services including capacity relief, power quality, and Volt/Var optimization, including CVR. The results of this work will be shared regionally through the existing network of stakeholder groups, spurring a realignment of utility planning and operation.

The estimated budget for this portion of the portfolio is \$4,500,000 and will target a mix of 750 single family, multifamily, and commercial customers.

2.2.3.7 Non-Wires Alternative(s)

These projects will constitute a significant portfolio of activities, many of them directly addressing or otherwise overlapping with the NWA goals outlined in UM 2005 and being carried out by the Distribution System Planning (DSP) team. Where possible and appropriate, the Testbed team will coordinate with DSP on projects that can inform and/or meet the NWA goals of UM 2005, optimizing the lessons, values and benefits of both activities and reducing ratepayer burden.

This activity area has no specific budget or enrollment target as of yet. Coordination of development of a NWA within the Testbed will be reported to stakeholders and the Commission through Testbed Phase II processes, the DRRC and through docket UM 2005 activity.

2.2.4 Project Concept Development

The Testbed team will develop Phase II projects in close coordination with internal groups at PGE (e.g., Grid Products, Market Insights, Program Operations, Integrated Grid) as well as interested members of the DRRC. Collaboration on and co-development of project concepts with DRRC members was specifically requested in the Phase II planning process and tested in developing Phase I demonstrations, such as the DHP controls project.

To ensure effective collaboration, the Testbed team will create dedicated time within Quarterly DRRC meetings to discuss concepts, taking input from all interested parties, and then form a team consisting of PGE and interested DRRC members to develop the concept further.

2.2.4.1 Project Review, Approval, and Oversight Process

During Phase I, PGE and OPUC staff collaborated on the development of a demonstration project review template. The document outlined key project information in a standardized format, allowing staff to have a concise and consistent view of proposed activities. Once

developed, this process was used for the water heater and ductless heat pump controls demonstrations outlined above. Given its effectiveness in Phase I, the team plans to use a similar format for projects funded through Phase II. Proposals submitted through this process include the following elements:

- An overview of key information including the number of customers, the technology of market intervention being tested, funding source(s) and amount(s), the period of performance, as well as any contractor(s) and/or partner(s) supporting the effort
- A narrative description of the planned activities, including among other things the project goals, research questions, as well as roles and responsibilities of partner organizations
- The target population for project, specifying the targeted customer segments, enrollment goals, and the reasoning behind these selections
- A discussion of optional activities and the alternatives considered
- Information on how the project fulfills the goals of the Testbed and informs product development, including the long-term transition to Pilot and/or Program.
- Total Costs and funding sources, with anticipated O&M expenses and revenues broken down by FERC account, capital costs, and the number of FTE employees and contractors
- A timeline of activity, milestones, risks, and a risk mitigation plan
- A description of benefits to customers and ratepayers
- The evaluation strategy and performance metrics on which the effort will be measured.

2.2.5 Project Approval and Oversight

2.2.5.1 Project Approval

DER markets are dynamic, with rapidly evolving technology and software solutions resulting in the emergence of new use cases and value streams. PGE and the DRRC are seeking to design a collaborative and responsive SGTB effort that can nimbly adapt to the market and the needs of stakeholders. Given this, the Phase II plan provided here outlines the overall program goals, research areas, administrative and governance structure, as well as overall budget and timeline, but does not specify project level activities that will be implemented to achieve these outcomes, with one important exception - at launch demonstrations.

The appendices of this plan include three demonstration projects meant for consideration and approval together with the plan. These projects were included for immediate consideration because they relate to ongoing, strategic work that can be easily transitioned to Phase II and/or have long lead times that require an immediate launch to ensure that results are available with the project period of performance. (Staffing levels to accomplish and manage these projects are described in Section 2.2.6).

The at-launch demonstration projects included here are:

- Flexible Feeder
- Solar Smart Inverters
- Multifamily (new construction)
- Single Family New Construction
- V2X - Cloud-based charging pilot

Detailed project plans for each of these activities can be found in the appendices.

Additional work to be completed in Phase II is not outlined here, as it will be scoped and reviewed with the DRRC following approval and launch of the overall portfolio. As stated above, this will ensure alignment with approved portfolio goals, then be submitted to the OPUC using the proposal template.

2.2.5.2 Project Oversight

Once approved, demonstration projects will be assigned dedicated project management staffing from the SGTB team and, in specific cases, a DRRC member sponsor, who can help guide the project from ideation through implementation. Sponsors will meet with relevant SGTB staff at an appropriate cadence outside of regular quarterly meetings.

2.2.5.3 Partnerships

Specific projects may benefit from co-funding and/or joint management with regional partners (e.g., Solar smart inverter demonstrations with Energy Trust). Such collaboration will help align demonstrations with other in-market activities, ensuring program resources are being used cost effectively and that lessons learned can be seamlessly integrated into ongoing activities. Co-funded and/or co-managed projects will, in most cases, require a DRRC member sponsor to ensure organizational alignment and oversight. Report-outs on all projects will be given to the full DRRC at quarterly meetings, with the sponsor participating in delivery of the update and the associated Q&A.

Overall program reporting, including project progress reporting, budget information, and other relevant updates will be submitted to the commission on an annual basis, in alignment with the reporting requirements set out in the multiyear plan.

2.2.6 Staffing and Program Management

2.2.6.1 Staffing

Given its expanded scope, Phase II will be staffed by a larger team of PGE employees. On the program and project management side this will include a Program Manager, two Project Managers, and a Standards Engineer. The Program Manager responsibilities will encompass overall program implementation management, including stakeholder/DRRC coordination, project scoping and overall management, evaluation, and reporting functions, as well as coordinating with other program groups such as product development and distribution operations. The Project Manager responsibilities will focus on management and delivery of specific demonstration project activities, including management of scope, budget, timeline,

contractors/vendors, and project-level reporting. The Standards Engineer responsibilities will focus on technology assessment, software integrations, DER dispatch strategy, and liaising with other internal engineering groups (e.g., Distribution Operations).

In addition to the staff outlined above, the size and scope of Phase II requires three incremental resources over Phase I staffing to assist with managing the broad portfolio of work called for in this proposal. These incremental resources include two Project Coordinators and a Program Analyst. PGE will submit detailed support for the additional positions in a cost recovery proposal for the incremental costs (Appendix A-C and subsequent requests as outlined in this proposal).

We are requesting additional incremental project FTEs for two reasons: first, these positions will be limited duration; secondly, because of how projects are proposed in Phase II of the SGTB, or whether Phase II will be approved, PGE could not plan for or include the staffing as part of our general rate case request.

As with Phase I, this core team will be supported by a cross functional team from Market Insights, DEI, DSP, Marketing, and Evaluation, amongst others. Specific staff roles include Product Developers (one assigned to each demonstration project), Market Insights Analyst, Marketing Manager, Marketing Associate, DSP Planning Analyst, and DEI Consultants. Several support roles in Phase II that were previously supported through the deferral will now be supported in base rates, specifically the marketing support and DEI consultants, who are now part of PGE's core service.

2.2.7 Implementation

2.2.7.1 Program/Project Management

Phase II will be managed as a project portfolio, with centralized budgeting and reporting, and implementation tasks managed at the project level. Phase II research areas will be divided between the Project Managers who will manage the associated projects with supervision from the Program Manager and support from Project Coordinators and cross functional teams.

The Testbed and matrixed support team will meet weekly to coordinate and manage portfolio activities using standardized tracking and reporting. The SGTB team will meet with the full DRRC at least once per quarter; Project teams will meet with select DRRC members on an as-needed basis for co-funded and/or co-managed projects.

2.2.7.2 Operating Tariff(s) and Regulatory Support

PGE is proposing to extend the Schedule 13 tariff to cover the five-year duration of Phase II. Additionally, PGE will, in a future advice letter, requests broadening Schedule 13's overarching project language, eliminating the need to file for multiple tariff updates and language changes required to accommodate the activity proposed here.

During Phase II implementation, additional tariffs and/or alternative tariffed approaches may be considered and developed on an as-needed basis. These include, but are not limited to,

fixed price rate schedules, transactive energy pilots, and other specialized incentive/transactional designs. This proposal does not seek any specific tariff changes or approvals.

2.2.7.3 Education and Outreach

Phase II will continue and expand upon the outreach and education work conducted in Phase I, maintaining Testbed brand awareness, general customer outreach, education, and engagement, as well as campaigns to drive knowledge of how flexible load supports grid operation. Specific marketing plans will be developed for demonstration projects as needed, to build awareness and drive project enrollments. Education and outreach plans and costs will be outlined and incorporated into the demonstration project budgets.

2.2.7.4 Evaluation

Phase II activities will be evaluated on both a project and portfolio basis. Project level evaluations will focus on the discrete research objectives of the activity. Portfolio level evaluations will summarize project level evaluations and explore cross-cutting themes, such as exploration of a DER valuation framework, standardization of communication protocols, and customer acceptance of flexible load technology. Portfolio evaluations will be conducted at two points during Phase II, once halfway through the program and again at the end.

Given the diversity of evaluation tasks likely to be needed in Phase II, the Testbed team plans to pre-screen and select a pool of evaluators rather than rely upon a single, program-wide evaluator. The team will then release project-specific RFPs to the pool and award contracts as needed.

Evaluation plans and cost breakdowns will be outlined and incorporated into the demonstration project budgets.

Appendices

Appendix A Testbed Demonstration Project Activity: Flexible Feeder

Subject: Flexible Feeder - Planning and Launch (Years 1-2)	Date: October 1, 2021
-----------------------------------------------------------------------------	---------------------------------

A.1 Summary of Project Dashboard

Number of Customers Involved	Technology Being Tested	Funding Source	Funding Amount	Time Period	Contractor and/or partner
550-700	HVAC and Water Heater Controls and Efficiency	SGTB Phase II and DOE Connected Communities (if selected for award)	Phase II: \$985,000 (year 1-2; year 3-5 not included) DOE: \$6.9M	Jan 22-Dec 23 (Jan 24-Dec 26 will be made in subsequent request)	Energy Trust, Community Energy Project, and National Renewable Energy Laboratory (NREL)

A.2 Demand Response Review Committee (DRRC) Sponsorship

PGE requests DRRC sponsorship for this project from Energy Trust of Oregon. The success of this demonstration relies heavily on strong collaboration with Energy Trust and the SGTB team feels that executive sponsorship will help facilitate more effective scoping, implementation, and DRRC governance.

A.3 Description of Demonstration Project (Statement of the Research Question)

PGE's recently deployed Advanced Distribution Management System (ADMS) will enable a series of new grid monitoring and management capabilities. A central element of the ADMS is the Distributed Energy Resource Management System (DERMS), which enables the dispatch and control of customer-sited distributed energy resources (DERs), such as smart thermostats, distributed storage, electric vehicle charging, and smart water heaters. As these new capabilities come online, the SGTB provides a unique opportunity to field test and document the use and value of DERs as an operational grid asset. To demonstrate these capabilities, the

SGTB team proposes a project designed to drive high levels of EE and DER adoption within the historically underserved North Overlook/South Arbor Lodge neighborhood in the North Portland portion of the SGTB.

To expand the impact of this demonstration, the SGTB team will coordinate closely with Energy Trust to explore how the flexibility value of these assets can be enhanced by pairing them with targeted energy efficiency. Energy Trust has already collaborated with two utilities (NW Natural and PacifiCorp) on the development and implementation of three targeted load management (TLM) projects. These projects focused on bringing additional value to the grid by deploying existing energy efficiency and renewable energy resources to select areas, as identified by the utilities. Specifically, they sought to identify, implement, and evaluate targeted existing energy efficiency and renewable offerings that could be deployed in a short timeframe to reduce demand on utility systems at peak times in localized areas. The Flexible Feeder demonstration builds upon this body of work by incorporating the TLM strategy into PGE's broader demand response and flexible load strategy.

To achieve this outcome, PGE will drive high levels of dispatchable load in a geographically concentrated area, using targeted incentives for new and existing equipment, controls, and energy efficiency. The work will also explore and document:

- Various operational use cases
- Development and testing of program design and customer acceptance/participation,
- Interplay between dispatch strategies, operational constraints, customer preferences, and incentives, and
- Informing the Distribution Resource Planning (DSP) process related to DER adoption and grid impact/value.

To increase engagement of and participation among underserved customers, PGE will collaborate with Community Energy Project (CEP) on this project. CEP brings unique and specialized experience serving low-income and traditionally underserved communities across the greater Portland Metro area. PGE will tap into this experience, working with CEP to canvass communities in the Flexible Feeder project area, assessing opportunities for DR and EE and conveying the value of these projects to customers.

PGE projects a total of \$4.5M in funding will be required to cover the costs of project scoping, management, incentives, customer engagement, partnerships, contractors, and evaluation. At this time, we are requesting funding of \$985k to cover the initial two years of the project; the remaining amount will be outlined in a follow-on request. This is being split into two requests in order to more fully develop the scope and understand the detailed requirements of implementation. In addition, seeking authorization for implementation funds in a later request will allow the project team to understand the results of its Connected Communities funding application outlined below.

In parallel to this request, the Testbed team submitted a proposal to the U.S. Department of Energy (DOE) seeking an additional \$6.9M in Connected Communities funding to supplement and expand the impact of this work; funds that, if awarded, will be used to fund the activities of the project partners, Energy Trust of Oregon, Northwest Energy Efficiency Alliance (NEEA),

Community Energy Project (CEP) and the National Renewable Energy Laboratory (NREL).¹⁹ Federal funding will bring to the project additional resources for:

- An expanded customer engagement campaign co-managed by PGE and Energy Trust,
- Targeting and engagement of underserved communities with EE and DR,
- Analysis of the value of distributed solar with smart inverters, storage, and managed charging, which will be tested in separate Phase II demonstrations,
- Enhanced technical assistance on distribution system modeling and DERMS integration/operation, and
- Engagement of regional stakeholders to support understanding and adoption of project learnings.

The addition of DOE funding on the Flexible Feeder project will allow PGE to integrate new and existing pilots and programs within the project scope, including other Phase II demonstrations, as well as PGE’s residential battery storage pilot. In expanding this work, PGE will broaden the analysis and DER optimization framework to include the additional measures. Due to the uncertainty associated with this funding (awardees have not yet been selected/notified), PGE is contingency planning; crafting discrete demonstrations that can stand alone, while also building in scope flexibility that will allow activities to be linked together if/when resources are made available.

A.4 Participation and Type of Participant Targeted (Provide reasoning for the number)

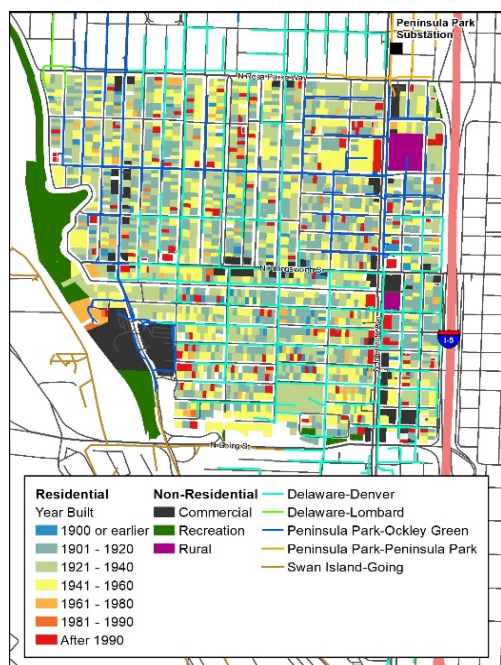


Figure 4 – Building Type and Vintage, with Distribution Infrastructure Serving Overlook/Arbor Lodge

PGE seeks to drive significant levels of DER/flexible load adoption on the distribution feeders serving the target community. The Overlook/Arbor Lodge communities include roughly 2,800 buildings comprising a mix of single-family (76.2%), multifamily (14.4%), and commercial (9.4%). The single-family stock is largely pre-war (68% built before 1940), with an average size of ~1,500ft². The multifamily stock consists primarily of smaller developments (2-4 units), however most of the multifamily residents (63%) live in larger complexes with 16 or more units. The non-residential stock is primarily small business and dispersed throughout the community (Figure 4).

We anticipate that this project, once it moves beyond the initial planning phase, will target 550-700 (or 20-25%) of the single family, multifamily, and commercial buildings in the two communities. This level of customer participation is expected to result in a flexible load resource that will allow for demonstration of bulk

¹⁹ Federal funding will not be used for direct customer incentives on materials or equipment.

services, including energy and capacity, as well as distribution services including congestion relief, and power quality.

A.5 Optional Activities or Alternatives Considered

Establishing accurate estimates for the value of DERs in grid operations is critical to building a cost-effective flexible load portfolio, meeting OPUC mandated flexible load targets, and optimizing investments of customer sided vs. utility sided infrastructure. Because these values, particularly on the distribution operations side, are heavily influenced by DER density and location, the primary alternative available to PGE is waiting until customer adoption naturally reaches a level of saturation that allows for this field testing and assessment. In addition, many of the operational schemes needed to unlock this value remain undeveloped. Developing these protocols and the associated business practices would also then wait for market maturation, as allocation of resources to that work in the absence of a near term need is unlikely.

A.6 How the Demonstration Project Fulfills Testbed Proposal Work

This proposal focuses on identifying and quantifying the value of grid services (Table 4) and the extent to which specific DERs can provide them (Table 5).²⁰ This project will improve our understanding of these values, informing program cost effectiveness and supporting increased incentives, helping to drive customer adoption and the development of PGE overall flexible load resource base. In addition, this work will support system integrations and operational learnings that will be critical to future dispatch and control of DERs for uses beyond bulk capacity, as well as enhancing and expanding PGE's coordination with Energy Trust, which are key aspects of the overall Testbed goals.

²⁰ The availability of federal funding will determine the extent to which specific services and DERs classes are tested in this project.

Table 4 – Grid Services with Service Characteristics

Grid Services	Grid Service Characteristics ²¹					
	Interval	Duration	Update Rate	Response Time	Power	Location Extent
Energy Schedule Service	hours, days	multiples of market rate	market rate (minutes)	minutes	real, +/-	Balancing area
Reserve Service	hours	multiples of market rate	market rate (minutes)	minutes	real, +/-	Balancing area, substation feeder
Regulation Service	minutes to hours	seconds to minutes	Seconds	seconds	real, +/-	Balancing area
Black Start Service	hours, days	minutes, hours	market rate (minutes)	(+): seconds (-): minutes	real & reactive, +/-	Substation feeder
Voltage Service	hours	extent of the interval	market rate (minutes)	algorithm-based	max or curves	Feeder section
Frequency Response Service	hours	extent of the interval	market rate (minutes)	algorithm-based	max or curves	Balancing area

²¹ Adapted from T. Slay and R. Bass, "Stacked services from aggregated distributed energy resources," Portland General Electric, Internal Tech. Rep. PSU-ECE PGE 023-1, September 7 2021. Services outline here align with those presented in UM 1751 Order 17-118.

Table 5 – Example Residential DER, Grid Service Characteristics, and Grid Services²²

DER	Grid-DER Service Characteristics			Applicable Grid Services
	Duration	Response Time	Power	
Water Heater - Resistance	~15 minutes	100's milliseconds	1-5 kW	Energy Schedule Reserve Regulation Black Start (load) Frequency Response
Water Heater - Heat Pump	~50 minutes	Minutes	1-1.5 kW	Energy Schedule Reserve Black Start (load)
PV/BESS Inverter	Minutes to hours	Seconds	+/- 10's kW +/- 10's kVAr	Energy Schedule Reserve Regulation Black Start (source)
	Extent of the interval	algorithm-based		Voltage Frequency Response
Thermostat (HP or AC)	Minutes to hours	Minutes	~5-10 kW	Energy Schedule Reserve Black Start (load)

A.7 How the Demonstration Project informs Pilot and Program Development (Including potential scale)

As outlined in the previous section, the results of this demonstration will have an impact on all future pilot and program activities by increasing cost effectiveness. These impacts are expected for both new and existing measures, as the results of this work will inform the quantification of value streams beyond their use as a bulk capacity resource. This project will also quantify the co-benefits of efficiency and demand response, as well as the enhanced value of co-adoption of DERs. As these values are quantified and tested, PGE will explore the extent to which they can be incorporated into incentive frameworks, enhance the value proposition for customers, and increase program participation.

A.8 Funding Source and Total Costs (Including: O&M expenses and revenues, broken down by FERC account, capital costs, number of FTE employees, and number of contractors.)

As illustrated in Table 6, below, PGE is seeking \$985,000 in SGTB Phase II funding to support the scoping and initiation (years 1 and 2) of this demonstration; the table below represents the details of this request. As the initial stages of the project near completion, the SGTB team, in consultation with the DRRC, will develop a follow-on funding request to cover the cost of subsequent years (3-5) and customer incentives; we anticipate the total amount of funding for

²² Adapted from T. Slay and R. Bass, "Stacked services from aggregated distributed energy resources," Portland General Electric, Internal Tech. Rep. PSU-ECE PGE 023-1, September 7 2021.

this activity will be \$4.5M If PGE’s application for federal funding is selected for award, an additional \$6.9M will be brought to this project and used to support PGE staff responsible for grant administrative, as well as staffing and other direct costs for partner organizations; Energy Trust, NEEA, NREL, and CEP.

Table 6 – Flexible Feeder Budget

Budget Item	Amount	Notes
PGE Staffing	\$390,000	Project Coordinator and Program Analyst staff
Hardware	\$0	No costs in this category during this phase of the project
Software & Controls	\$0	No costs in this category during this phase of the project
Customer Incentives	\$0	No costs in this category during this phase of the project
Recruitment & Outreach	\$80,000	Customer awareness and recruitment campaign launch
Low-income Customer Engagement	100,000	Canvassing of low-income communities by Community Energy Project
Evaluation	\$0	No costs in this category during this phase of the project.
Energy Trust Collaboration	\$315,000	Project Management, Modeling, and Measure Dev.
Contracts/Vendors	\$100,000	Grid Modeling and DERMS Command Development
Total	\$985,000	This amount is for project years 1-2. A subsequent project proposal will be made for years 3-5.

A.9 Timeline of Activity (Including Milestones, Risks, and Mitigation Plan)

A.9.1 Project Planning and DER Adoption Forecasting (Q1-Q3)

The project team will use customer demographics, building characteristics, and billing data to develop DER adoption forecasts. Single family and small multifamily will be segmented using load disaggregation. Small business will be researched to supplement existing data. Large commercial accounts will be engaged through PGE’s Key Customer Managers to understand opportunities for efficiency and load flexibility.

A.9.2 Campaign Development (Q4)

The team will develop promotions and campaigns to drive DER adoption. Campaigns will vary by segment, likely including:

- A fixed price, standard package for market rate single family
- Direct install, custom package(s) for low-income that is low or no cost
- Semi-custom packages for multi-family and small-medium businesses, and

- Fully custom packages for large commercial.

Project offers will build on existing energy efficiency and flexible load programs and pilots, with Testbed staff taking a lead role in coordinating measure specification across internal PGE product/program teams and Energy Trust. The Testbed team will ensure that all planned and existing measures are accounted for in the campaign development process, as well as all constraints related to cost effectiveness and operations/dispatch. Coordination will occur during regular bi-weekly SGTB meetings and through project meetings with Energy Trust staff.

A.9.3 Contractor Engagement and Training (Q4-Q5)

The team will engage regional contractors, negotiate volume-based pricing, and conduct training on the project. Contractor training will cover a range of topics, including information on utility dispatch and control of DERs and their value in grid operations, how to effectively communicate flexible load concepts to customers and address concerns/misconceptions, as well as technical information related to the installation and commissioning of approved efficiency and flexible load measures, including device setup and integration.

Milestone: Complete contractor training

Risk and Mitigation Strategy:

- Risk that contractors are unwilling to participate in the demonstration

Mitigation Strategy - The project team will leverage Energy Trust's existing contractor network, in order to build on existing relationships/partnerships in energy program delivery. PGE is also prepared to provide contractor incentives, bonuses, or other inducements to further facilitate participation.

A.9.4 Campaign Launch (Q5-Q6)

Project marketing and outreach teams will launch the marketing campaign plan. Outreach will include activities, such as community events and neighborhood meetings, to raise awareness of the project, encourage engagement, and solicit feedback and ideas to increase effectiveness.

Milestone: Launch marketing campaign to Overlook/Arbor Lodge residents

Risk and Mitigation Strategy:

- Risk that public health and/or safety conditions are not conducive to campaign activities

Mitigation Strategy - SGTB Phase I was continuously impacted by unforeseen issues, such as COVID-19, wildfires and power outages related to weather events, such as the 2021 ice storm. As a result, PGE's marketing and outreach teams have developed numerous tools and strategies to safely maintain a field presence and/or adapt to online based engagement approaches, these strategies include continued participation at select in person events where social distancing and masking requirements are enforced, as well as an increased reliance on digital channels (e.g., email, social, and web ads) and community-based advertising (e.g., billboards and neighborhood media).

A.9.5 Customer Engagement, Enrollment and Project Commissioning (Q5-Q8)

Following the campaign launch, the team will expand customer engagement, updating public information to include go-live messaging about measure availability, incentives, and pathways for residential and SMB customer participation. Engagement with large C&I will begin through key account management. CEP will begin its field efforts, canvassing low-income households, identifying savings and flexible load potential and the cost of measure deployment.

As residential customers respond to marketing activities, the team will screen and match them with partner contractors for a site assessment and project scoping. The Project Team will develop and report project activity through a dashboard which will include customer counts, measure adoption statistics and load shifting metrics on a rolling monthly basis. The Customer Engagement, Enrollment and Project Commissioning portion of this work will extend beyond Q8 into the remainder of the project. Additional funding for this portion of the project, including incentives, will be outlined in the subsequent request.

Risk and Mitigation Strategy:

- Risk that customers do not participate in the offer

Mitigation Strategy - Increase customer incentives, including adding an upfront incentive to entice enrollment. The project team may also seek other research dollars or R&D funds both with PGE and/or from partner organizations (e.g., NEEA).

- Risk that customers drop out of program

Mitigation Strategy - Continually engage customers in the research and findings, provide regular updates on energy savings and incentive earned. Proactively solicit feedback on customer experience (e.g., bill savings, comfort, etc.) and take corrective actions for negative experiences associated with program design/delivery.

A.10 Lessons to be Learned (Learning Objectives)

Once complete, this project will:

- Provide insights into the technical potential of distributed energy resources (DER) to serve as a resource for distribution and transmission operations,
- Demonstrate the combined value of building efficiency and flexible load technology to deliver grid services, while improving occupant comfort and satisfaction,
- Develop and deploy grid controls focused on scalability, resilience, and grid services, and

Develop insights into low income / underserved customer adoption of EE/DR measures.

In the first phase of the project, PGE seeks to learn a series of lessons learned that will prepare the project for advancement into the implementation phase. These objectives include:

Table 7 – Flexible Feeder Learning Objectives

Learning Objective	Success Metrics
Identify technical potential of flexible load resources in the Flexible Feeder project area	A report outlining estimated DR, EE, and flex load potential in the project area
Which EE/DR measures/packages deliver the greatest flexibility value and co-benefits	Specification of a measure package(s) to maximize flex value and realize co-benefits
How to engage and train contractors to support flexible load development	Development of a training module and feedback from training participants
Identify effective strategies for delivering combined EE/DR in underserved communities	Metric on customer engagement and recruitment into the project

A.11 Benefit to Customers and Ratepayers

More cost-effective programs design and delivery

- This research will provide insights into the co-benefits of energy efficiency and flexible loads, allowing for more cost-effective programs for technologies that provide both benefits.
- The demonstration provides an opportunity for PGE and Energy Trust to jointly implement a complex customer facing initiative, providing lessons that will inform future collaborations leading to lower cost design and delivery.

Optimize ratepayer dollars

- Though this project, PGE will quantify and document the value of flexible loads and efficiency in utility operations, enhancing the company’s framework for making capital investment decisions.
- This project will provide real world experience for grid operators on how to model, control and optimize the use of DERs, including the software, sensors and protocols that are required

Greater value to customers

- The combination of energy efficiency and flexible loads will provide participating customers with great cost savings and improved comfort.

A.12 Evaluation Strategy (Including a Final Report)

During and following completion of this demonstration, SGTB and Energy Trust, will evaluate and at the close of the activity, report the results of the demonstration to the Commission. These findings will include impact results related to the ability of DERs to function as an operation resource for PGE across all tested value streams (bulk system and distribution operations, as well as the value of incorporating energy efficiency into flexible load measure deployment). In addition, the project will also report on qualitative, process evaluation impacts

related to the lessons learned in joint PGE-Energy Trust program design, delivery, and evaluation, and lessons learned related to PGE grid operations, including any new processes or protocols developed to support the operationalization of DERs as a grid resource.

Following scoping of the evaluation by PGE and Energy Trust, PGE will issue an RFP for a third-party evaluator. PGE will report the outcome of the RFP to the DRRC. A specific funding amount for the evaluation component of this work will come in a subsequent request, but the SGTB team anticipates evaluation costs will be on the order of \$300,000.

It should also be noted that the work outlined here is limited to the first 2 years of a 5-year project and no specific evaluated results are expected during that period. The project team will, however, report to the DRRC and Commission at least quarterly on the status of the project, including any major accomplishments, barriers, and/or proposed changes to scope. The Testbed team will also hold a dedicated meeting, or dedicated portion of an existing DRRC meeting, near the end of the Flexible Feeder planning phase to review learnings and outline implementation phase scope, budget, and learning objectives.

Appendix B Testbed Demonstration Project Activity: Managed Charging/V2X

Subject: Telematics-based Managed Charging

Date: October 1, 2021

B.1 Summary of Project Dashboard

Number of Customers Involved	Technology Being Tested	Funding Source	Funding Amount	Time Period	Contractor and/or partner
800 - 1,200	Telematics-based EV charge management	SGTB Phase II	\$872,200	Jan 2021-December 2023	N/A

B.2 Description of Demonstration Project (Statement of the Research Question)

PGE seeks to perform managed charging of electric vehicles (i.e., actively controlling the time, rate, and/or duration of electric vehicle charging), using on-board telematics to optimize charging around grid considerations, such as wholesale prices, the emissions intensity of generation, bulk capacity needs, distribution congestion, and equipment health (e.g., keeping transformer loading with equipment rating).

The demonstration will employ charge management software capable of accessing vehicle manufacturer's cloud systems through an API. PGE is currently contracting with a telematics based managed charging provider, testing basic operations and customer acceptance with funding provided through the Clean Fuels Program (CFP). PGE proposes to build on the CFP efforts, incorporating more sophisticated controls, charge management strategies and integrations with PGE distribution operations systems, such as the ADMS.

In this demonstration, PGE will control the timing of EV charging, while ensuring that vehicles meet the operational needs of participants (e.g., state of charge is at or above minimum requirements at planned departure time). The objective is to better understand how managed charging can reduce the negative impacts of high EV adoption rates and turn them into an operational asset.

B.3 Participation and type of participant targeted (Provide reasoning for the number)

PGE will recruit customers with compatible electric vehicles (those sold by vehicle manufacturers who provide API access to their cloud) and who have installed residential Level

II chargers.²³ Customer will be recruited using various strategies, including direct customer outreach, web ads, driver forums/community boards. Recruitment will seek to achieve high levels of participation of EV drivers that take service within a discrete area of the distribution system (e.g., substations, feeders, and/or service transformers), targeting those areas with the highest adoption rate. This concentration of participants will allow the demonstration to test both bulk system and distribution-based locational use cases.

The existing CFP telematics charging project has an enrollment cap of 500 vehicles. Recruitment for that project will not include any geographic targeting, due to its focus on testing basic functionality. For the Phase II demonstration, we plan to build on this population of enrollees, expanding the range of participating OEMs, the overall number of customers, and the concentration of enrollees in the targeted geographic area(s).

The goal for this demonstration is to supplement the existing customers with 800 - 1,200 additional customers drawn from 2-3 high adoption feeders (those with 20% or more EV premises).²⁴ By targeting this level of adoption on high penetration circuits, the project will have a greater likelihood of successfully demonstrating the impacts of managed charging on power quality (e.g., reactive power, voltage), reliability, and operational flexibility.

B.4 Optional Activities or Alternatives Considered

Management of electric vehicle charging based on grid conditions is an important roadmap item for PGE and is a feature being considered in the EVSE program; however, implementing this strategy in a charger-based program presents numerous technical challenges, including:

- Data on plug-in time (when a vehicle is parked, plugged in, and not charging)
- The ability to capture user preferences related to state of charge and departure time, and
- Initiating active charging events that can override vehicle-based scheduling.

While these issues are actively being explored through the EVSE-based program, the telematics route embeds these features into the standard product offer and may provide a more expedient and efficient path towards active charge management. In addition, telematics-based charge management may also facilitate more effective roll out and implementation of EV TOU rates, allowing TOU pricing signals to drive charge scheduling, while conforming to a customer's predetermined operational needs and preferences.

B.5 How the Demonstration Project fulfills Testbed Proposal Work

This demonstration supports SGTB goals by providing insight into the potential of telematics-based charge management to support PGE's flexible load portfolio. The project also drives

²³ Currently, Tesla is the only vehicle OEM that has made APIs available for telematics-based charge management. PGE has spoken with various industry experts and anticipates a number of other major OEMs to follow suit in 2022, rapidly expanding the pool of eligible vehicles.

²⁴ Based on currently available vehicle adoption data (Q1 2020), very few circuits have this level of adoption; however, EV purchase/lease rates have been rising rapidly and our expectation is that such circuits will become more prevalent over the course of this work. PGE may also target circuits with lower levels of adoption that have strategic value, such as Flexible Feeder project circuit.

expanded coordination between PGE’s grid products and operations teams, which will be instrumental for tapping into DER value streams beyond their use as a bulk capacity resource.

B.6 How the Demonstration Project informs Pilot and Program Development (Including potential scale)

The results of this demonstration will be extremely impactful to PGE’s electric vehicle pilot and program development efforts. It expands PGE’s understanding of a new EV charge management strategy, building new pathways into this growing source of load, and insights into vehicle use and charging behavior through the telematics data stream.

These learnings are critical given Oregon’s statewide ZEV goal, which is expected to result in an estimated 2.5 million new ZEVs by 2035, a majority of which will reside in the PGE service territory.

B.7 Funding Source and Total Costs (Including: O&M expenses and revenues, broken down by FERC account, capital costs, number of FTE employees, and number of contractors.)

As illustrated in Table 8, below, PGE is seeking \$872,200 in SGTB Phase II funding to support this 3-year demonstration project; the table below represents the details of this request. The project builds on an on-going telematics-based DR program, funded through the Clean Fuels Program (CFP).

Table 8 – Managed Charging/V2X Budget

Budget Item	Amount	Notes
PGE Staffing	\$187,200	Project Coordinator and Program Analyst staff
Hardware	\$610,000	No costs in this category
Software & Controls		Licensing for telematics platform and vehicle control, includes customer enrollment and ongoing incentives
Customer Incentives		
Contracts/Vendors		Grid modeling and simulation of dispatch value
Recruitment & Outreach		Customer awareness and recruitment campaign launch
Evaluation	\$75,000	Third party evaluation contractor
Total	\$872,200	

B.8 Timeline of Activity (Including Milestones, Risks, and Mitigation Plan)

B.8.1 Project Planning (Q1)

The Testbed team will consult with the telematics service provider, PGE grid operations teams, and the DRRC to develop technical requirements for the demonstration. These requirements will be incorporated into a project scope of work for review by the DRRC.

Milestone: All costs and technical requirements are identified, and the project scope of work is complete.

B.8.2 Contracting (Q2)

PGE Contracting will engage with our existing telematics vendor to establish contract pricing and terms.

Milestone - Execute Scope of Work with telematics vendor.

B.8.3 Customer Recruitment Campaign (Q3-Q4)

The SGTB team will conduct outreach to potential participants, targeting portions of the service territory with high levels of electric vehicle adoption. The project team will use a number of existing datasets to support this effort, including load disaggregation data and customer load research products. Customer will be made aware of the project using various strategies, including direct customer outreach, web ads, driver forums/community boards. Participants will be offered a cash incentive for enrolling in the demonstration and on-going incentives for their continued participation. As customers enroll in the demonstration, they will complete a digital handshake between their vehicle OEM cloud account and the telematics vendor's software platform, enabling optimization of charging based on utility and participant requirements.

Milestone - Recruit at least 800 participants from the 2-3 targeted feeders.

Risk and Mitigation Strategy:

- Risk that customers do not participate in the offer

Mitigation Strategy - Increase customer enrollment incentives. PGE may also consider partnering with and providing vehicle OEM incentives to assist with recruitment.

B.8.4 Active Charge Management (Q5-Q12)

Once the customer enrollment window has closed, the project team will begin active charge management. Charge management will be used to optimize electric vehicle load around a range of operational considerations and use cases; many of these strategies will require real or near real-time insights into grid conditions.²⁵ The demonstration will use the variability in participant vehicle composition and feeder typology to explore how these factors impact various use cases.

Risk and Mitigation Strategy:

- Risk that customers drop out of program

Mitigation Strategy - Continually engage customers in the research and finds, provide regular updates on energy savings and incentive earned. The telematics vendor's existing software suite includes a customer engagement feature that provides updates on participant performance and cost savings. The project team will monitor customer

²⁵ To support this activity, the demonstration project team will work with the PGE's Integrated Grid and IT teams to explore data integrations via the Advanced Distribution Management System (ADMS).

retention and consider adjusting the frequency and content of this messaging if necessary.

Decision Point - Consider opening recruitment back up to replace attrition of more than 20% of participants.

B.9 Lessons to be learned (Learning Objectives)

The primary goal of this project is to assess the capability of telematics-based EV charge management to provide value in grid operations.

In addition to the goals listed above, the project will also provide insights into:

- How variations in the structure and capabilities of OEM APIs impacts the value of their vehicles in utility operations,
- The technical requirements, costs, and benefits of telematics-based charge management vs. EVSE-based charge control options, and
- User satisfaction and acceptance of telematics-based EV charge management and incentive structures that would be required to scale this type of offering in the future.²⁶

B.10 Benefit to Customers and Ratepayers

More cost-effective programs design and delivery

- This demonstration provides an opportunity to test the viability of using telematics-based charge management, which has the potential to dramatically expand the pool of EV drivers participating in PGE's flexible load programs.

Optimize ratepayer dollars

- This project, PGE will quantify and document the value of EV charge management in utility operations, enhancing the company's framework for making capital investment decisions.

Greater value to customers

- The telematics demonstration provides a path for existing EV drivers who installed a legacy EVSE that is non-program eligible or new EV owners who prefer to use the EVSE from their vehicle OEM (e.g., Tesla) to participate in PGE's EV flexible load offering.

B.11 Evaluation Strategy (Including a Final Report)

²⁶ This project will test a range of managed charging optimization strategies based on price signals from wholesale energy down to localized capacity. These values vary widely over time and space and PGE seeks to explore how they can be translated to customer level incentives, both in terms of incentive amount and structure (e.g., upfront incentives, pay for performance, and monthly or seasonal incentives). In selecting and testing incentive structures, the Testbed team will engage with DRRC members to assess and prioritize various design options.

Following the completion of the demonstration, the SGTB team will present to the Commission an evaluation of project activities and results. These findings will include impact results related to:

- the ability of telematics-based EV charge management to function as an operation resource for PGE across all tested optimization inputs
- wholesale prices
- the emissions intensity of generation
- bulk capacity needs
- distribution congestion
- equipment health (e.g., keeping transformer loading with equipment rating).

The evaluation will also include feedback from customers on their experience with the project, including satisfaction with incentives, performance and functionality of the vendor platform, and impact on vehicle use.

The SGTB team will issue an RFP for a third-party evaluator to conduct this work. PGE is requesting \$75,000 to conduct this evaluation, which will be completed within 3 months of project completion.

In addition to the formal evaluation, the project team will report to the DRRC and Commission at least quarterly on the status of the project, including any major accomplishments, barriers, and/or proposed changes to scope.

Appendix C Testbed Demonstration Project Activity: Smart Inverter

Subject: Smart Inverter Demonstration

Date: October 1, 2021

C.1 Summary of Project Dashboard

Number of Customers Involved	Technology Being Tested	Funding Source	Funding Amount	Time Period	Contractor and/or partner
Up to 500 new and existing solar PV customers spread across 2-3 feeders	Smart PV inverters features and communications with PGE's DERMS	SGTB Phase II Funding	\$1,000,000	Q1 2022 - Q4 2024	Energy Trust of Oregon, National Renewable Energy Laboratory (NREL), SolarEdge, and Enphase

C.2 Description of Demonstration Project (Statement of the Research Question)

Smart inverter capabilities are now standard on many PV systems being interconnected onto PGE's distribution system. An increasing number of PV systems already installed include an inverter that is capable of being remotely updated to enable smart inverter capabilities to provide grid services. The latest smart inverter standard (IEEE Std 1547-2018) includes a range of grid support functions that can be optimized by grid operators - such as voltage regulation, frequency support and ride through capabilities--making it a potentially valuable resource for managing the distribution system.

PGE is currently dealing with various considerations related to distributed solar, including a lack of visibility into system production creating challenges for grid operations, the need to curtail or otherwise throttle solar PV on circuits at or near their hosting capacity limits, and interest in the value of distributed PV as an operational resource. This demonstration will explore these issues, and document the costs, capabilities, and technical requirements of integrating smart inverters to PGE's Distributed Energy Resource Management System (DERMS) to:

- Capture real-time data on system generation, which will allow for verification of system operations and more accurate distribution load modelling,
- Enable active control of system output in order to throttle or curtail generation when distribution feeders are at or near their hosting capacity limit, replacing the existing practice of adding a second meter at the point of interconnection, and

- Operationalize solar PV systems equipped with smart inverters to support distribution operational needs, such as providing Volt/VAR support.

A key element of this work will be assessing the readiness of existing DERMS platforms and their integrations between inverter OEMs and PGE’s Advanced Distribution Management System (ADMS) to perform this work. PGE will use, to the extent practical, existing vendors, communications pathway(s), and dispatch strategies in the implementation of this demonstration. This strategy will maximize the value of existing investments and reduce overall demonstration costs.

To implement this demonstration, PGE will partner with Energy Trust of Oregon, SolarEdge and Enphase on API integrations between their cloud systems and our DERMS platform.

- Energy Trust plays a leading role in Oregon’s solar market, administering a solar incentive program, managing a solar trade ally contracting community, and educating customers on solar technology.
 - PGE will also work with Energy Trust on the project to administer incentives, train contractors and educate new and existing solar customers on the goals of the project and its value to participants.
- SolarEdge and Enphase are the leading smart inverter OEMs in Oregon, together representing a majority of smart inverter capacity. being installed. Both inverter manufacturers have equipment that is internet connected and can be remotely upgraded to enable grid interactive functionality.

C.3 Participation and Type of Participant Targeted (Provide reasoning for the number)

The demonstration project will focus on new and existing solar customers located on one of three feeders: two rural feeders at or near hosting capacity limits, and one urban feeder with voltage or other power quality issues. The two rural feeders will be located outside of the Phase I Testbed boundary, as the 10 feeders inside the boundary do not have adequate solar adoption to warrant active testing of device curtailment/throttling. The remaining circuit will be located inside the Phase I boundary, possibly overlapping with the Flexible Feeder project area, if feeder characteristics are conducive to that selection. PGE seeks to recruit a total of 500 customers across these three circuits, equal to roughly 4.2 MW of installed capacity.²⁷ Based on initial modeling, PGE believes this base of customers is sufficient to explore the learning objectives outline below in Section D.9.

C.4 Optional Activities or Alternatives Considered

Currently, PGE does not have a means of gathering operations data, or controlling the output of solar generation interconnected to its system. This creates significant operational challenges. The company is currently offering a two-meter solution to curtail generation on generation limited feeders; however, this option is expensive, requiring additional metering and staff costs, cannot be effectively scaled, and provides a relatively crude means of managing

²⁷ The capacity target for enrolled customers is based on initial estimates by PGE standards engineers.

over-generation. The demonstration proposed here represents a more cost-effective pathway to achieve the same ends by relying on the telemetry and control embedded in the inverter.

C.5 How this Demonstration Project Fulfills Testbed Proposal Work

This project supports SGTB goals in multiple ways. First, the project seeks to integrate a DER class not previously included in PGE's product portfolio. The demonstration also seeks to quantify and document operational value streams of solar smart inverter systems, while establishing the IT and procedural requirements needed to incorporate them into distribution operations. Finally, the success of this project is contingent on establishing a new programmatic partnership with Energy Trust, an important goal of the Testbed.

C.6 How the Demonstration Project informs Pilot and Program Development (Including potential scale)

The results of this demonstration will be very impactful on the future pilot and program development of future solar programs. It will provide insights into how PV systems are operating at the inverter and create new pathways for active management including throttling or curtailment, thereby lowering the cost of future interconnections. Depending on the results of this demonstration, the project may also result in new payments to solar customers, based on the value streams their systems provide the distribution system (e.g., Volt/VAR support, frequency response).

C.7 Funding Source and Total Costs (Including: O&M expenses and revenues, broken down by FERC account, capital costs, number of FTE employees, and number of contractors.)

The PGE is seeking \$1,000,000 in SGTB Phase II funding to support this 3-year demonstration; the table below represents the details of this request.

Table 9 – Smart Inverter Budget

Budget Item	Amount	Notes
PGE Staffing	\$300,000	Project Coordinator and Program Analyst staff
Contractors/vendors	\$100,000	Alignment with ongoing research and support in dispatch optimization ²⁸
Software & Controls	\$150,000	Smart Inverter OEM integration and cloud fees ²⁹
Customer Incentives	\$230,000	Up front and on-going incentives for solar customers ³⁰
Recruitment & Outreach	\$50,000	Customer awareness and recruitment campaign launch
Evaluation	\$50,000	Third party evaluation contractor
Energy Trust Collaboration	\$120,000	Project Management, Modeling, and Measure Dev.
Total	\$1,000,000	

C.8 Timeline of Activity (Including: Milestones and evaluation)

C.8.1 Project Planning and Preparation (Q1-Q4)

The Testbed team, in coordination with Energy Trust, will consult with industry stakeholders (DERMS providers, Inverter OEMs, and solar contractors) to gather additional information on the cost structures, features/capabilities, and limitations of smart inverters. Next, the SGTB team will work with distribution planners and engineers to characterize possible host feeders and down select to the target areas. During this phase of the project, PGE’s Legal and Regulatory Affairs teams will review existing tariffs, customer agreements, and regulations related to interconnection and solar net metering to assess if any changes are required. Finally, PGE’s Integrated Grid team will document the architectural requirements of the project, contract for, and manage integrations with inverter OEM clouds.

²⁸ PGE will contract with the National Renewable Energy Laboratory (NREL) on this project. NREL currently supports smart inverter research in California (Rule 21 and a separate project with San Diego Gas & Electric), as well as Hawaii. NREL support will ensure that PGE’s efforts are building on, rather than recreating, existing work in this area.

²⁹ As with other grid integrated DERs, there are two broad categories of costs: 1) upfront integration fees required to establish a link between the OEM cloud systems and the DERMS platform, and 2) ongoing cloud services fees to maintain the connection and manage data. Based on our experience, PGE anticipates that only a small portion of this cost would be ongoing. Additional start-up costs would most likely be incurred if additional inverter OEMs were added to this type of project.

³⁰ Incentive structure is to be determined but will most likely include a combination of upfront enrollment incentives and on-going performance or seasonal incentives. Ultimately, funding will be needed to encourage customers to enroll their systems into the demonstration and then compensate them for the service(s) they provide and/or the value of lost generation (using PV for reactive power could reduce real power output and bill savings).

Milestone - Complete stakeholder assessment of smart inverter characteristics, tariff review, select host feeders for demonstration project, and complete inverter OEM/DERMS integrations.

C.8.2 *Customer Recruitment and Implementation (Q4-Q7)*

The SGTB team will work with Energy Trust to establish the programmatic infrastructure needed to incentivize customers for participation in the demonstration. Next, Energy Trust will target existing solar customers interconnected to the 3 target feeders using grid topology and interconnection data from PGE, as well as Energy Trust solar rebate data. Energy Trust will also screen new solar rebate applicants for participation. Participants will be offered a cash incentive for enrolling in the demonstration and on-going incentives for their continued participation. As customers enroll in the demonstration, their systems will be linked in the OEM cloud to PGE's DERMS platform, enabling remote monitoring and control of system operation.

Milestone - Recruit up to 500 new and existing solar PV customers interconnected on one of the targeted feeders.

Risk and Mitigation Strategy:

- Risk that customers do not participate in the offer
- Mitigation Strategy - Leverage Energy Trust existing connection to customers through solar incentives. For new customers, Energy Trust may begin offering higher incentives for smart inverter-based installations that are interconnected to the DERMS platform. PGE may also consider partnering with and providing SPIFFs to solar contractors with recruitment.

C.8.3 *Active Monitoring and Control of Smart Inverters (Q6-Q12)*

Overlapping with the customer enrollment period, the project team will begin active monitoring and control of enrolled smart inverters. The monitoring and control strategy will focus on demonstrating the research objectives outlined above. The demonstration will use the variability in participant system sizing and feeder typology, to explore how these factors impact the various use cases and research goals.

Risk and Mitigation Strategy:

- Risk that customers drop out of program
- Mitigation Strategy - Continually engage customers in the research and finds, provide regular updates on system production impacts and incentive earned. The project team will monitor customer retention and consider reopening recruitment and/or increasing incentives to customers if customer attrition on any single feeder is more than 20% of enrolled participants.

C.9 Lessons to be Learned (Learning Objectives)

The primary goal of this project is to assess the capability of solar smart inverters to support utility planning and operations.

In addition to this overarching goal, the project will also:

- Validate the extent to which smart inverter DERMS integrations can be used to collect real time operational data on PV generation output in support of distribution planning,
- Test the capability of smart inverters to throttle or curtail generation, and/or limit the need for throttling/curtailment, thereby replacing the existing two-meter solution on generation limited feeders,
- Quantify and document the value that smart inverters can provide in supporting distribution operations,
- Document the technical requirements and costs of smart inverter integration into the utility DERMS platform.

C.10 Benefit to Customers and Ratepayers

More cost-effective program design and delivery

- This demonstration provides an opportunity to test whether smart inverter integrations can serve as an alternative to the two-meter solution, reducing the costs and time, for PGE and contractors, associated with interconnecting NEM customers on feeders with hosting capacity constraints.
- The project will help assess whether the live data feed from smart inverters can assist Energy Trust in determining quality installation and system performance, which would save time and money related to pre-incentive inspections.

Greater value to customers

- The smart inverter demonstration provides a path for new and existing solar customers to potentially access new incentives and payments for the value that their systems provide in distribution operations.³¹

C.11 Evaluation Strategy (Including a Final Report)

Follow completion of the demonstration, the SGTB team will present to the Commission an evaluation of project activities and results. These findings will include impact results related to the ability of the smart inverter integrations to:

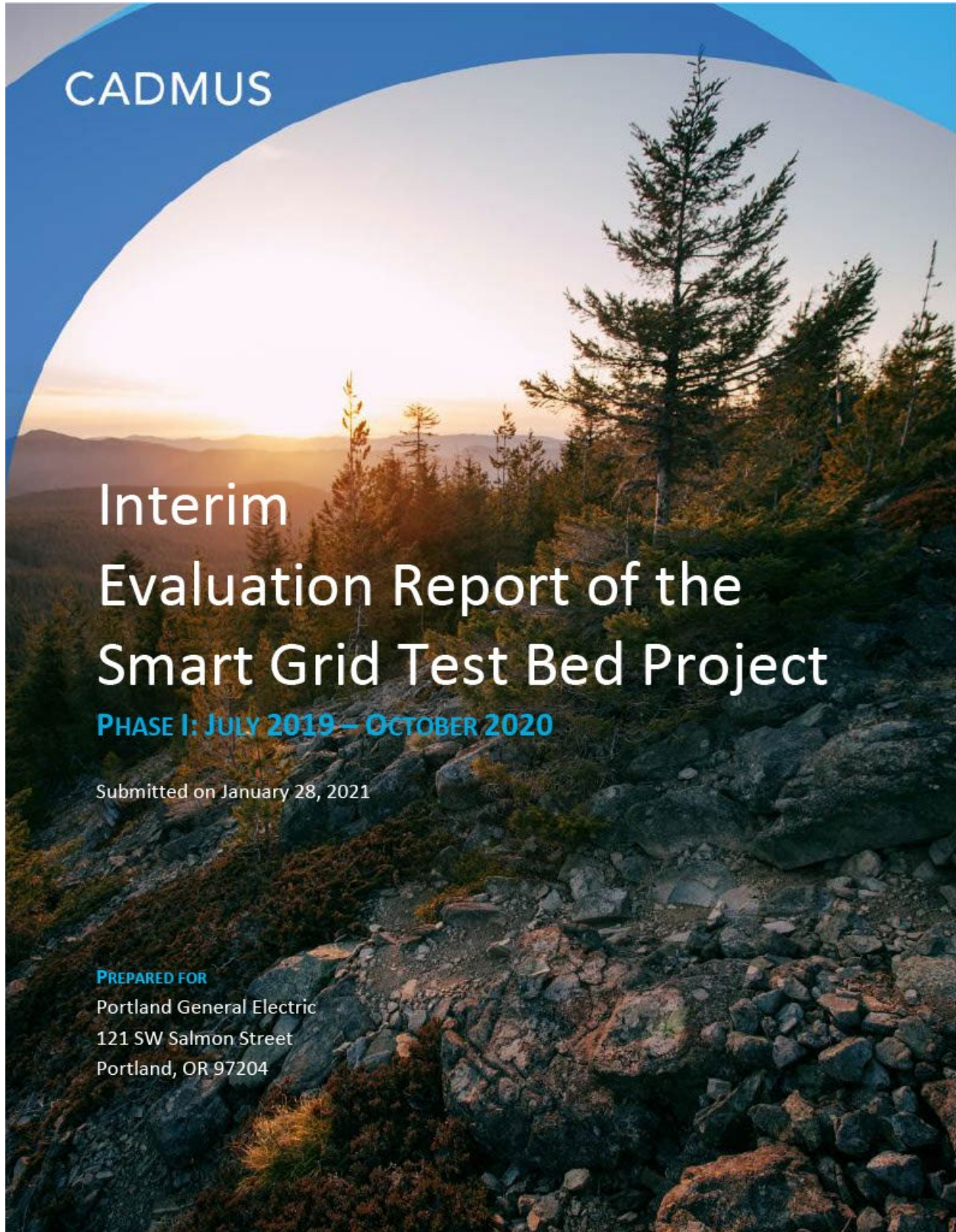
- Capture real-time or near real-time data on PV production to assist in distribution operations,
- Serve as a replacement for the existing two-meter solution on feeders at or near hosting capacity limits, and
- Support distribution operations by providing services such as Volt/VAR support.

The evaluation will also include impacts on the performance of participating PV systems and the value of incentives relative to lost production. The SGTB team will issue an RFP for a third-

³¹ This demonstration will not evaluate the effectiveness of incentives to drive customer participation but will rather focus on determining the value(s) these systems can provide in utility operation, which can then be incorporated into a future incentive design if the technology is scaled up to a pilot or program.

party evaluator to conduct this work. PGE is requesting \$50,000 to conduct this evaluation, which will be completed within 3 months of project completion.

In addition to the formal evaluation, the project team will report to the DRRC and Commission at least quarterly on the status of the project, including any major accomplishments, barriers, and/or proposed changes to scope.



CADMUS

Interim Evaluation Report of the Smart Grid Test Bed Project

PHASE I: JULY 2019 – OCTOBER 2020

Submitted on January 28, 2021

PREPARED FOR

Portland General Electric
121 SW Salmon Street
Portland, OR 97204



PREPARED BY

CADMUS

Scott Reeves
Jim Stewart, PhD
Masumi Izawa
Marisa Hobbs
Phillip Kearns
Jeana Swedenburg

LARKSPUR ENERGY

Marianne Steiner

TABLE OF CONTENTS

Acronyms ii

Terms and Definitions iii

Executive Summary..... 1

 Research Objectives and Approach..... 2

 Conclusions..... 3

 Pathways for Increasing Residential Demand Response Potential 10

 Recommendations..... 11

 Future Research..... 14

Introduction 15

SGTB Phase I Project Description and Activities..... 17

 SGTB Organization and Roles 17

 Residential Approach 18

 Nonresidential Approach 21

Evaluation Objectives and Approach 24

 Evaluation Design 24

 Evaluation Activities 25

Residential Evaluation Findings 29

 SGTB Key Performance Indicator (KPI) Goals 29

 Awareness and Knowledge 31

 PTR Event Participation and Load Reduction 33

 Customer Satisfaction and Resonance 47

 PTR Enrollment and Retention 52

 Smart Thermostat DLC Migration..... 56

 Community Engagement and DEI..... 62

Nonresidential Evaluation Findings..... 70

 Schedule 25 Energy Partner Smart Thermostat Program 70

 Schedule 26 Energy Partner Program 73

Appendix A. Residential SGTB Logic Model A-1

Appendix B. Evaluation Methodology B-1

ACRONYMS

Acronym	Definition
AMI	Advanced metering infrastructure
CBOs	Community-based organizations
CVP	Customer value proposition
DEI	Diversity, Equity, and Inclusion
DER	Distributed energy resource
DLC	Direct load control
DRRC	Demand Response Review Committee
HVAC	Heating, ventilation, and air conditioning
KCMs	Key customer managers
kW	Kilowatt
kWh	Kilowatt-hour
MW	Megawatt
OPUC	Oregon Public Utility Commission
PGE	Portland General Electric
PTR	Peak Time Rebates
RCT	Randomized controlled trial
SGTB	Smart Grid Test Bed (see <i>Test Bed</i> in Terms and Definitions for description)

TERMS AND DEFINITIONS

Term	Definition
Control Group	Control group refers to nonparticipants matched to PTR enrollees through propensity score matching used in the Flex 2.0 Impact Evaluation. The electricity demand of the control group provided a baseline for measuring the PTR event demand impacts and for comparing rates of Smart Thermostat program enrollments outside of the SGTB.
Control Keepers	Control keepers refers to a segment of PTR enrollees in the SGTB that cited concerns regarding ceding control of their thermostats as a reason for not participating in a DLC program (Source: Cadmus CVP 1/CVP 3 Surveys)
CVP	Customer value proposition refers to PGE messaging campaigns that are tested as a component of the SGTB project residential implementation.
Energy Partner	PGE’s nonresidential demand response programs for business customers, composed of Schedule 25 (smart thermostat DLC) and Schedule 26 (custom) offerings.
Flex Pilot Program	Flex is PGE’s pricing and behavioral demand response pilot program, which launched in 2016 and tested residential time of use (TOU) rates, peak time rebates, and behavioral demand response over two years. Starting in April 2019, PGE revised the design (Flex 2.0) and began offering an opt-in PTR to residential customers. In July 2019 under the SGTB project, PGE utilized the same PTR product under the Flex pilot to automatically enroll customers in the Test Bed if they had not previously self-enrolled.
Flex PTR	Flex PTR refers to the PTR offering outside of the SGTB in which participants must self-enroll.
Hazard Rate	Hazard rate is defined as the likelihood of unenrollment from PTR conditional on being enrolled. The daily hazard rate is calculated as the number of unenrollments during a day divided by the starting enrollment for the day.
HVAC	Heating, ventilation, and air conditioning, often referring to the type of equipment or fuel
Micro-Segment	Five PGE customer segments used in characterizing residential customer demand response potential: Big Impactors, Fast Growers, Middle Movers, Borderliners, and Low Engagers. See the <i>Impact Metrics</i> section for additional descriptions.
Migration	Migration is defined as a customer who is enrolled in PGE’s PTR offering prior to enrolling in PGE’s Smart Thermostat demand response program.
PACE Model	A PACE model is a framework for efficient collaboration, standing for: Process Owner, Approver, Contributor, and Executor.
Peak Time Event	A demand response event usually lasting between one and three hours when PGE asks PTR participants to shift or reduce their energy usage.
Schedule 25	Schedule 25 Energy Partner Smart Thermostat program is one of two nonresidential demand response programs available to small and medium sized business customers.
Schedule 26	Schedule 26 Energy Partner program is one of two nonresidential demand response programs available to large sized business customers. Schedule 26 targets large commercial and industrial businesses and offers customized load reduction plans.
Survival Rate	Survival rate is the percentage of enrolled customers who remain enrolled in PTR and is calculated by dividing the current enrollment by the starting enrollment. The calculation excludes unenrollments due to service account closure or PTR ineligibility.

Term	Definition
Test Bed	Test Bed, also referred to as the PGE Smart Grid Test Bed (SGTB), refers collectively to the area of PGE’s territory served primarily by the substations of Island, Roseway, Delaware (representing the communities of Milwaukie/Oak Grove, Southern Hillsboro, and North Portland, respectively) participating in the SGTB project. The majority of residential customers residing in the Test Bed were automatically enrolled in the PTR treatment offered through the Flex 2.0 pilot program. Throughout this document, reporting will differentiate between PTR enrollees within the Test Bed (Test Bed PTR) and outside of the Test Bed (Flex PTR).
Test Bed PTR	Test Bed PTR enrollees are PGE customers in the SGTB neighborhoods who were enrolled in PTR. The majority of such customers were auto-enrolled in the PTR offering in July 2019.
Underserved Customers	For this research and report, PGE defined these customers to include low-income customers, non-English speakers, people of color, and renters. Going forward, PGE will expand this definition to include “environmental justice communities,” described in OR House Bill 4067. ¹

¹ Environmental justice communities include communities of color, communities experiencing lower incomes, tribal communities, rural communities, frontier communities, coastal communities and other communities traditionally underrepresented in public processes and adversely harmed by environmental and health hazards, including but not limited to seniors, youth and persons with disabilities.

EXECUTIVE SUMMARY

In 2016, the Oregon Public Utility Commission (OPUC) directed Portland General Electric (PGE) to establish a test bed that would enable PGE to accelerate the development of new flexible load capacity and test new strategies for engaging customers in demand response.² The directive was accompanied by the OPUC's order that PGE also obtain 77 MWs and 69 MWs of, respectively, winter and summer peaking demand response capacity across its full service territory by 2021. In authorizing a demand response test bed, the OPUC recognized that PGE's ability to meet the 2021 demand response targets and to acquire future flexible load capacity would require that PGE develop new and innovative strategies for scaling its programs.

In July 2019, PGE launched the PGE Smart Grid Test Bed (SGTB) project aimed at identifying these strategies.³ The project began with PGE automatically enrolling residential customers from three separate neighborhoods (roughly defined by electric substation boundaries) into the Flex 2.0 Peak Time Rebates (PTR) program. Through various customer messaging campaigns since its launch, the project sought to increase residential customer education about grid operations and time-based pricing of electricity and spur customers to reduce peak demand. Implementation of nonresidential SGTB project components were largely delayed because of the COVID-19 pandemic. The longer-term objective of the SGTB is to enroll customers in direct load control and other time-based pricing programs to support the utility's decarbonization and flexible load objectives.

A defining feature of PGE's SGTB project is that it seeks to gain insights about utility customer behaviors that can be applied in the rest of its service area to acquire flexible load capacity. Though the SGTB has tested or will test specific demand response products including opt-out peak time rebates, smart thermostat demand response, battery storage demand response, and water heater demand response, among others, its focus remains the customer experience and how to engage customers in demand response.

This interim evaluation of Phase I of the SGTB project was designed with this focus in mind and covers from the project's launch in July 2019 to October 2020. The primary evaluation objective is to understand customer motivations and the best ways for PGE to engage its customers in demand response, as scaling future demand response programs will require understanding the value customers derive from participation. Though the interim SGTB evaluation reports on PTR demand savings, it does so with the purpose of understanding how the SGTB opt-out PTR program design and the messaging influenced the savings. Detailed results about the savings in the SGTB from the PTR program and other demand response products can be found in the product-specific evaluation reports.

² See OPUC Order 17-386. October 9, 2017: <https://apps.puc.state.or.us/edockets/docket.asp?DocketID=20423>.

³ PGE submitted its SGTB Project proposal to the OPUC on October 25, 2018. See the PGE Test Bed Proposal at <https://edocs.puc.state.or.us/efdocs/HAS/um1976has12165.pdf>.

Research Objectives and Approach

PGE defined these research objectives for the SGTB project:

Assess customer participation in, motivations for, and comfort levels with demand response

Determine best methods to engage customers in demand responses and evaluate SGTB messaging campaigns and changes in customer awareness

Provide insight in how to structure future demand response program offerings

The Cadmus team evaluated PGE's progress toward meeting the SGTB goals by assessing the project's short-run outcomes as defined in PGE's residential SGTB logic model (see *Appendix A*). The logic model short-run outcomes concerned SGTB customer awareness of demand response and grid operations, demand response event participation, satisfaction with PTR, enrollment and retention in demand response programs, and community engagement including diversity, equity, and inclusion (DEI).⁴

Evaluating these outcomes and providing guidance about how to structure and scale PGE's demand response programs required gathering and analyzing data on the perspectives and experiences of Test Bed customers, program managers, and stakeholders. The evaluation team analyzed data on SGTB customer attitudes, knowledge, motivations, and behaviors from several sources, including metered electricity consumption, surveys of residential SGTB customers, rebates paid to PTR customers, residential customer focus groups, and field visits to nonresidential SGTB customers' businesses. The evaluation team also interviewed PGE staff, partners, and implementation contractors. The team then synthesized the findings from these evaluation activities to draw conclusions and make recommendations for better engaging customers in demand response.

Evaluation Research Activities

Interviews 	Surveys 	Marketing Reviews 	Metrics 
Resonance Assessment 	Focus Groups 	Walk-Alongs 	Logic Model Review 

⁴ Development of PGE's nonresidential SGTB logic model is in progress and anticipated in Q1 2021.

Conclusions

At the highest level, the trends and takeaways from the evaluation are:

Through the SGTB project, PGE has enhanced its ability to deliver demand response programs to residential customers. PGE has advanced its ability to serve hard-to-reach communities and improved the customer experience for participants in demand response programs.

The SGTB project has yielded learnings (as detailed in this report) that PGE can apply to scale future demand response program offerings. These learnings concern customer marketing and messaging, emergent customer segments, program design, implementation, and cost-effectiveness.

Though customers report high levels of awareness of and engagement with PTR and the concept of demand response, PTR savings are not as high as they could be and lag for some customer segments. Bright spots have been high PTR retention and the relatively high rate of migration from the PTR program to the smart thermostat demand response program for Test Bed PTR customers.

The following are the specific conclusions and supporting findings from the interim SGTB evaluation.

SGTB Key Performance Indicator Goals

PGE met most of its residential sector performance goals, with remaining key performance indicators (KPIs) still a work in progress.

- At the beginning of the SGTB Project, PGE established key performance indicators (KPIs) for tracking progress towards the project's goals. These metrics concerned a range of SGTB outcomes, from customer awareness about demand response and demand response event participation to engaging community stakeholders and finding diversity, equity, and inclusion (DEI) partners.
- The following tables overview PGE's residential KPIs and the status of each based on the findings from this evaluation. Data sources for the findings are referenced in the table, with additional details provided in the *Evaluation Activities* section.

PGE Residential SGTB KPIs – Overall

KPI Name	Metric Description and Goal	KPI Status (as of October 2020)
PTR Event Participation	At least 50% of SGTB customers earn a rebate during each demand response season	<ul style="list-style-type: none"> Summer 2019: 97% earned in season, 48% earned per event Winter 2019/2020: 62% earned in season, 62% earned per event Summer 2020: 94% earned in season, 53% earned per event <i>Source: Cadmus analysis of PGE PTR program tracking and rebate data</i>
PTR Event Load Impacts	Per-customer PTR kWh higher in 2020 than 2019 (Note: may be influenced by event day temperatures)	Savings increased, but the increase was not statistically significant. <ul style="list-style-type: none"> Summer 2019: 0.06 kW Summer 2020: 0.08 kW <i>Source: Cadmus load impact analysis (Flex 2.0 Evaluation, 2020)</i>
PTR Retention	80% of SGTB customers are still enrolled in PTR by the end of 2019	As of September 2020, SGTB customer retention in PTR was 94.2% (or 95.7% when adjusted for Smart Thermostat migration). <i>Source: Cadmus analysis of PGE PTR program tracking</i>
Demand Response Awareness	Statistically significant increase within SGTB over baseline survey (58% aware)	From CVP 1 and 3 surveys, 86%-90% aware, a significant increase over baseline <i>Source: PGE DR Baseline Survey (2019) and Cadmus CVP 1/CVP 3 Surveys</i>
Grid Operations Awareness	Statistically significant increase within SGTB over baseline survey (Note: comprises five grid operations knowledge questions. See Table 10.)	CVP 1 and CVP 3 survey respondents' knowledge on two of the five grid operations concepts significantly increased relative to baseline. <i>Source: PGE DR Baseline Survey (2019) and Cadmus CVP 1/CVP 3 Surveys</i>
PTR Satisfaction	At least 80% SGTB customer satisfaction with PTR for each event season	Customer satisfaction ranged from 68% to 78% <i>Source: Cadmus CVP 1/CVP 3 Surveys</i>
SGTB Awareness	75% of SGTB customers have heard about the project	<ul style="list-style-type: none"> 55% aware from CVP 1 survey 50% aware from CVP 3 survey <i>Source: Cadmus CVP 1/CVP 3 Surveys</i>

Green = Met goal Yellow = Partially met goal or in progress Purple = Did not meet goal Grey = Cannot determine/no data

PGE Residential SGTB KPIs – CVP-Specific

KPI Name	Metric Description and Goal	KPI Status (as of October 2020)
CVP1 Monetary Incentives - Smart Thermostat Migration	2% of SGTB customers with eligible HVAC enroll in Smart Thermostat DLC program	3.6% migrated to Smart Thermostat DLC program <i>Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data</i>
CVP1 Monetary Incentives - Smart Thermostat Program Awareness	75% of SGTB eligible customers heard about Smart Thermostat DLC program (considered by PGE to be a stretch goal)	65% were aware <i>Source: Cadmus CVP 1 Survey</i>
CVP2 Giving Back - Partnering	Delivery of co-branded materials (PGE and the three charities) and social media sharing	Ran co-branded emails, direct mail, and digital ads. Shared on Facebook and Twitter. <i>Source: Cadmus review and analysis of PGE SGTB marketing collateral and data</i>
CVP2 Giving Back - Enrollment	2% enrollment rate	2.3% enrollment rate <i>Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data</i>
CVP2 Giving Back - Awareness	25% email open rate with 2% click through rate	28.7% email open rate and 1.06% click through rate <i>Source: Cadmus review and analysis of PGE SGTB marketing collateral and data</i>
CVP2 Giving Back - PTR Satisfaction	Satisfaction with PTR 5% higher for Giving Back enrollees than non-enrollees	Unable to measure this as no winter 2019/2020 survey was conducted
CVP3 Carbon - Awareness	50% of those getting messages (treatment group) aware of campaign and participate in events to affect carbon reduction	From CVP 3 survey, 43% remembered hearing about carbon messages and 55% said they participated in events to reduce carbon footprint <i>Source: Cadmus CVP 3 Survey</i>
CVP3 Carbon - PTR Event Participation	PTR rebates for treatment group statistically higher than for control group	No statistically significant difference detected regarding average participation per kW load impacts between treatment and control group. <i>Source: Cadmus load impact analysis (Flex 2.0 Evaluation, 2020)</i>

Green = Met goal Yellow = Partially met goal or in progress Purple = Did not meet goal Grey = Cannot determine/no data

PGE Residential SGTB KPIs – Community Engagement, DEI, and Ongoing Improvements

KPI Name	Metric Description and Goal	KPI Status (as of October 2020)
DEI - Partners Identified	List of prioritized community stakeholders with assigned PGE relationship owners (2019) and Salesforce dashboard tracking (2020)	Both goals were met. See Table 10 for list of community stakeholders.
DEI - Community Engagement Best Practices	Develop community engagement workplans (2020), develop Equity Lens Toolkit (2020), and start to implement Toolkit/operationalize DEI learnings (2021)	The first two goals were met. Third goal is to be completed in 2021.
DEI - PACE Model for Community Feedback	Create priority stakeholder outreach strategy (2019) and CBO partnership strategy developed and initiated (2020)	Both goals were met. See Table 10 for stakeholder and CBO outreach strategy.
Customer Insights Resources	Delivery of customer insights findings in PowerPoint presentation and/or report format after each CVP campaign	PGE and Cadmus have delivered findings after each CVP
Communication Improvements	Apply and test lessons learned and suggested improvements from the SGTB project evaluation and PGE research by end of 2020	PGE implemented Cadmus' suggestion of running a randomized control trial to test CVP 3 (Carbon). More learnings to be applied in 2021 (e.g., smart thermostats marketing, Giving Back with Learnings CVP).

Source: Stakeholder interviews

Green = Met goal

Yellow = Partially met goal or in progress

Purple = Did not meet goal

Grey = Cannot determine/no data

PTR Awareness and Engagement

Awareness of demand response among SGTB customers has increased during the first half of Phase I.

- Approximately 90% of surveyed SGTB customers were aware of the concept of demand response, a statistically significant increase over the baseline (58% awareness in June 2019 before SGTB activities began).
- High demand response awareness and understanding were corroborated through residential customer focus groups, where participants demonstrated high familiarity with demand response, the intent of the PTR program, and why it is important to shift or reduce energy use during peak times

PTR awareness and participation increased among the residential SGTB customers during the first half of Phase I.

- Awareness of PTR has increased since the July 2019 SGTB launch. As of October 2020, approximately 98% of customers reported hearing about PTR (up from 93% reported in Feb 2019), and 92% reported that they participated in some or all seasonal events (up from 86%).
- Awareness of PTR exceeded knowledge of the SGTB itself, which is approximately 50% (as of Oct 2020) and has been relatively steady. Reasons for lower customer awareness of the SGTB itself include PGE placing greater emphasis on marketing and outreach education efforts on PTR, Smart Thermostat DLC, and the customer value proposition (CVP) campaigns – the more critical aspects of the SGTB – as well as the COVID-19 pandemic, which halted all in person outreach and community events intended to inform customers about the SGTB.

PTR awareness is strong and growing, but additional barriers to increasing PTR event participation remain.

- Given nearly universal PTR awareness (98%) and self-reported participation in events (92%) in summer 2020, only 33% of customers reported participating in *all events*.
- There was no difference in awareness between those who participated in all events and *some events* (59%), suggesting awareness is not the primary determinant of all-event participation.
- PTR awareness has remained consistently high during the SGTB period from summer 2019 to summer 2020.

Residential customers who participate in PTR events more vs. less frequently exhibit higher enthusiasm for demand response and present different opportunities for PGE engagement.

- *All-event* participants reported higher satisfaction with PTR (52% delighted), were more passionate about their reasons for participating, and had higher awareness and incidence of migration to the Smart Thermostat DLC program. Of the top 10 reasons for event participation, all-event participants showed statistically significance differences of “very true” responses for each reason compared to some-event respondents.
- Conversely, *some-event* participants reported lower satisfaction with PTR (35% delighted), indicating they did not find it simple to shift their energy use (29% found it simple to shift energy use, compared to 56% of all-event participants). Though they have indicated substantial barriers to Smart Thermostat enrollments (through CVP 1 and CVP 3 surveys), some-event participants may be ideal candidates for DLC programs due to perceptions about PTR being difficult to do.

Saving money is the primary motivator of PTR participation across all customer groups.

- Individual monetary rewards are the primary motivator across all customer groups, specifically related to reducing one’s energy bill by earning rebates. See Figure 6 for more detail.
- Contributing to the greater good also has widespread appeal and is related to both the environment and the community.
- Demonstrating PGE’s commitment to the greater good is also important to build more customer trust as a prerequisite to increased customer engagement, especially in DLC options where customers are asked to cede control to PGE (discussed more below).

PTR participants seek more information about how to save and to earn higher rebates.

- PGE has provided residential customers in PTR with energy-saving/shifting tips, an energy savings guide infographic, a PTR checklist, and same-day event reminders. Still, customers in residential surveys and focus groups frequently asked for more tips on how to shift or reduce energy.
- Though PGE has continued to provide educational information on ways to shift and save energy, there is opportunity to continue customer touchpoints on this topic and refine the information to encourage actions that will yield higher savings and rebates.

Smart Thermostat Awareness and Engagement

Two key barriers to migration to the Smart Thermostat DLC program are customers’ perceptions about their eligibility and concerns about ceding control.

- Nearly two-thirds (63%) of customers who responded to the CVP1 survey about the Smart Thermostat program disqualified themselves based on the belief that their heating or cooling systems were not compatible with a smart thermostat. These customers were mostly correct: 69% correctly assessed their cooling system’s eligibility and 87% correctly assessed their heating system’s eligibility, based on survey self-reports. This leaves approximately 31% that incorrectly believe they are ineligible, which serves as a barrier to their enrollment.

- Overall, those who disqualified themselves are highly satisfied customers (57% delighted with PGE vs. 37%) and more likely to participate in all PTR events (38% more likely to participate vs. 31%) compared to those concerned with control. Self-disqualifiers are also more likely to care about the environment and about doing business with companies that do what they can to protect the environment. This points to an important retention opportunity—to clearly communicate relevant offers and reinforce the value of customers to PGE.
- Nearly half of respondents (47%) cited concerns regarding giving PGE control of their thermostat. These customers, dubbed *control keepers*, tended to be less satisfied with PGE, PTR, and the size of the rebates.
- Focus groups with control keepers revealed a lack of trust in large corporations was a barrier to DLC. Control keepers sought more information regarding societal impacts and a deeper understanding of why PGE would offer a smart thermostat DLC program. This points to an opportunity and need for PGE to build brand trust as a precursor to DLC adoption and to fine-tune communications to resonate with key values and motivations.

There is not a consistent engagement approach for customers migrating from PTR to Smart Thermostat DLC.

- There are discontinuities in the customer experience related to notifications, performance history, messaging, and engagement for customers who transition between PTR and Smart Thermostat DLC programs.
- Examples for filling these gaps include a participant webpage to track seasonal load control events, performance, and rebates; educational materials about savings actions and event timing; and SGTB CVP campaigns (currently aimed only at PTR participants)
- There are opportunities to increase consistency in program features, messaging, and touchpoints for Smart Thermostat enrollees that are commensurate with the PTR program experience. The focus groups revealed that customers who migrate from PTR to DLC may expect or want the same communication touchpoints as before. Focus group respondents said they liked PTR's pre-event notifications. They valued knowing what was going on with events and the program.

Control keepers are a critical segment for acquiring flexible load capabilities.

- As of February 2020, nearly half (47%) of surveyed SGTB customers who had not enrolled in Smart Thermostat DLC program were identified as control keepers, citing concern regarding giving the utility control of their thermostat.
- Focus groups identified trust as a key barrier, revealing general skepticism of corporate interests. Control keepers also valued active participation rather than the do nothing aspects of automated demand response ("Set it and Forget it"). Control keepers participating in the focus groups cited that they are motivated by societal impacts in how demand response supports their community and the greater good.
- Control keepers represent a sizable portion of eligible customers and their concerns present a challenge for PGE to learn ways to adapt messaging to overcome these barriers.
- The reluctance of control keepers to give PGE control of their thermostats for demand response suggests that for some, PTR will remain their primary program and will not serve as a stepping stone to firmer demand response. Accordingly, PTR will be important for engaging control keepers and other reluctant customer types in demand response.

SGTB Demand Response Savings

SGTB PTR customers who were auto-enrolled in the program reduced their demand during events, though by a smaller percentage than self-enrolled Flex PTR customers outside of the SGTB.

- In summer 2020, Test Bed PTR enrollees saved an average of 0.08 kW per customer (or 4% of baseline demand) across all Flex events. In winter, they saved an average of 0.02 kW or 1% of demand.

- These savings were significantly less than savings of Flex PTR customers, who saved an average of 0.16 kW per enrollee or 8% of demand in summer events and 0.1 kW per enrollee or 5.4% in winter events.³ Test Bed PTR customers saved less because the opt-out PTR program design likely resulted in the enrollment of many customers who were not motivated to participate in demand response events, resulting in lower average impacts across the enrolled population. Specifically, because of the auto-enrollment, the Test Bed PTR program included a higher proportion of customers with low demand response savings potential (Low Engagers, Borderliners) and low probability of self-enrollment.

The largest micro-segment groups (Low Engagers and Borderliners) produce zero or small PTR savings .

- Low Engagers, the largest demand response micro-segment in the Test Bed, did not save during summer 2020 PTR events. Borderliners, the next largest micro-segment, saved an average of only 0.03 kW per customer.
- In contrast, Low Engagers and Borderliners outside the Test Bed who self-enrolled in PTR saved an average of 0.04 kW and 0.12 kW per customer, respectively. The Flex PTR savings demonstrate potential for some customers in these micro-segments to save peak demand.
- Low Engagers and Borderliners account for over 60% of customers in the SGTB PTR population. It is still early in the SGTB project, but these results suggest it may not be cost-effective to auto-enroll all Low Engagers and Borderliners in a peak time rebates program. However, it may still prove cost-effective to migrate eligible Low Engagers or Borderliners to PGE demand response DLC programs.

Enrollment and Retention

Auto-enrolling customers in PTR led to a very large and persistent increase in PTR enrollment.

- At the end of summer 2020, 93.7% of Test Bed customers who were automatically enrolled in PTR in July 2019 remained in the PTR program. In comparison, at the end of summer 2020, only 8.7% of eligible customers outside the Test Bed self-enrolled in PTR.
- This finding demonstrates the effectiveness of auto-enrollment as a strategy for quickly scaling PTR enrollment. Auto-enrollment takes advantage of consumer tendencies to adhere to the default option (i.e., enrollment in PTR).

Auto-enrolled customers who would not have enrolled in PTR on their own realized energy savings.

- Customers automatically enrolled in PTR who would not have enrolled themselves saved approximately 0.073 kW per customer during summer PTR events.

Auto-enrolling customers in PTR and encouraging them to enroll in Smart Thermostat DLC led to increased Smart Thermostat enrollments.

- In comparing SGTB PTR customers to a group of matched nonparticipants outside of the Test Bed (not enrolled in PTR or Smart Thermostat programs), the evaluation found that SGTB customers were over two times as likely to enroll in Smart Thermostat DLC.
- This lift in enrollment rate measures the combined effect of auto-enrollment into PTR, the encouragement to enroll in Smart Thermostat, and the combination of other SGTB messaging (through September 2020).

³ PGE only called one PTR event during the 2019/2020 winter season.

The PTR auto-enrollment benefits of additional PTR savings and accelerated enrollment in Smart Thermostat DLC should be weighed against the costs of administering the program to additional customers.

- Making participation the default option will be cost-effective for the PTR program only if the benefits from the savings of customers who would not have enrolled themselves (0.073 kW) exceeds the costs of administering the program to them.
- Even if the savings of these “complacent” customers are not enough to make PTR auto-enrollment cost-effective, auto-enrolling them may still be cost-effective if it causes enough customers to later enroll in PGE’s smart thermostat demand response program or other direct load control programs.

Community Engagement and DEI

PGE made notable progress in advancing its community engagement practice, both within the SGTB communities and more broadly within the organization.

- PGE created its first community outreach team and hired new team members, established a Diversity, Equity, and Inclusion (DEI) framework to help guide project design, and crafted a Community Engagement Strategic Plan.
- PGE forged partnerships with many city stakeholders and community-based organizations (CBOs).
- The SGTB’s community engagement practice has led to organizational changes within PGE that have fostered greater collaboration across teams at PGE and helped break down silos that have traditionally existed across departments.

Underserved customer groups face disparities in housing, marketing, education, and decision-making power that make demand response less accessible.

- For low-income customers, structural barriers to participating in demand response programs exist (such as living in older homes that lack quality weatherization). These contribute to logistical challenges with shifting energy use while maintaining comfort, given heating and cooling leaks.
- Driving participation in Smart Thermostat DLC among renters is challenging, given the need for landlord approval before installing new appliances and devices.
- Educational materials about demand response have been largely limited to English, though PGE offered PTR and Smart Thermostat DLC information in Spanish (and Russian for PTR) but not in other languages. As a result, non-English speaking customers are less likely to be aware of the availability and benefits of PGE’s demand response programs.

Nonresidential

Nonresidential SGTB activities did not progress as planned due to the COVID-19 pandemic.

- The slow progress in enrollments for Schedule 25 stems largely from PGE’s inability to roll out some of its planned activities on time because of the COVID-19 pandemic.
- For Schedule 25 and Schedule 26, the COVID-19 pandemic specifically impacted the ability to do in-person outreach, a key activity to engage with business customers. In-person outreach activities were delayed, along with thermostat installs for Schedule 25 and on-site technical assessments for Schedule 26.

In-person outreach to business customers proved valuable for obtaining contact information, reaching key decision makers, and recruiting demand response program participants.

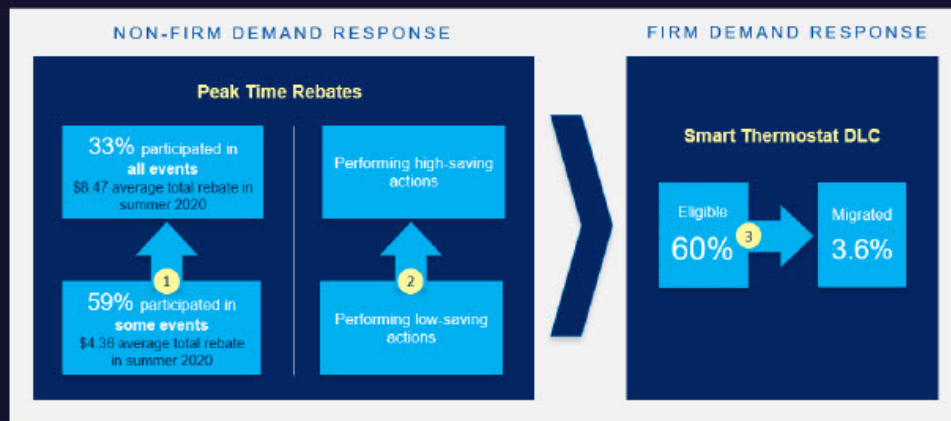
- Schedule 25’s door-to-door outreach has been the most effective effort to date because of the ability to directly engage with and inform decision-makers.
- Schedule 26’s in-person visits by key customer managers (KCMs) were the most effective at driving enrollment.

Pathways for Increasing Residential Demand Response Potential

In theory, PGE has three main pathways for increasing demand response potential in the SGTB:

1. **Increasing the frequency** of customer participation in PTR. This would primarily involve encouraging *nonparticipants* to participate in some events or *some-event* participants to become *all-event* participants.
2. **Increasing the intensity** of participation in PTR. This would entail getting all customers who participate in PTR events to take more impactful actions.
3. **Migrating more** eligible customers from PTR to firmer types of demand response such as smart thermostat or water heater DLC.

Through the SGTB, PGE has gained specific and useful knowledge about how to achieve greater demand response savings through the pathways (1) and (3), as this figure illustrates.



1 Increasing the frequency of customer participation in behavioral demand response

For the majority of PGE's customers, PTR will be the primary demand response program rather than a gateway to a DLC program. Retaining and growing PTR participation will be the foundation of achieving demand response load reductions. PTR is available to all customers and elicits high rates of self-reported event participation. Although there is near-ubiquitous awareness and high engagement in PTR among SGTB customers, only one-third of enrollees participate in all events. This presents PGE with an opportunity to increase participation in PTR events while remaining attentive to the continued engagement of customers already participating in events.

2 Encouraging all PTR participants to take the most impactful actions to save

This evaluation shows many SGTB customers do not take the most impactful actions to save during PTR events. Recommendations about how to reduce demand specific to individual households and homes might lead more customers take higher savings actions. However, until recently, when PGE completed a residential load disaggregation study for the SGTB, PGE lacked information about the electricity end-uses in customer homes, hindering its ability to make customer-specific recommendations. More research is needed during the second half of the Test Bed project about how to encourage SGTB customers to take the highest savings actions.

3 Migrating more eligible customers to firm demand response

Two key barriers to DLC migration are customer system eligibility and customers' perceptions about ceding control to the utility. PGE can increase enrollment by designing program communications to explicitly address these barriers. Two key customer groups emerged from responses citing barriers to migration to Smart Thermostat DLC. First, nearly two-thirds (63%) of respondents self-disqualified based on the belief that their heating or cooling systems would make them ineligible. Second, nearly half (47%) cited concerns regarding giving PGE control of their thermostat.

Respondents who disqualified themselves were mostly correct in doing so (69% correct for cooling system, 87% correct for heating system). To help customers who were incorrect about their eligibility, PGE could provide an easily accessible quick reference guide to help customers determine eligibility. PGE can also eliminate DLC program-related communications that are not relevant to ineligible customers and thereby preserve these customers' high levels of PTR satisfaction as well as reduce program costs.

Customer concerns about control are also very real and require focus on building a stronger foundation of brand satisfaction and trust among targeted customers (especially control keepers) as well as providing more information on the features and benefits of the DLC program.

Recommendations

This evaluation presents the following sets of recommendations to deepen residential customer engagement, improve the customer experience, and increase demand response potential along the three pathways depicted in the section above.

Target and personalize messaging and outreach based on program-related behaviors and demand response savings potential

Tailor PTR communications based on customer behavior, attributes, and demand response savings potential

- Increase frequency of some-event participation by speaking to values, needs, and underlying concerns

- Periodically acknowledge and thank all-event participants to retain and reinforce their behavior
- Increase communications to those with greatest energy savings potential (e.g., electric heating & cooling), offering “personalized event action plans” to bring focus to high-impact actions (e.g., HVAC temperature setbacks)

Build brand trust among DLC prospects, with an eye toward winning over control keepers

- Communicate PGE Corporate Social Responsibility commitments, activities, and outcomes
- Reinforce environmental and community benefits of programs and customer participation. For example, one suggestion from the focus groups was to put savings in the context of collective impacts on environment, such as salmon restoration, as individual rebate savings per event did not seem worth the effort to participate.

Target DLC program offers to eligible customers to reduce excess communications to ineligible customers⁶

- By HVAC (and domestic hot water) system type (e.g., central cooling, electric heating, electric water heating)
- By tenure (owner vs. renter) because renters are less able to change out equipment or controls

Refine DLC communications to overcome concerns and leverage familiarity with PTR

- Provide quick reference for customers to determine eligibility
- Build on familiarity with PTR and relate to DLC (e.g., testimonials)
- Provide clear, detailed information about what participation entails (e.g., case study)
- Highlight both do-nothing and conscientious aspects of DLC to appeal to customers who wish to be active and diligent
- Consider testing additional grid operations messaging regarding firm vs. non-firm demand response by providing transparency into motivations for DLC migration and the value of its reliability as a resource

Build communications stream tailored to DLC customers once they are in the program

- Provide an event tracking tool and consider consistency in event notifications
- Create ongoing touchpoints to encourage participation outcomes (e.g., reduce frequency of enrollee’s overriding load control events)

Consider piloting a hybrid option allowing DLC enrollees to participate in PTR events

- Provide opportunities for active engagement, especially relevant for control keepers, and expand ways to earn additional rebates
- Research how to operationalize this hybrid design, including how to estimate the customer baseline and whether the hybrid approach would be cost-effective

⁶ PGE completed a load disaggregation study for SGTB customers in summer 2020 to collect data on customer HVAC systems and fuels.

Structure communications and messaging to connect with what customers care about

Though tailored communications as elaborated above will unlock the greatest demand response potential from customers with distinct characteristics, all communications and messaging streams should be structured to ensure they cover the full range of topics customers care most about—money, environment, carbon, community, and PGE’s social responsibility initiatives. These topics will not be covered in every communication but rather included and weighted over time relative to their importance, here in the figure noted as **customer value intensity**.



Messaging should most frequently and prominently remind customers of the personal financial benefits of PTR participation by emphasizing the leading motivations across all customer groups

- Promote key phrases from PGE SGTB communications that are most resonant among all customers: *to reduce my energy bill, it doesn't cost me anything and to earn rebates*

Messaging about environment and community are strong supporting points

- Utilize these messages to boost program-related behaviors for specific groups (e.g., some-event PTR, DLC migration) where particularly relevant
- Leading phrases that resonate: *to save the planet, to reduce my carbon footprint, to help build a cleaner energy future, to help keep electricity prices affordable for my community, and to help my community avoid power outages*

PGE's corporate social responsibility commitments, actions, and outcomes are important to residential customers and should be shared through SGTB communications

- Share PGE's actions as a corporation to build brand trust and pave the way for greater customer participation, especially for DLC migration (a key opportunity with the control keeper group)

Future Research

This evaluation identified new questions for research. Based on the evaluation findings, PGE should consider undertaking new research in these areas:

- **Consistency in experience for PTR migration to Smart Thermostats.** As noted above, there are inconsistencies in the experiences of customers in the PTR and Smart Thermostat programs. This research would investigate whether the customer experience could be improved by harmonizing the delivery of the programs more closely. This research would track and assess PTR participants who migrate from the PTR to the Smart Thermostat programs to understand changes in customer experience, engagement, and satisfaction.
- **Strategies for supporting low engagement customers.** Low Engagers and Borderliners in the SGTB who were automatically enrolled in PTR had zero savings on average. As auto-enrollment resulted in the enrollment of many customers with low savings potential, PGE should undertake additional research to identify ways to increase the engagement of these customers. This could include the development of new demand response products specifically aimed at these customer groups.
- **Opportunities to coordinate demand response with gas utilities.** Approximately 85% of SGTB customers heat their homes with natural gas. There is an opportunity for natural gas utilities to use demand response to aid gas transmission and distribution flow on high heating days. PGE should explore opportunities to cross-market demand response efforts with the local gas utility.
- **Assessment of cross-product and portfolio-level cost-effectiveness.** The SGTB project auto-enrolled customers in PTR and then sought to migrate them to firmer smart thermostat demand response. As this strategy involves customers transitioning between programs, the strategy's cost-effectiveness cannot be assessed by looking at the cost-effectiveness of the individual programs. For example, it may not be cost-effective only to auto-enroll SGTB customers in PTR; however, if enough of the auto-enrolled customers migrate to smart thermostat demand response, the combination of PTR auto-enrollment and migration might be cost-effective. Thus, PGE should conduct more cross-program, portfolio level evaluation to assess the benefits and costs of auto-enrolling residential customers in PTR.

INTRODUCTION

Order No. 17-386 from the Oregon Public Utility Commission (OPUC) directed PGE to establish a demand response test bed by July 1, 2019, establish a demand response oversight committee, and acquire at least 77 MW of winter and 69 MW of summer demand response capacity across its service territory by 2021.⁷

In response to the OPUC’s order, PGE launched the Smart Grid Test Bed (SGTB) in July 2019—a multi-year, community-centered research project designed to test and learn how to accelerate the development of demand response capacity resources, acquire demand response at scale, and demonstrate the ability of demand response to function as a resource.⁸ The directive to acquire **demand response at scale** meant that PGE had to set aggressive customer participation goals, as this would inform and market the potential of new technologies and resources. PGE, therefore, established its demand response participation goals higher than the national residential rate of 5% to 10%.⁹

SGTB Demand Response “At Scale” Participation Goals

- 66% residential
- 40% large businesses
- 25% small and medium businesses

During the planning stages of the SGTB project, PGE’s stakeholders expressed interest in exploring activities beyond the scope envisioned by the OPUC. In response, PGE agreed to revisit these items in a potential second phase of the SGTB project. The current phase of research focuses on understanding customer engagement and customer value propositions aimed at establishing high customer participation in demand response resources.

PGE outlined the following goals for Phase I:¹⁰

- Identify, develop, and communicate the customer value proposition of demand response to PGE’s customers
- Work with customers to establish and retain a high level of customer participation in demand response programs
- Learn how to recruit and retain customers’ participation and translate these learnings into development of cost-effective strategies across the service territory

⁷ Public Utility Commission of Oregon. Order 17-386, Docket LC 66. <https://apps.puc.state.or.us/orders/2017ords/17-386.pdf>

⁸ Portland General Electric. October 2018. *PGE Test Bed Proposal*. <https://edocs.puc.state.or.us/efdocs/UAC/adv859uac113045.pdf>

⁹ Federal Energy Regulatory Commission. *2017 Assessment of Demand Response and Advanced Metering Report*. <https://www.ferc.gov/legal/staff-reports/2017/DR-AM-Report2017.pdf>

¹⁰ Portland General Electric. October 2018. *PGE Test Bed Proposal*. <https://edocs.puc.state.or.us/efdocs/UAC/adv859uac113045.pdf>

- Collect information on demand response potential, which PGE expects to inform future potential studies
- Create new program offerings that can quickly translate to broad deployment program offerings
- Coordinate on new program development with other demand-side measure providers such as the Energy Trust of Oregon
- Study and understand the system operational implications of high levels of demand response as well as gain insight into the implications that the high levels of flexible load necessary to meet PGE's carbon reduction goals will have upon PGE's grid




PGE concentrated the first 16 months of the project primarily on engaging and understanding residential customers and how to move them from non-firm (behavior-based) demand response to firm (technology-based) demand response. As a secondary concentration, PGE experimented with an array of marketing and outreach efforts to engage and recruit nonresidential customers for demand response.

This interim evaluation report documents the activities and findings on Phase I of the SGTB project during the first 16 months of the project from the July 2019 launch through October 2020.

SGTB PHASE I PROJECT DESCRIPTION AND ACTIVITIES

PGE implemented the SGTB project in three neighborhoods of its service territory, each clustered around a distinct distribution substation. Figure 1 shows the three neighborhoods selected and a brief profile of the community. PGE selected these neighborhoods for their customer representativeness and promising opportunities to research and develop DERs.

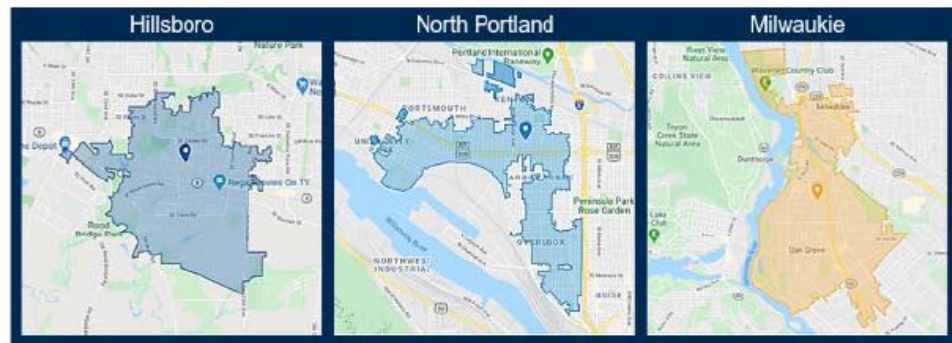
Figure 1. Neighborhoods Selected for the SGTB

 HILLSBORO	 NORTH PORTLAND	 MILWAUKIE
<p>ROSEWAY SUBSTATION</p> <ul style="list-style-type: none"> • More suburban, family lifestyle • High income and more likely to be homeowners • Newer residential and nonresidential construction • More likely to have non-electric heating, therefore lower PGE bill • More likely to have solar power 	<p>DELAWARE SUBSTATION</p> <ul style="list-style-type: none"> • More urban and younger • Low to medium income level • High concentration of single-family homes, but homes are older, smaller, and more expensive • Higher green affinity • More likely to have non-electric heating, therefore lower PGE bill 	<p>ISLAND SUBSTATION</p> <ul style="list-style-type: none"> • More suburban • Older, larger homes with electric heating • High concentration of multifamily residences and pockets of low-income housing • Traditional downtown businesses and several industrial businesses

Source: PGE’s Presentation Deck for April 2018 Demand Response Review Committee (DRRC) Meeting

Figure 2 shows the substation boundary for the three neighborhoods in the SGTB.

Figure 2. SGTB Neighborhood Boundaries



Source: PGE. “Smart Grid Test Bed.” <https://portlandgeneral.com/about/smart-grid/smart-grid-test-bed>

SGTB Organization and Roles

PGE organized a large team of advisors, internal staff, partners, and implementation contractors for the SGTB project. The Demand Response Review Committee (DRRC) contributes to the SGTB planning and advises PGE. PGE internal staff—including product managers, marketers, and outreach team members—

coordinate with each other on demand response program offerings and SGTB activities. Partners collaborate with PGE on customer/community outreach and research opportunities. Implementation contractors support and execute the delivery of specific demand response offerings and outreach to PGE customers. Table 1 describes the roles and responsibilities of each party involved with the SGTB project.

Table 1. SGTB Organization and Roles

Oversight	
Demand Response Review Committee (DRRC)	As directed in the OPUC's Order No. 17-386, PGE formed this oversight committee. Made up of over 40 members from city, state, and regional organizations and departments, including PGE staff. Meets every quarter to review SGTB progress and advises PGE.
PGE	
SGTB Manager	Manages other team members and coordinates with other product managers.
Residential Marketing Lead	Plans and manages residential demand response marketing activities. Creates content.
Energy Partner Product Manager	Oversees Schedule 25 and Schedule 26 (collectively marketed as "Energy Partner").
Energy Partner Marketing Lead	Plans and manages Energy Partner marketing and outreach activities. Creates content.
Diversity, Equity, and Inclusion (DEI) Community Outreach Consultants	Made up of three members (one for each SGTB neighborhood) and a team leader. Coordinates with city partners and CBOs and builds relationships with their community. Reviews communications, planning, and research for any equity issues.
Ambassadors	Made up of 10 to 20 PGE employees who live in the SGTB neighborhoods. Gathers feedback from their neighborhood and reports back to DEI Community Outreach Consultants.
Partners	
Energy Trust of Oregon (Energy Trust)	Administrator of energy efficiency programs in PGE service area. Teams with PGE on deployment of smart thermostats, Energy Partner program, and SGTB demonstration projects.
City of Hillsboro/Milwaukie/Portland	Coordinates with DEI Community Outreach Consultants on city's sustainability and/or climate goals. Help connect DEI Community Outreach Consultants to key city members, stakeholders, and CBOs. Teams up on city projects, education, and messaging.
Community-based Organizations (CBOs)	Locally based, nonprofit agencies. Coordinates with DEI Community Outreach Consultants on education, outreach, and messaging. For a full list of CBOs currently involved with the SGTB, see Table 21.
Northwest Energy Efficiency Alliance (NEEA)	Provides resources to utilities and program administrators to transform the energy efficiency market in the Northwest. Brings to the SGTB insights into how to align program activities with broader regional market transformation efforts.
Implementation Contractors*	
CLEAResult	Coordinates installation appointments and enrollments for Schedule 25. Performs smart thermostat installations for Schedule 25. Identifies opportunities and conducts customer outreach and recruitment for Schedule 26. Guides Schedule 26 customers through enrollment and enablement process.
TROVE Predictive Data Science (TROVE)	Serves as an implementation contractor for PGE's Flex 2.0 Peak Time Rebates (PTR) pilot. Calculates the baseline energy consumption for each customer, the customer's energy savings, and rebates resulting from the peak time events.
Oracle	Serves as an implementation contractor for PGE's Flex 2.0 PTR pilot. Sends pre-event notifications and post-event results to customers.
Green Mountain Energy	Conducts canvassing activities such as the door-to-door outreach for Schedule 25

*Implementation contractors listed here include those providing demand response products and services both in and outside of the SGTB.

Residential Approach

To engage residential customers in the SGTB and meet the 66% participation goal, PGE adopted a **platform approach**, in which PGE took an existing demand response program and modified its program design rather than building a new program offer from scratch. In this way, PGE leveraged an opt-in peak

time rebates (PTR) offering from its Flex 2.0 pilot program to develop an opt-out PTR program design for the SGTB. In July 2019, approximately 13,000 residential customers in the three SGTB neighborhoods were auto-enrolled into PTR (in addition to about 1,000 customers who had previously self-enrolled in PTR).

PTR is a non-firm demand response resource that relies on customers to take actions to reduce or shift their electricity consumption when called upon during peak time events. Customers are notified of a peak time event in advance via email, text, and/or voice mail and receive their event performance results a day after the event. Customers earn \$1 for every kWh of savings relative to their baseline electricity consumption.

In the SGTB, PGE’s expectation was the enrollment in PTR would expose customers to demand response concepts and ultimately lead customers to migrate to a direct load control (DLC) program. DLC is a firm demand response resource that enables the utility to take control of a household end use to reduce electricity consumption during peak time events. This technology-based resource is considered more reliable for grid operations than a non-firm resource like PTR. PGE envisioned a customer journey where customers move from a non-firm resource to a firm resource (Figure 3).

Figure 3. SGTB Residential Approach and Envisioned Customer Journey



Residential SGTB Engagement Activities

PGE engaged with residential customers by introducing them to the SGTB and PTR and testing value propositions. During the first 16 months of the SGTB project, PGE launched the project and carried out three different customer value proposition (CVP) messaging campaigns. The CVP campaigns aimed to test customer reactions to three different motivational messaging types: monetary incentives, giving back to the community, and carbon emissions reductions. PGE plans to carry out two more CVP campaigns (Giving Back with Learnings and Renewables+Community) during Q4 2020 through Q3 2021.

Customer value proposition (CVP):
a statement that explains how a product or service delivers specific benefits to the customer

Table 2 describes the SGTB launch and the three CVP engagement activities. Specific goals tied to each engagement activity and their outcomes are described in the *Residential Evaluation Findings* section of this report.

Also during the first 16 months, PGE launched several demonstration projects in the SGTB neighborhoods to test new distributed energy resources and DLC technologies in ductless heat pump controls (in coordination with Energy Trust), heat pump water heater controls, and monitoring of

electric vehicle use and charging. These demonstration projects operate as mini pilots and are not covered in this evaluation. PGE will continue to collaborate with Energy Trust and other partners on additional technologies.

Table 2. Summary of Residential SGTB Engagement Activities

Engagement Activity	Time Period	Objective	Marketing, Education, and Outreach Activities Completed
SGTB Launch and PTR Auto-Enrollment	July 2019 through Sept. 2019	Establish customer awareness of the SGTB, inform customers of their enrollment in PTR, and orient customers to PTR	<ul style="list-style-type: none"> • SGTB mailers and emails in English, Spanish, and Russian • SGTB billboards in neighborhoods • Community outreach events conducted by DEI Community Outreach Consultants: farmer’s markets, fairs, lunch-and-learns with city partners, and presentations to CBOs • Digital banner ads and Pandora ads on PTR • Neighborhood canvassing by Green Mountain Energy and ambassadors • PGE website page
CVP 1 Monetary Incentives	Oct. 2019 through Dec. 2019	Promote the Smart Thermostat DLC program and persuade customers they can earn more by switching from PTR to Smart Thermostat DLC	<ul style="list-style-type: none"> • Mailers and emails in English and Spanish • Door hangers for North Portland neighborhood • Telemarketing conducted by PGE and CLEAResult • Digital banner ads and social media • DEI Community Outreach Consultants attended local community events and gave presentations • PGE website page
CVP 2 Giving Back	Jan. 2020 through Feb. 2020	Offer customers the chance to donate their PTR earnings to one of three charities of their choice	<ul style="list-style-type: none"> • Emails and mailers co-branded with selected charities • Digital banner ads and social media • PGE website page • DEI Community Outreach Consultants informed ambassadors • PGE matched \$5,000 in donations to the three charities
CVP 3 Carbon	July 2020 through Sept. 2020	Explore the customer impacts when framing the PTR benefits in terms of avoided carbon emissions, and increase PTR event participation	<ul style="list-style-type: none"> • PTR checklist mailer • Gamification: Customers in the SGTB neighborhood with the highest percentage of event participation were entered in an Amazon gift card sweepstakes and received a tree-planting donation in their community • Carbon email set #1 with sweepstakes promotion • Carbon email set #2 with sweepstakes promotion • Carbon email summary #4 (note: email set #3 cancelled) • Wildflower seed packet mailer

Cancelled Residential Activities

Several residential SGTB activities did not go as planned for PGE due to a mild 2019/2020 winter season (i.e., only one PTR event called), the COVID-19 pandemic, and the 2020 Oregon wildfires. As a result, these activities were cancelled:

- **In-person marketing events and outreach activities (spring-summer 2020).** All in-person marketing events and outreach activities that were scheduled to take place in the SGTB neighborhoods were cancelled due to the COVID-19 pandemic. Most of these activities impacted the DEI Community Outreach Consultants whose work primarily involves being directly in the communities. PGE has worked to switch some of the outreach activities to webinars.

- **CVP 3 email set #3.** PGE could not send out the CVP 3 emails during the wind-driven power outages, wildfires, and hazardous air quality in September. During this three-week period, PGE halted all customer marketing activities and did not call any PTR events.
- **Line voltage thermostat demonstration project.** PGE cancelled this demonstration project because it could not address the property access issues (due to COVID-19 health and safety requirements) in time to meet the project’s installation deadlines. PGE is currently exploring other research opportunities and partnerships with this technology.

Nonresidential Approach

PGE chose a different engagement approach for SGTB nonresidential customers (i.e., businesses) by not auto-enrolling them in a demand response program or treating them with CVP messaging campaigns. PGE has frequently encountered challenges with a lack of business customers’ email addresses and of current contact information on the decision-makers at businesses and a longer program onboarding process than for residential customers. For these reasons, PGE marketed opt-in demand response programs to SGTB business customers and focused on **reaching and engaging with the decision-maker** through an array of marketing and outreach efforts to recruit business customers for demand response programs.

PGE offers two nonresidential demand response programs to business customers—Schedule 25 Energy Partner Smart Thermostat program and Schedule 26 Energy Partner program. Schedule 25 and Schedule 26, jointly marketed as Energy Partner, are offered to business customers in and out of the SGTB, with no changes to their program design for the SGTB.

Schedule 25 SGTB Engagement Activities

Schedule 25 targets small- to medium-sized businesses (less than 200 kW) with ducted heating and/or cooling system and a Wi-Fi network. Businesses that enroll receive a complimentary smart thermostat(s) and installation and are paid \$60 per season for allowing PGE to change their thermostat setpoints during peak demand events.

Of the estimated 1,848 small and medium eligible business premises in the SGTB, PGE aims to enroll about 460 business premises (25%) into Schedule 25 by the end of 2021.¹¹ Table 3 summarizes the engagement activities conducted to reach and recruit decision-makers at small and medium businesses. The effectiveness and outcomes of the various activities are described in the *Nonresidential Evaluation Findings* section of this report.

¹¹ This goal could be revised due to business closures from the COVID-19 pandemic.

Table 3. Summary of Nonresidential Schedule 25 SGTB Engagement Activities

Engagement Activity Completed	Time Period	Description/Objective
SGTB launch mailer and email by PGE	Q3 2019	Notify businesses about the SGTB and communicate that they are part of something special.
Energy Partner digital ads by PGE	Q4 2019	A/B test different headlines (SGTB neighborhood headline vs. Oregon energy future headline). Recruit businesses to enroll.
Energy Partner promotion email by PGE	Q4 2019	Recruit businesses to enroll.
Energy Partner promotion postcard and tri-fold by PGE	Q4 2019	A/B test different formats (postcard vs. tri-fold). Recruit business to enroll.
Dedicated call center by PGE and CLEAResult	Q3 2019 to present	Give businesses a forum to directly call to discuss eligibility, ask questions, and schedule an installation appointment with a representative.
Energy Partner business letter promotion by PGE	Q1 2020	Sent from PGE's Energy Efficiency and Service team. Recruit businesses to enroll.
Telemarketing by CLEAResult	Q3-Q4 2020	Contact 500 businesses to recruit for enrollment.
Door-to-door outreach by Green Mountain Energy	Q3-Q4 2020	Reach the decision-maker at the business. Obtain email address of the decision-maker. Recruit business to enroll.
Chinook Book digital ad offer	Q3 2020	Offer free Chinook Book advertising for 25 businesses in the SGTB if they enroll in Schedule 25.

Schedule 26 SGTB Engagement Activities

Schedule 26 targets large commercial and industrial businesses and offers customized load reduction plans. Businesses that enroll and participate receive substantial payments for automated and/or manual load reduction during peak demand periods. PGE identified 13 candidate businesses in the SGTB that have the highest potential for reducing peak loads and set a goal of enrolling and enabling five of them (40%) into Schedule 26 by the end of 2021.

Table 4 summarizes the engagement activities conducted to reach and recruit decision-makers at these 13 candidate businesses. The effectiveness and outcomes of the various activities are described in the *Nonresidential Evaluation Findings* section of this report.

Table 4. Summary of Nonresidential Schedule 26 SGTB Engagement Activities

Engagement Activity Completed	Time Period	Description/Objective
SGTB launch mailer and email by PGE	Q3 2019	Notify businesses about the SGTB and communicate that they are part of something special
Phone/email/in-person outreach by key customer managers (KCMs)	Q3 2019 to present	A one-on-one discussion with businesses to go over the program, benefits, and custom plan
Phone/email/in-person outreach by CLEAResult	Q3 2019 to present	A one-on-one discussion with businesses to go over the program, benefits, and custom plan

Delayed or Postponed Nonresidential Activities

Several nonresidential SGTB activities did not go as planned due to slow progress in enrollments and the COVID-19 pandemic. Specifically, the following activities were delayed or postponed:

- **Schedule 25 marketing and installations (spring 2020).** PGE paused all marketing activities and smart thermostat installations during the first few months in spring 2020 due to the COVID-19 pandemic. During this time, PGE and CLEAResult developed health and safety procedures for when installations could resume. The pandemic caused only short delays in installations, as businesses were allowed to reopen.

CADMUS

- **In-person outreach.** Schedule 25's door-to-door outreach was originally planned for spring 2020 but was postponed until late summer due to the pandemic. The pandemic also prevented PGE's key customer managers (KCMs) and CLEAResult from meeting with Schedule 26 candidates in person. This was resolved by changing to a virtual meeting format.

EVALUATION OBJECTIVES AND APPROACH

PGE hired Cadmus and its subcontracting partner Larkspur Energy (collectively, the evaluation team) as the evaluator of the SGTB project for Phase I. PGE specified the following general research questions for this phase:¹²

- What are customers’ participation in, motivations for, and awareness of demand response?
- What are the best methods to engage customers in demand response?
- How should PGE structure future demand response program offerings?

Guided by these primary research questions, PGE further established the following specific research questions:¹³

- Does PTR event participation change after each CVP campaign, and how does participation compare inside and outside of the SGTB?
- Which residential and business customers migrate to smart thermostat DLC offerings, and why? Is migration due to specific PGE messaging/promotions or other factors?
- Does SGTB messaging affect participant retention in PGE’s PTR and smart thermostat DLC programs?
- Do SGTB customers achieve different demand response savings than other customers?
- Can customer engagement with energy management be measured in other ways (e.g., the frequency of online energy tracking)?
- Does SGTB messaging affect customer awareness and comprehension of demand response and smart grid concepts?

Evaluation Design

The Cadmus evaluation team designed the SGTB project evaluation to answer these research questions. The evaluation was organized around assessing the short-term outcomes in PGE’s residential SGTB logic model.¹⁴ (PGE’s residential SGTB logic model can be found in *Appendix A*.) The short-term outcomes concern customer awareness, demand response event participation, satisfaction with PGE, enrollment and retention in demand response programs, and community engagement including diversity, equity, and inclusion (DEI).

Evaluating these outcomes required gathering and analyzing data on the perspectives and experiences of Test Bed utility customers, program implementation managers and contractors, and other utility stakeholders. The evaluation team collected and analyzed data on SGTB customer attitudes, knowledge, motivations, and behaviors regarding energy consumption and the environment from several sources,

¹² Source: PGE. July 1, 2019. *PGE Requirements Document*.

¹³ Source: *Ibid*.

¹⁴ Development of PGE’s nonresidential SGTB logic model is in progress and anticipated in Q1 2021.

including metered electricity consumption, surveys of residential Test Bed customers, rebates paid to PTR customers, residential customer focus groups, and field visits to nonresidential Test Bed customers. The team also conducted interviews with PGE Test Bed managers, stakeholders, and implementation contractors. The team synthesized the findings from these different activities to draw conclusions and make recommendations.

Evaluation research to date has largely focused on the residential sector, which receives a heavier focus in this report. The implementation of the nonresidential SGTB was significantly delayed due to the COVID-19 pandemic, which limited opportunities for the evaluation to collect and analyze data. The evaluation was able to conduct stakeholder interviews and perform walk-alongs while PGE representatives conducted door-to-door outreach to small and medium businesses for Schedule 25 recruitment.

Evaluation Activities

Table 5 lists the research activities performed as part of this SGTB evaluation. (*Appendix B* describes each evaluation activity in more detail.) This evaluation has also incorporated research and findings from concurrent and past evaluations of other PGE demand response pilots, namely the residential Flex 2.0 PTR evaluations and Smart Thermostat evaluations.

Table 5. SGTB Evaluation Activities

Activity	Description	Time Period and Frequency	Purpose
Residential CVP Surveys*	Online surveys launched at culmination of SGTB CVP campaigns.	CVP 1 survey—launched in Feb 2020 (n= 699); CVP3 survey—launched in Oct 2020 (n=891)	Assess awareness and knowledge of demand response, SGTB, PTR, and grid operations; messaging and channels of CVPs and PGE communications; values and attitudes in general and specifically regarding energy/PGE/SGTB; motivations regarding PTR/Smart Thermostat DLC program participation and in response to PGE communications; and specific aspects of CVP campaigns.
Residential Focus Groups	Focus groups conducted to specifically assess barriers to Smart Thermostat enrollment by comparing customers identified as control keepers to a general nonparticipant group.	Four online focus groups conducted in Sept. 2020 (n=24 total customers)	Explore customer values, barriers, and motivations associated with Smart Thermostat DLC program enrollment
Nonresidential Walk-Alongs	Staff walk-alongs with implementation contractor in the three SGTB neighborhoods to observe door-to-door outreach to Schedule 25 customers	Conducted in October 2020—observed 19 businesses out of 61 potential interactions based on the number of open businesses with available staff	Gauge nonresidential customer awareness of SGTB, successes/challenges of door-to-door outreach, motivations/barriers for participation
Stakeholder Interviews	Interviews with PGE staff, implementers, and partners to understand program processes, successes, and challenges	Conducted a total of 20 interviews with various stakeholders from winter 2019 through fall 2020	Obtain thorough understanding and documentation of the program design and implementation

Activity	Description	Time Period and Frequency	Purpose
Impact Metrics Analysis	Collection and compilation of PGE program tracking data into database. Analysis of PGE program tracking, customer information, and rebate data.	Assessed metrics at the end of each CVP campaign (Jan 2020; March 2020; Oct 2020)	Summarize statistics of program information to track KPIs and assess metrics by different customer segments
Residential Resonance Assessment*	Resonance assessment was a multivariate analysis that used a combination of customer activity data and market research survey results to uncover how and why specific stimuli drive certain customers to act, and what may be preventing others from taking the desired actions.	Conducted in Q1-Q2 for CVP1; assessment for CVP3 slated for Q1 2021	Assess extent to which PGE is succeeding in engaging customers through its SGTB messaging and what PGE can do to amplify the resonance of its communications
Marketing Reviews	Systematic review of all customer-facing SGTB marketing collateral	Conducted reviews for the SGTB launch and three of CVP campaigns (CVP1, CVP2, and CVP3)	Identify marketing treatments that would inform the resonance assessment for evaluating what messages or marketing collateral is working, for whom, and why.
Logic Model Review / Update	Assessment of whether the program operated and produced results as theorized; documentation of KPIs	Reviewed PGE's initial residential logic model in Q1 2020	Document what is and what is not producing the theorized results; Provide PGE feedback on ways to align/refine SGTB activities to outputs to outcomes.
AMI Hourly Consumption Analysis **	Performed regression analysis using matched comparison groups to estimate average hourly load impacts of PTR events (from Flex 2.0 Evaluation)	Flex 2.0 evaluation performed impact evaluation of the summer 2019, winter 2019/2020, and summer 2020 PTR event seasons	Estimate load impacts associated with PTR enrollee by PTR event and season.

* Because there was only one PTR demand response event early in the winter 2019/2020 season, PGE cancelled the customer surveys and associated resonance assessment scheduled at the conclusion of the CVP 2 Giving Back campaign.

** Note, the SGTB evaluation used the consumption analysis conducted under the Flex 2.0 evaluation to assess load impacts associated with PTR enrollees in the SGTB.

Figure 4 presents the schedule of SGTB evaluation research activities conducted through October 2020. Note, evaluation research leveraged for this evaluation (e.g., the Flex 2.0 impact evaluation) is not included below.

Figure 4. SGTB Evaluation Research Schedule

Activity	2019			2020			
	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Program Season	Summer		Winter	Summer		Winter	
Residential							
Residential CVP Surveys (x2)				CVP1			CVP3
Impacts Metric Analysis (x3)				CVP1	CVP2		CVP3
Resonance Assessments (CVP1 complete; CVP3 in progress)					CVP1		
Marketing Reviews				CVP1	CVP2		CVP3
Stakeholder Interviews			✓		✓		✓
Logic Model Review (Residential)			✓				
Residential Focus Groups						✓	
Nonresidential							
Stakeholder Interviews			✓		✓		✓
Small/Medium Nonresidential Walk Alongs						✓	

Data Sources

This evaluation collected and analyzed a variety of data, including from customer advanced metering infrastructure (AMI) electricity meters, surveys of residential Test Bed customers, rebates paid to PTR customers, residential customer focus groups, field visits to nonresidential Test Bed customers, and other sources.¹⁵ The data collected can be used to analyze and gain insights about different aspects of SGTB customer attitudes, behaviors, and experience.

Table 6 lists the data sources used in this evaluation of the SGTB.

Table 6. SGTB Evaluation Data Sources

Data Type	Source	Notes
SGTB Residential CVP Surveys	SGTB evaluation (Cadmus)	CVP1 and CVP3 surveys
SGTB Residential Focus Groups	SGTB evaluation (Cadmus)	Focus group recordings and analysis from four separate sessions
SGTB Stakeholder Interviews	SGTB evaluation (Cadmus)	In-depth interview notes from 20 separate stakeholder interviews
Nonresidential Walk-Alongs	SGTB evaluation (Cadmus)	Field data collection based on observations from walk-alongs with SGTB implementation contractor

¹⁵ Cadmus estimated PTR load impacts as part of the Flex 2.0 evaluation, which is concurrent with the evaluation of the SGTB project. In this report, we reference and present load impacts from analysis of hourly AMI meter consumption data from the Flex 2.0 evaluation. PGE has filed the Flex 2.0 evaluation report covering the summer 2019 and winter 2019/2020 PTR event seasons with the OPUC. Cadmus’ evaluation of Flex 2.0 PTR for the summer 2020, winter 2020/2021, and summer 2021 event PTR seasons is currently in progress.

Data Type	Source	Notes
Demand Response Program Tracking Data	PGE and implementation contractors	From Flex 2.0 (PTR) and Smart Thermostat pilot programs and contains customer ID numbers, contact information, enrollment dates and status, and other program-specific data
Customer Information System Data	PGE	Used to characterize customers by key demographic and customer segments
PTR Rebate Data	PGE and implementation contractor	Includes rebates paid to each customer by PTR event.
PTR Demand Response Event Notification Data / Seasonal Event Log	PGE	Starting times and durations of demand response events and counts of customers receiving pre- and post-event notifications
SGTB Marketing Materials	PGE	Includes all customer-facing SGTB marketing collateral
PGE Hourly AMI Consumption Data	PGE	Used to estimate hourly load impacts for the Flex 2.0 PTR evaluation
PGE PTR Opt-Out Survey	PGE	PGE provided a top-line report used to document the reasons for why some customers unenrolled from PTR
PGE Demand Response Baseline Survey	PGE	PGE provided completed survey data used for baseline awareness estimates

The different data types have relative strengths and weaknesses, and none provides a definitive picture of the SGTB by itself. For example, analysis of AMI meter data can show that customers reduced their demand during a demand response event but not why they did so. Likewise, customer survey data can help to understand motivations for saving, but the motivations of survey respondents may differ from the SGTB customer population at large. These relative strengths and weaknesses of the individual data sources should be kept in mind.

Often a single SGTB customer behavior can be analyzed using multiple types of data. For example, whether a customer took action to reduce demand during demand response events can be assessed through analysis of self-reports from customer survey data, data on rebates PGE paid to customers, or AMI meter data. This evaluation has attempted to overcome the limitations of individual data sources for making inferences about customer behaviors by relying on the analysis of multiple data types when possible.

RESIDENTIAL EVALUATION FINDINGS

This section presents the detailed findings for residential customers from the SGTB project evaluation. Sections are organized according to the outcome areas identified in PGE’s residential SGTB logic model (Appendix A):

- Awareness and knowledge
- PTR event participation and load reduction
- Customer satisfaction
- PTR enrollment and retention
- Smart Thermostat DLC migration
- Community engagement and DEI

SGTB Key Performance Indicator (KPI) Goals

PGE developed a set of KPIs to evaluate performance goals as part of developing its residential sector logic model. Table 7, Table 8 and Table 9 are an overview of the residential KPIs and their status, as of this report, for general and CVP-specific goals and for goals associated with community engagement and DEI. Note, KPI metrics and targets were developed by PGE and all reporting on the status of KPIs is based on research activities from this evaluation. Data sources are referenced below, with additional details provided in the *Evaluation Activities* section.

Table 7. PGE Residential SGTB KPIs – Overall

KPI Name	Metric Description and Goal	KPI Status (as of October 2020)
PTR Event Participation	At least 50% of SGTB customers earn a rebate during each demand response season	<ul style="list-style-type: none"> • Summer 2019: 97% earned in season, 48% earned per event • Winter 2019/2020: 62% earned in season, 62% earned per event • Summer 2020: 94% earned in season, 53% earned per event <i>Source: Cadmus analysis of PGE PTR program tracking and rebate data</i>
PTR Event Load Impacts	Per-customer PTR kWh higher in 2020 than 2019 (Note: may be influenced by event day temperatures)	<ul style="list-style-type: none"> • Savings increased, but the increase was not statistically significant. • Summer 2019: 0.06 kW • Summer 2020: 0.08 kW <i>Source: Cadmus load impact analysis (Flex 2.0 Evaluation, 2020)</i>
PTR Retention	80% of SGTB customers are still enrolled in PTR by the end of 2019	<p>As of September 2020, SGTB customer retention in PTR was 94.2% (or 95.7% when adjusted for Smart Thermostat migration).</p> <i>Source: Cadmus analysis of PGE PTR program tracking</i>
Demand Response Awareness	Statistically significant increase within SGTB over baseline survey (58% aware)	<p>From CVP 1 and 3 surveys, 86%-90% aware, a significant increase over baseline</p> <i>Source: PGE DR Baseline Survey (2019) and Cadmus CVP 1/CVP 3 Surveys</i>
Grid Operations Awareness	Statistically significant increase within SGTB over baseline survey (Note: comprises five grid operations knowledge questions. See Table 10.)	<p>CVP 1 and CVP 3 survey respondents' knowledge on two of the five grid operations concepts significantly increased relative to baseline.</p> <i>Source: PGE DR Baseline Survey (2019) and Cadmus CVP 1/CVP 3 Surveys</i>
PTR Satisfaction	At least 80% SGTB customer satisfaction with PTR for each event season	<p>Customer satisfaction ranged from 68% to 78%</p> <i>Source: Cadmus CVP 1/CVP 3 Surveys</i>
SGTB Awareness	75% of SGTB customers have heard about the project	<ul style="list-style-type: none"> • 55% aware from CVP 1 survey • 50% aware from CVP 3 survey <i>Source: Cadmus CVP 1/CVP 3 Surveys</i>

Green = Met goal Yellow = Partially met goal or in progress Purple = Did not meet goal Grey = Cannot determine/no data

Table 8. PGE Residential SGTB KPIs – CVP-Specific

KPI Name	Metric Description and Goal	KPI Status (as of October 2020)
CVP1 Monetary Incentives - Smart Thermostat Migration	2% of SGTB customers with eligible HVAC enroll in Smart Thermostat DLC program	3.6% migrated to Smart Thermostat DLC program <i>Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data</i>
CVP1 Monetary Incentives - Smart Thermostat Program Awareness	75% of SGTB eligible customers heard about Smart Thermostat DLC program (considered by PGE to be a stretch goal)	65% were aware <i>Source: Cadmus CVP 1 Survey</i>
CVP2 Giving Back - Partnering	Delivery of co-branded materials (PGE and the three charities) and social media sharing	Ran co-branded emails, direct mail, and digital ads. Shared on Facebook and Twitter. <i>Source: Cadmus review and analysis of PGE SGTB marketing collateral and data</i>
CVP2 Giving Back - Enrollment	2% enrollment rate	2.3% enrollment rate <i>Source: PGE PTR and Smart Thermostat program tracking and enrollment data</i>
CVP2 Giving Back - Awareness	25% email open rate with 2% click through rate	28.7% email open rate and 1.06% click through rate <i>Source: Cadmus review and analysis of PGE SGTB marketing collateral and data</i>
CVP2 Giving Back – PTR Satisfaction	Satisfaction with PTR 5% higher for Giving Back enrollees than non-enrollees	Unable to measure this as no winter 2019/2020 survey was conducted
CVP3 Carbon – Awareness	50% of those getting messages (treatment group) aware of campaign and participate in events to affect carbon reduction	From CVP 3 survey, 43% remembered hearing about carbon messages and 55% said they participated in events to reduce carbon footprint <i>Source: Cadmus CVP 3 Survey</i>
CVP3 Carbon – PTR Event Participation	PTR rebates for treatment group statistically higher than for control group	No statistically significant difference detected regarding average participation per kW load impacts between treatment and control group. <i>Source: Cadmus load impact analysis (Flex 2.0 Evaluation, 2020)</i>

Green = Met goal Yellow = Partially met goal or in progress Purple = Did not meet goal Grey = Cannot determine/no data

Table 9. PGE Residential SGTB KPIs – Community Engagement, DEI, and Ongoing Improvements

KPI Name	Metric Description and Goal	KPI Status (as of October 2020)
DEI - Partners Identified	List of prioritized community stakeholders with assigned PGE relationship owners (2019) and Salesforce dashboard tracking (2020)	Both goals were met. See Table 10 for list of community stakeholders.
DEI - Community Engagement Best Practices	Develop community engagement workplans (2020), develop Equity Lens Toolkit (2020), and start to implement Toolkit/operationalize DEI learnings (2021)	The first two goals were met. Third goal is to be completed in 2021.
DEI - PACE Model for Community Feedback	Create priority stakeholder outreach strategy (2019) and CBO partnership strategy developed and initiated (2020)	Both goals were met. See Table 10 for stakeholder and CBO outreach strategy.
Customer Insights Resources	Delivery of customer insights findings in PowerPoint presentation and/or report format after each CVP campaign	PGE and Cadmus have delivered findings after each CVP
Communication Improvements	Apply and test learnings and suggested improvements from the SGTB project evaluation and PGE research by end of 2020	PGE implemented Cadmus' suggestion of running a randomized control trial to test CVP 3 (Carbon). More learnings to be applied in 2021 (e.g., smart thermostats marketing, Giving Back with Learnings CVP).

Source: Stakeholder interviews

Green = Met goal Yellow = Partially met goal or in progress Purple = Did not meet goal Grey = Cannot determine/no data

Awareness and Knowledge

Summary of Goals, Barriers, Challenges, and Activities

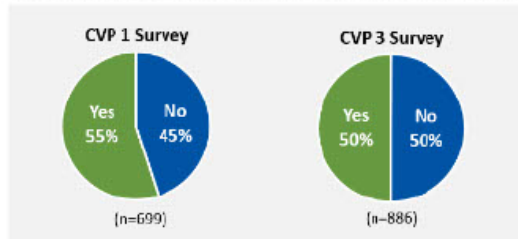
GOALS	<ul style="list-style-type: none"> • Attain 75% customer awareness of the SGTB • Increase customer awareness of demand response and grid operations from baseline
BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> • Lack of clear information on demand response and grid operations to educate customers
ACTIVITIES PGE IMPLEMENTED TO OVERCOME BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> • Demand response awareness campaign • Direct mailers and emails to inform customers about the SGTB • SGTB billboards in neighborhoods • Community outreach events conducted by DEI Community Outreach Consultants: farmer’s markets, fairs, lunch-and-learns with city partners, and presentations to CBOs • Auto-enrollment into PTR exposes customers to demand response and peak time events

Source: PGE’s residential SGTB logic model, staff interviews, and marketing reviews

Customer Awareness of the SGTB and PTR

Currently, PGE is not meeting the goal of 75% customer awareness of the SGTB. As shown in Figure 5, half of the CVP survey respondents said they had heard about the SGTB, and this level held steady between the CVP 1 survey (55%) and the CVP 3 survey (50%). Two factors possibly account for PGE not meeting its goal. First is that PGE focused its marketing and education efforts on PTR, Smart Thermostat DLC, and the CVPs – the more critical aspects of the SGTB – rather focus marketing and educational efforts on the SGTB project itself. Second is that the COVID-19 pandemic halted all in-person outreach and community events intended to inform customers about the SGTB.

Figure 5. Residential Customer Awareness of the SGTB



Source: Cadmus CVP1 and CVP3 Survey Question. “The images above represent the three neighborhoods that are part of PGE’s Smart Grid Test Bed. Have you heard about the Smart Grid Test Bed?”

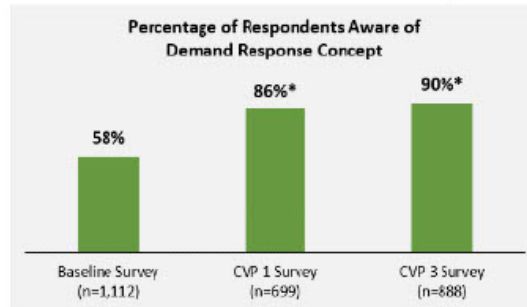
The focus on educational efforts of PTR paid off as PGE achieved near universal customer awareness of the PTR program; 93% of CVP 1 survey respondents (n=699) and 98% of CVP 3 survey respondents (n=890) had heard of the PTR program. Moreover, this increase was statistically significant at the 90% confidence level.

Customer Awareness of Demand Response and Knowledge of Grid Operations

PGE’s marketing, the demand response awareness campaign, and the experience of participating in the PTR program (such as receiving peak time event notifications and results) are having its intended effects.

Early on in the SGTB project, PGE met its goal of increasing customer awareness of demand response.¹⁶ As shown in Figure 6, the proportion of respondents who were aware of the concept of demand response significantly increased from the PGE DR Baseline survey (58%) to the CVP 1 survey (86%) and the CVP 3 survey (90%). Focus group respondents also demonstrated high familiarity with demand response by being able to articulate the intent of the PTR program and why it is important to shift or reduce energy use during peak times.

Figure 6. SGTB Customer Awareness of Demand Response Concept



* Difference from baseline is significant with 90% confidence (p<0.10).
 Source: PGE DR Baseline Survey and Cadmus CVP 1/CVP 3 Survey Question.
 “Electric utilities sometimes offer programs that reward customers for making small shifts in when and how they use energy. Doing this helps avoid spikes in energy usage for the community as a whole. These energy spikes occur for just a few hours on the hottest and coldest days of the year. And without energy spikes, utility companies can keep prices lower. Were you previously aware of this concept?”

However, PGE has not entirely met its goal of increasing customer awareness of grid operations from the baseline. Of the five grid operations knowledge questions (Table 10), respondents showed an increase in knowledge about two grid operations concepts—peak demand time periods (80% correctly responded compared to 68% in the baseline) and balancing energy supply and demand (61% correctly responded compared to 54% in the baseline). Respondents’ knowledge about the variable cost of electricity showed a slight decrease (64% correctly responded compared to 74% in the baseline). One plausible reason for the inconsistency is that PGE’s SGTB marketing and CVP communications have not included information on grid operations other than on peak demand times.

¹⁶ PGE administered the Demand Response Baseline Survey in the first half 2019 prior to the launch of the SGTB. The evaluation asked the same demand response awareness and grid operations knowledge questions in the CVP surveys.

Table 10. SGTB Customer Knowledge of Grid Operations

Grid Operations Question	Percentage of Respondents with Correct Answer		
	Baseline Survey (n=1,124)	CVP 1 Survey (n=697)	CVP 3 Survey (n=888)
Do you believe that PGE's cost to provide electricity is the same at all times of the day?	74%	74%	64%*
What part of the day do you think the most electricity is used in your community?	68%	78%*	80%*
How much of the energy generated by PGE comes from renewable sources such as hydro, wind or solar power?	10%	7%	11%
Agree or disagree statement: PGE can store electricity and use it when there are times of high demand for electricity.	46%	48%	48%
Agree or disagree statement: PGE must constantly balance the amount of energy that it supplies with the amount that is used, so that they are equal.	54%	60%	61%*

* Difference from baseline is significant with 90% confidence (p≤0.10).

Source: PGE DR Baseline Survey and Cadmus CVP 1/CVP 3 Survey Questions.

PTR Event Participation and Load Reduction

Summary of Goals, Barriers, Challenges, and Activities

GOALS	<ul style="list-style-type: none"> Achieve at least 50% of customers earning a rebate during each season Achieve per-customer PTR kWh savings higher in 2020 than 2019
BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> Insufficient or constrained implementation resources: no ability to send out same-day event notifications in 2019 and no ability to call events on Mondays in 2019 Customers forget about events and want same-day event notifications Customers do not know how to shift or reduce energy during events or want more ideas on this Customer value proposition(s) for participation in demand response is poorly defined Uncertain how to keep customers engaged and motivated for future events
ACTIVITIES PGE IMPLEMENTED TO OVERCOME BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> Development and implementation of same-day event notifications via email in January 2020 Removed event-calling limitation and called first-ever Monday event in August 2020 Energy-saving/shifting tips included in customer's event notifications (summer 2019), energy savings guide infographic mailed to customers (summer 2020), and a PTR checklist mailed to customers (summer 2020) Roll-out of CVP 1 Monetary Incentives, CVP 2 Charitable Giving, and CVP 3 Carbon campaigns to test customer reactions to different motivational messages Gamification in summer 2020: SGTB community with the highest percentage of event participation entered in an Amazon gift card sweepstakes and received a tree-planting donation in their community

Source: PGE's residential SGTB logic model, staff interviews, marketing reviews, and Cadmus Flex summer surveys

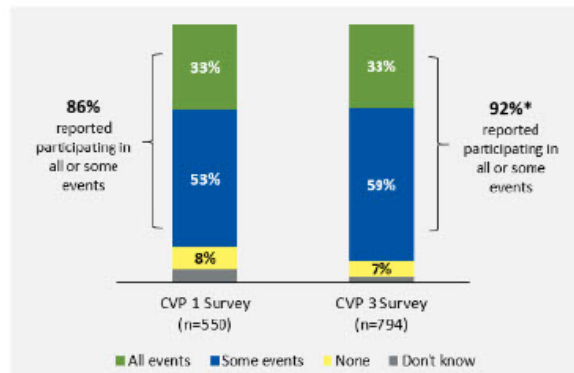
Self-Reported Event Participation Outcomes

Based on self-reports, a large majority of SGTB customers participated in the PTR events. As shown in Figure 7, 86% of CVP 1 survey respondents and 92% of CVP 3 survey respondents reported participating in all or some of the summer events.¹⁷ Moreover, self-reported event participation showed a statistically

¹⁷ Cadmus did not conduct a CVP survey for winter 2019/2020 because only one peak time event was called during that season and the number of enrollees in the charitable giving offer were limited.

significant improvement from summer 2019 (CVP 1 86%) to summer 2020 (CVP 3 92%). A combination of providing customers with same-day event notifications, the energy-savings infographic, the PTR checklist, and gamification likely contributed to the higher event participation rate in summer 2020.

Figure 7. SGTB Customer Participation in PTR Events

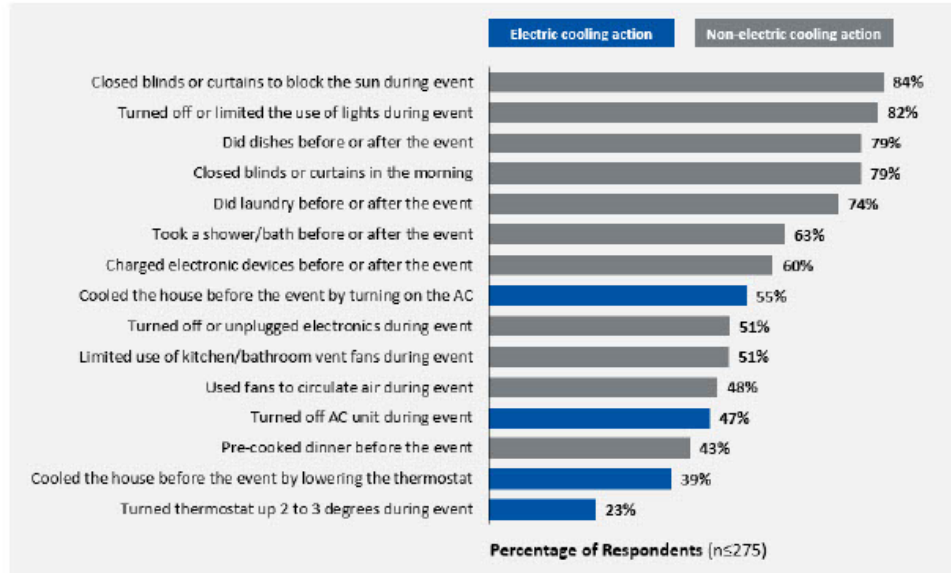


* Difference between CVP 1 and CVP 3 is significant with 90% confidence (p≤0.10).
 Source: Cadmus CVP 1 and CVP 3 Survey Question. "Did you or others in your household do anything to shift/reduce energy use during the summer Peak Time Events?"

Although a large majority of respondents said they participated in events, most participated in some rather than all events during the summer. Figure 7 shows that just over half reported participating in some events in summer 2019 (CVP 1, 53%) and summer 2020 (CVP 3, 59%), which indicates a challenge for PGE to keep these customers engaged and an opportunity to expand participation in PTR. When asked an open-end question in the CVP 3 survey about what information customers would like to receive, respondents most frequently asked for more tips on how to shift or reduce energy use (38%, n=122). Providing more tips may be one way to expand customer participation in PTR events.

Another challenge is that customers most frequently took the lowest rather than the highest energy-saving/rebate-earning actions. In particular, in summer customers were less likely to take [actions to reduce or shift their space cooling electricity use](#), perhaps due to thermal discomfort and inconvenience. As illustrated in Figure 8, respondents most frequently closed blinds/curtains during an event (84%), turned off lights during an event (82%), and did dishes before or after an event (79%). Actions to reduce or shift use of electric cooling ranked toward the bottom.

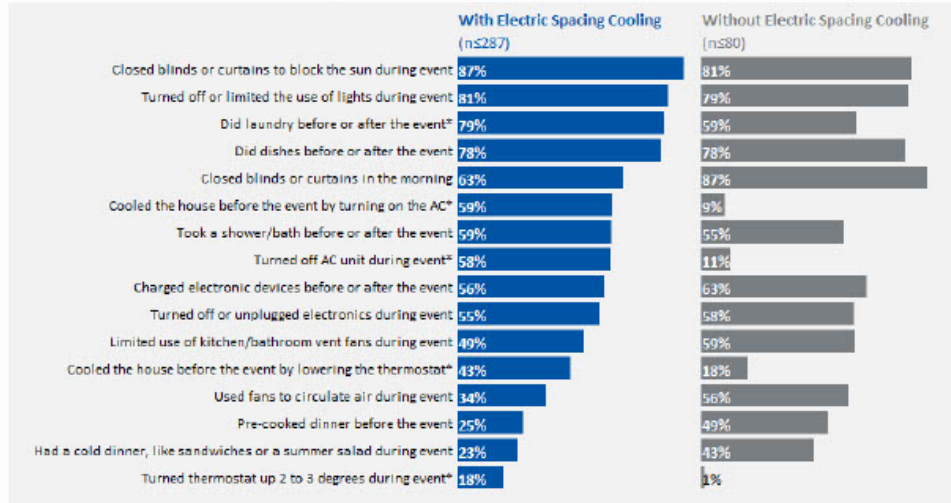
Figure 8. SGTB Customer Actions Taken During Summer 2020 Events



Source: Cadmus Flex Summer 2020 Survey Question. "Here is a list of things your household may have done to shift or reduce energy for the Peak Time Event. For each item, please indicate Yes if you did this or No if you did not."

Nonetheless, SGTB customers with electric space cooling did engage in actions to reduce or shift use of electric cooling more frequently than customers without electric space cooling. As demonstrated in Figure 9, significantly more respondents with electric space cooling than respondents without cooled the house before the event and turned their thermostat up two to three degrees during the event.

Figure 9. SGTB Customer Actions Taken During Summer 2020 Events by Presence of Electric Space Cooling



* Difference between respondents with electric cooling and respondents with non-electric cooling is significant, with 90% confidence (p≤0.10).

Source: Cadmus Flex Summer 2020 Survey Question. "Here is a list of things your household may have done to shift or reduce energy for the Peak Time Event. For each item, please indicate Yes if you did this or No if you did not."

Event Participation Reasons and Motivations

The CVP surveys asked customers who participated in some or all peak time events for their reasons. To gauge the impact of specific SGTB messaging, the surveys used the same phrasing as the language in SGTB communications.

Money (saving on bills and earning rebates) was customers' primary motivator for event participation. As the Figure 10 illustrates, **money-related reasons** ranked first, **environment/carbon-related reasons** ranked second, and **community-related reasons** ranked third. Although PGE tested the CVP 3 carbon messaging during summer 2020, these overall rankings did not change from summer 2019 to summer 2020. Respondents indicating *to reduce my carbon footprint* was about the same from the CVP 1 survey (55%) to the CVP 3 survey (56%). Remarkably, the evaluation observed a significant decrease in the percentage of respondents indicating *to earn rebates* from the CVP 1 survey (70%) to the CVP 3 survey (58%), possibly an effect of the CVP 3 campaign.¹⁸

¹⁸ Difference between CVP 1 and CVP 3 is significant with 90% confidence (p≤0.10).

Figure 10. SGTB Customers' Top Event Participation Reasons and Motivations

CVP 1 Survey (n=417)		CVP 3 Survey (n=489)	
Rank	% of Respondents Who Said the Statement Was "Very True"	Rank	% of Respondents Who Said the Statement Was "Very True"
1	To reduce my energy bill (77%)	1	To reduce my energy bill (71%)
2	To earn rebates (70%)	2	It doesn't cost me anything (62%)
3	It doesn't cost me anything (63%)	3	To help build a cleaner energy future (60%)
4	To help build a cleaner energy future (58%)	4	To help save the planet (60%)
5	To reduce my carbon footprint (55%)	5	To earn rebates (58%)
6	To help keep electricity prices affordable for my community (54%)	6	To reduce my carbon footprint (56%)
7	To help shape the future of how we consume energy in Oregon (52%)	7	To build a brighter cleaner tomorrow (54%)
8	To help PGE rely more on renewable energy during peak times (50%)	8	To help keep electricity prices affordable for my community (52%)
9	To help the community avoid power shortages (46%)	9	Because the little things I do can make a big impact (51%)
10	It's simple to shift my energy use (39%)	10	To help the community avoid power shortages (51%)

Motivation Typology Key	Money	Community	Environment / Carbon	Social Responsibility	Other
-------------------------	-------	-----------	----------------------	-----------------------	-------

Note: The same statements were not used in CVP 1 and CVP 3 surveys. Cadmus incorporated the phrasing used in the SGTB PTR's communications in the survey question statements that customers rated. PGE repeated some phrases across CVPs but also introduced new phrases.

Source: Cadmus CVP1 and CVP3 Survey Question. "Below are reasons people might decide to shift/reduce their energy use during the summer Peak Time Events. Please indicate how well each reason applies to you."

Earned Rebates

PGE did meet its goal of achieving at least 50% of customers earning a rebate during each demand response season. Cadmus' analysis of PGE's PTR rebate data found that 97% of SGTB customers in summer 2019, 62% in winter 2019/2020, and 94% in summer 2020 earned a rebate.¹⁹

¹⁹ Whether a customer received a rebate may not be an accurate indicator of whether a customer reduced demand during PTR events because of random error in the estimate of customer's PTR savings. Consider a customer whose true (but unknown) savings are equal to zero. If the probability distribution of the savings estimate for this customer has a mean equal to zero (i.e., on average the estimate is accurate) and is symmetric around the mean (positive and negative errors in the estimate are equally likely), a customer whose true savings are zero has a 50% chance of earning a rebate. Over five events, a customer who has true savings equal to zero for each event will therefore have 97% chance of earning a rebate over the summer. [Prob(earning a rebate)= 1 - Prob(not earning a rebate for any event)= 1 - 0.5⁵) = 0.968.] The probability of earning a rebate will be larger for an actual saver. Thus, whether an individual customer earns a rebate or the percentage of customers earning rebates over the summer is not informative about customer savings because almost all customers are expected to earn a rebate. However, comparisons of the rebate distributions or measures of central tendency (mean, median) for two groups of customers can be informative. For example, if one group has more probability distributed on larger rebate levels, then all else the same, that would suggest that the group saved more than the other group, even if the level of savings for the higher saving group is uncertain.

Table 11 provides additional detail for SGTB PTR and Flex PTR customers on average rebate amounts per event, per season, and on the proportion of customers that received rebates per event and per season.

Table 11. Summary of Rebates Amounts and Percentages of SGTB PTR vs. Flex PTR Enrollees

Season	Percentage of PTR Enrollees Earning Rebate Per Season	Percentage of PTR Enrollees Earning Rebate Per Event	Avg Rebate Per Event	Avg Rebate Per Season
Test Bed PTR Customers				
Summer 2019	97%	48%	\$1.04	\$5.20
Winter 2019 / 2020	62%	62%	\$1.11	\$1.11
Summer 2020	94%	53%	\$0.92	\$4.60
Flex PTR Customers				
Summer 2019	97%	50%	\$1.14	\$5.72
Winter 2019 / 2020	63%	63%	\$1.31	\$1.31
Summer 2020	95%	54%	\$1.04	\$5.18

* Rebates are based on averages of rebates for all enrolled participants for a given event, including those that received \$0.
 Source: Cadmus analysis of PGE PTR program tracking and rebate data

A comparison of average rebates from the summer 2020 season found that SGTB survey respondents who reported participating in all events earned an average of \$9.68 per season compared to \$5.11 per season for respondents who reported participating in some events. This suggests that the distinction between all-event participants and some-event participants in the self-report survey is meaningful.

Peak Time Rebates Demand Savings

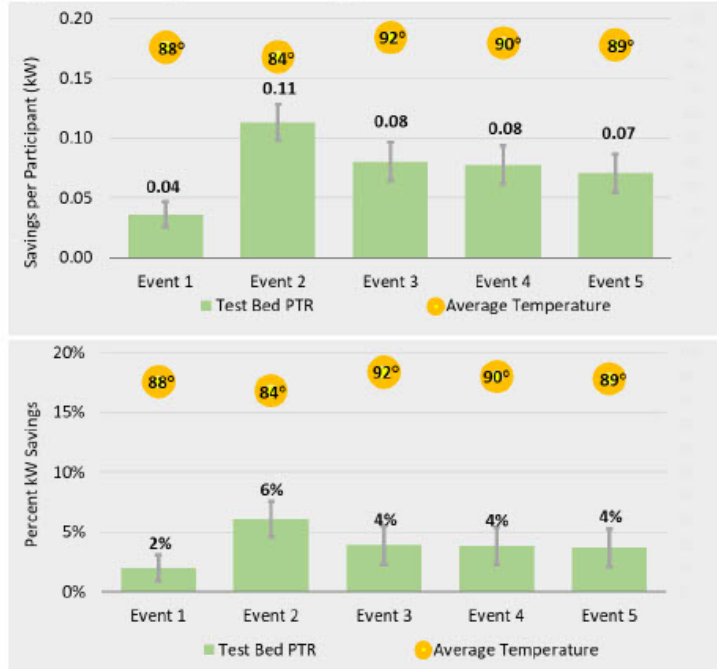
As part of the Flex 2.0 PTR evaluation, Cadmus estimated PTR savings for SGTB customers.²⁰ Figure 11 shows the average demand savings (kW) per Test Bed PTR customer and the percentage savings (the kW savings relative to baseline demand) for each of the five summer 2020 events.²¹ The PTR savings ranged from 0.04 kW (2%) for event one to 0.11 kW (6%) for event two. In winter 2019/2020, there was one Flex PTR event, and SGTB PTR customers saved 0.02 kW or 1% of demand, while Flex PTR customers

²⁰ The SGTB PTR customers include customers whom PGE auto-enrolled and those who enrolled themselves before PGE began the auto-enrollment. PGE has continued to auto-enroll new residential accounts in PTR.

²¹ The events occurred from 5:00 p.m. to 8:00 p.m. on the June 23, 2020, July 21, 2020, July 30, 2020, August 17, 2020, and September 3, 2020. Cadmus provided evaluated savings for SGTB customers in the Flex 2.0 PTR program in a PowerPoint presentation to PGE on December 11, 2020. These results will be included in a final Flex 2.0 evaluation report, expected to be filed with the OPUC in 2022.

saved 0.1 kW or 5.4% of demand. More details about the PTR savings of SGTB customers can be found in the publicly available Flex 2.0 evaluation report.²²

Figure 11. Average Demand Savings per SGTB PTR Customer - Summer 2020



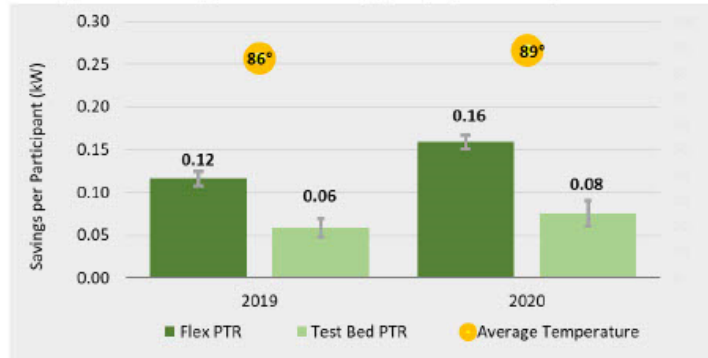
Note: Estimates based on Cadmus analysis of AMI meter data from the summer 2020 event season for Flex 2.0 PTR participants and matched comparison group. Each summer 2020 event occurred on a weekday beginning at 5 p.m. and lasted 3 hours. Error bars indicate 90% confidence intervals based on standard errors clustered on customers. For each event, some enrolled customers did not receive pre-event notifications. Percentage savings were equal to the kW savings divided by baseline demand. The kW savings were estimated across enrolled PTR customers who received notifications and a small percentage (<5%) of those who did not. Source: Cadmus load impact analysis (Flex 2.0 Evaluation)

Figure 12 compares the summer 2020 SGTB PTR savings to the SGTB PTR savings in summer 2019 and the savings for PGE residential customers outside the Test Bed who were enrolled in the Flex PTR program (referred to as Flex PTR customers to differentiate them from SGTB PTR customers). Average demand savings per SGTB PTR customer increased from 0.06 kW in 2019 to 0.08 kW in 2020; however,

²² Evaluated load impacts and methodology for savings calculations are documented in the 2020 Flex 2.0 Demand Response Pilot Evaluation Report (June 2020). The report covers the summer 2019 and winter 2019/2020 seasons. <https://edocs.puc.state.or.us/efdocs/HAQ/um1708haq124912.pdf>.

in percentage terms, the savings remained constant at 4% of demand.²³ Flex PTR participants saved 0.16 kW or 8% on average based on the summer 2020 event season.

Figure 12. Average Demand Savings (kW) by PTR Group and Season



Note: Error bars indicate 90% confidence intervals based on standard errors clustered on customers. The increase in kW savings between summer 2019 and summer 2020 is statistically significant for Flex PTR, but not so for Test Bed PTR.

Source: Cadmus load impact analysis (Flex 2.0 Evaluation)

The comparison of Test Bed PTR and Flex PTR savings illustrates the effect of making participation in PTR the default option in Test Bed. The average demand savings per customer was higher for Flex PTR customers than for Test Bed PTR customers. As Figure 12 shows, demand savings for Flex PTR customers were about twice as large in summer 2020. This difference is attributable to the opt-out PTR program design in the SGTB. By automatically enrolling customers in PTR, PGE enrolled customers who would have enrolled themselves as well as many who would not have done so, including many who had and continue to have little interest in saving. The inclusion of these customers in the program reduces the average savings per customer.

In the next section of this report, Cadmus analyzes more completely the effects on enrollment and savings of making PTR participation the default option in the Test Bed. However, some insight about the effects can be gleaned by comparing the savings of SGTB PTR customers and Flex PTR customers by

²³ Cadmus provided evaluated savings for SGTB customers in the Flex 2.0 PTR program to PGE in a PowerPoint presentation on December 11, 2020.

demand response micro-segment.²⁴ Figure 13 presents the summer 2020 average demand savings per customer for SGTB PTR and Flex PTR customers by demand response micro-segment.

Low Engagers and Borderliners are the largest micro-segments, accounting for over 60% of PGE customers. However, in the Test Bed, these groups saved very little. SGTB PTR Low Engagers (who were automatically enrolled) saved an average of only 0.01 kW (not statistically different from zero), while Flex PTR Low Engagers (who opted into the program) saved an average of 0.04 kW. Similarly, SGTB Borderliners saved only 0.03 kW per customer, while Flex PTR Borderliners saved an average of 0.12 kW per customer.²⁵

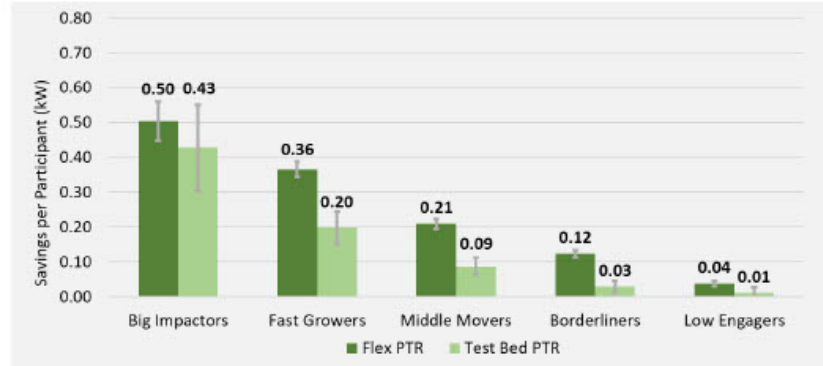
Furthermore, because of the auto-enrollment, the Test Bed PTR program included a higher proportion of customers with low demand response savings potential (Low Engagers, Borderliners) and low probability of self-enrollment.²⁶ This also contributed to the smaller average savings per PTR customer in the Test Bed.

²⁴ Before summer 2019, PGE segmented their customers into five groups (micro-segments) reflecting potential demand response program savings and engagement. This customer segmentation was developed specifically for the Flex 2.0 pilot to facilitate targeted marketing and more insightful evaluation. Definitions of micro-segments are provided in Table B-3 in *Appendix B*.

²⁵ PGE obtained similar savings for these groups in summer 2019. See the 2020 Flex 2.0 Demand Response Pilot Evaluation Report (June 2020): <https://edocs.puc.state.or.us/efdocs/HAQ/um1708haq124912.pdf>.

²⁶ Among Test Bed PTR and Flex PTR customers, the distributions across the micro-segments were as follows: Big impactors: 1.3% for Test Bed PTR, 3.8% for Flex PTR; Fast Growers: 6.1%, 11.2%; Middle Movers: 17.3%, 21.4%; Borderliners: 35.4%, 30.1%; and Low Engagers: 39.9%, 33.4%. Thus, the micro-segments with the highest savings potential (Big Impactors and Fast Growers) were underrepresented in Test Bed PTR relative to Flex PTR, and the micro-segments with the lowest savings potential (Low Engagers and Borderliners) were overrepresented. A test of the equality of the distributions of PTR customers across micro-segments between the Flex PTR and Test Bed PTR programs indicated the difference was statistically significant ($\chi^2(4)=1,150$, p-value < .001).

Figure 13. Average Demand Savings (kW) by PTR Group and Micro-Segment – Summer 2020



Note: Estimates based on Cadmus analysis of AMI meter data from S20 for Flex 2.0 PTR participants and matched comparison group. Error bars indicate 90% confidence intervals based on standard errors clustered on customers. Customers without a micro-segment assignment are not included in the graph, but savings were computed. Analysis samples by micro-segment for Flex PTR and Test Bed PTR, respectively, are as follows: Big Impactors (2,162 and 171), Fast Growers (7,494 and 5,640), Middle Movers (15,697 and 947), Borderliners (23,060 and 6,444) and Low Engagers (27,285 and 2,720).
 Source: Cadmus load impact analysis (Flex 2.0 Evaluation)

At the end of summer 2020, the SGTB project was just one year old, but the negligible or small savings of automatically enrolled Low Engagers and Borderliners suggest that most customers in these groups are not engaged with the PTR program. This presents PGE with an opportunity to increase their engagement and savings but also a challenge for making PTR auto-enrollment cost-effective. If the savings performance for these groups does not improve, it may not be cost-effective for the PTR program to automatically enroll them.²⁷

Enrollment and Savings from Auto-Enrolling Customers in PTR

PGE automatically enrolled most residential SGTB customers into PTR in July 2019, pending specific eligibility requirements.²⁸ Automatic enrollment in PTR was a key feature of the residential SGTB approach and a means toward its goals of engaging customers in demand response and obtaining flexible load capability. For most Test Bed customers, enrollment in the PTR program was their first experience with demand response. PGE hypothesized that automatically enrolling customers would

²⁷ As discussed in the next report section, it could be cost-effective for PGE to auto-enroll Low Engagers and Borderliners if doing so led to a large enough increase in enrollment in PGE’s direct load control programs and increase in new demand response capacity.

²⁸ Eligibility requirements for Flex PTR include: customer is on PGE’s Schedule 7 Basic Service rate or Schedule 7 TOU rate; not a participant in PGE’s Smart Thermostat DLC program or Solar Payment option; must provide valid email address or working mobile number; and have functioning interval AMI consumption meter.

significantly increase enrollment in the peak time rebates program, increase PTR event demand savings, and eventually lead customers to migrate toward firmer types of demand response.

In previous studies, making program enrollment the default option has been shown to dramatically increase enrollments. In PGE's Flex 1.0 Pilot, automatic enrolling customers increased PTR enrollment from about 5% - when customers had to enroll themselves - to about 97% when PGE automatically enrolled them.²⁹ Similarly, in the Sacramento Municipal Utility District's SmartPricing Options study, 89% of customers automatically enrolled in critical peak pricing remained enrolled after 15 months, whereas only 19% of customers given the opportunity to enroll opted in and remained enrolled over the same period.³⁰

Automatic enrollment takes advantage of consumers' tendency to remain with the status quo.³¹ By making enrollment the default option, it is possible for utilities to nudge customers to make (beneficial) choices they would not otherwise make.

Using the enrollments of residential customers outside of the Test Bed in PGE's Flex PTR Program as a baseline, one can approximate the effect of making PTR enrollment the default option. The estimate is an approximation because the Test Bed, the three SGTB neighborhoods, while similar to the rest of PGE's service area, also differed in several respects.³² These differences are not big enough to invalidate the comparison, however.

Table 12 shows the percentage and counts of residential customers in and outside of the Test Bed who were enrolled in PTR on the day before the first Flex 2.0 PTR event (July 25, 2019) and one week after the final Flex 2.0 PTR event in summer 2020 (September 3, 2020). The first date is about 11 days after most Test Bed customers had been automatically enrolled in PTR (July 13, 2019). For Test Bed PTR, the percentages are calculated as the numbers of enrolled Test Bed customers on each date relative to the original PTR enrollment on July 13, 2019. For Flex PTR, the percentages are the count of enrolled customers relative to the number of eligible customers on the date. The Test Bed counts in Table 12 include auto-enrolled and self-enrolled customers and exclude any customer whose accounts became

²⁹ Cadmus. 2018. *Flex (1.0) Pricing and Behavioral Demand Response Pilot Program*. <https://edocs.puc.state.or.us/efdocs/HAH/um1708hah16432.pdf>

³⁰ Fowle et al. 2017. *Default Effects and Follow-on Behavior: Evidence from an Electricity Pricing Program*. National Bureau of Economic Research working paper 23553.

³¹ This tendency can arise because it is rational (i.e., not economically worthwhile) for consumers to pay more attention or because the situation is complex and it would be costly or difficult for consumers to collect the information needed to assess the benefits and costs of different actions.

³² See pp. 18-20 of PGE Test Bed Proposal (2018) to the OPUC: <https://edocs.puc.state.or.us/efdocs/HAS/um1976has12165.pdf>.

inactive or who was deemed ineligible for PTR over the analysis period (July 13, 2019-September 10, 2020).³³

On July 24, 2019, almost all Test Bed PTR customers automatically enrolled by PGE or who had enrolled themselves remained. In comparison, just 3.5% of eligible customers outside the Test Bed were enrolled in PTR. However, because some automatically enrolled customers subsequently unenrolled, it is more informative to make the comparison after more time has passed. About 13 months later, on September 10, 2020, about 94% of the originally-enrolled Test Bed PTR customers remained. In contrast, only 9% of the eligible residential customer population outside the Test Bed had enrolled in PTR. The high percentage of automatically-enrolled Test Bed customers remaining in PTR suggests that making enrollment the default option had significant and lasting effects on enrollment.

Table 12. PTR Customer Enrollment Rates

PTR Group	July 24, 2019		September 10, 2020	
	Percentage Enrolled	Enrolled Customer Count	Percentage Enrolled	Enrolled Customer Count
Test Bed PTR (Auto-enrolled and self-enrolled)	99.8%	11,559	93.8%	10,860
Flex PTR (Self-enrolled)	3.5%	25,470	8.7%	65,125

Notes: Test Bed PTR percentage enrolled is the number of Test Bed customers enrolled in PTR divided by the number of Test Bed customers enrolled in PTR on July 13, 2020, the day Test Bed customers were automatically enrolled in PTR. The Test Bed customer counts include Test Bed customers whom PGE auto-enrolled or who self-enrolled before auto-enrollment occurred on July 13, 2019. Self-enrolled customers are included because these customers would have been auto-enrolled if they had not self-enrolled. Also, the Test Bed PTR counts exclude any customers whose account became inactive or who were deemed ineligible for PTR over the analysis period. Flex PTR percentage enrolled is the number of enrolled Flex PTR customer (outside the Test Bed) on July 24, 2019 or September 10, 2020 divided by the number of customers eligible for Flex PTR outside the Test Bed on the same dates.

Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data

Savings from Making PTR Enrollment the Default Option

Making enrollment the default option raises the question of whether automatically enrolling customers who would not have enrolled themselves had the effect of increased PTR savings. It will increase PTR savings if these “complacent” customers saved during Flex events after being enrolled. Defaulting customers into PTR will only be cost-effective if the savings from the complacent customers are large enough to outweigh the costs of administering the program to them.

³³ Because of these exclusions, the counts in Table 12 will differ from the counts of Test Bed PTR customers in Table 16.

Using the analytical framework in Fowlie (2017),³⁴ it is possible to estimate the average savings for the complacent customers. The average PTR savings per enrolled Test Bed customer can be represented as the weighted average of savings for three customer types:

- **Always-takers (A):** customers who did or would have enrolled themselves in PTR if they had not been automatically enrolled.
- **Complacents (C):** customers who remain enrolled after being auto-enrolled but would not enroll themselves if given the choice.
- **Never-takers (N):** customers who never enroll or who unenroll after being automatically enrolled. The savings of never-takers is zero since they do not participate in events.

The average PTR savings per enrolled Test Bed customer, s , can be expressed as:

$$s = s_A * \% \text{Always-takers} + s_C * \% \text{Complacents} + s_N * \% \text{Never-takers}$$

Rearranging and solving for the average savings per complacent customer s_C :

$$s_C = [s - s_A * \% \text{Always-takers}] / \% \text{Complacents}$$

Table 13 shows the estimated average PTR demand savings per complacent Test Bed PTR customer for summer 2020 and the arguments used in the calculation. Several arguments, including the average savings per Test Bed PTR customer and per Test Bed always-taker, were obtained from PGE’s Flex 2.0 PTR evaluation. The savings of always-takers s_A and percentage of always-takers in the Test Bed can be approximated by the savings and enrollments of PTR customers outside the Test Bed.

Table 13. Savings Calculations for Complacent Customers

Parameter	Definition	Source and Calculation Method	Value
s	Average PTR savings (kW) per enrolled customer in Test Bed	Flex 2.0 Evaluation: Average PTR savings per enrolled customer in the Test Bed	0.076 kW
s_A	Average PTR savings (kW) per “Always Taker” customer in Test Bed	Flex 2.0 evaluation: Average PTR savings per Flex PTR customer (self-enrolled and outside the Test Bed)	0.159 kW
$\% \text{Always-takers}$	Percentage of always-takers in the Test Bed	PGE CIS data: percentage of residential customers outside the Test Bed who enrolled in PTR	8.7%
$\% \text{Complacents}$	Percentage of complacent customers in the Test Bed	PGE 2.0 evaluation and CIS data: $1 - \% \text{Always takers} - \% \text{Never takers}$. $\% \text{Never takers}$ estimated as $\%$ of Test Bed customers automatically enrolled who opted out of PTR before September 10, 2020.	85.0%
s_C	Average savings (kW) per customer who would not have enrolled self	$s_C = [s - s_A * \% \text{Always-takers}] / \% \text{Complacents}$	0.073 kW

Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data, and Cadmus load impact analysis (Flex 2.0 Evaluation).

³⁴ Fowlie et al. 2017. *Default Effects and Follow-on Behavior: Evidence from an Electricity Pricing Program*. National Bureau of Economic Research working paper 23553.

The average demand savings per Test Bed PTR customer who would not have self-enrolled was 0.073 kW. These savings are only slightly less than the average savings per PTR Test Bed customer (0.076 kW) because most Test Bed PTR customers (85%) are complacent customers.

Cost-effectiveness analysis is not part of the scope of the SGTB evaluation. Nevertheless, this analysis yields two main takeaways regarding the cost-effectiveness of PTR auto-enrollment. First, making participation the default option will be cost-effective for the PTR program only if the benefits from the savings of complacent customers (0.073 kW) exceeds the costs of administering the program to them. Second, even if the savings of complacent customers are not enough, auto-enrolling customers may still be cost-effective for PGE if it causes enough customers to later enroll in PGE’s smart thermostat demand response program or other direct load control programs.

The evaluation team’s analysis of smart thermostat migration suggests that auto-enrolling Test Bed customers in PTR and then encouraging them to migrate to the smart thermostat program increased enrollment in smart thermostat demand response by about 350% (see Table 18).³⁵ PGE could evaluate whether the benefits from the PTR savings of complacent customers and from increasing or accelerating customer enrollment in smart thermostat demand response programs outweighs the costs of administering the PTR program to complacent customers.

³⁵ The migration analysis suggested that always-takers are about three times more likely to migrate to smart thermostats than automatically-enrolled customers who do not enroll in PTR when given the chance (complacents). We compared the migration rates between July 13, 2019 and September 19, 2020 of SGTB customers who self-enrolled in PTR before the July 13, 2019 autoenrollment with the migration of SGTB customers who were auto-enrolled in PTR on July 13. For this analysis, we dropped any SGTB customer who unenrolled from PTR (never-takers) over the analysis period, whose billing account closed over this period, or who was deemed ineligible for PTR over the analysis period. The self-enrolled customers are all always-takers. The auto-enrolled group comprises complacents and some always-takers who would have self-enrolled in PTR over the analysis period if they had not been auto-enrolled on July 13. Since the auto-enrolled group includes some always-takers and always-takers are expected to have higher thermostat migration rates than complacents, the migration rate for the auto-enrolled group likely overestimates the migration of complacent customers. The estimated thermostat migration rates were 5.2% for self-enrolled PTR customers (43 migrants/833 self-enrolled) and 1.6% for auto-enrolled PTR customers (160 migrants/10,152 auto-enrolled), suggesting that customers who self-enroll (always-takers) are at least three times more likely to migrate. This difference is statistically significant at the 1% level ($t= 4.67, p<0.001$).

Customer Satisfaction and Resonance

Summary of Goals, Barriers, Challenges, and Activities

GOALS	<ul style="list-style-type: none"> • Achieve at least 80% customer satisfaction with PTR for each event season • Obtain customer insights that informs improvements aimed to increase customer resonance with demand response and program offerings
BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> • Customer dissatisfaction with the rebate amount • Customers not aware of and not partaking in the highest energy-saving/rebate-earning actions that will help them earn more on rebates • Customers think the rebate is not worth the effort or sacrificing comfort
ACTIVITIES PGE IMPLEMENTED TO OVERCOME BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> • Adjustments made to the baseline energy consumption calculation methodology in January 2020, now a 10-in-10 day matching approach with a weather adjustment to improve baseline calculation accuracy, repeatability, and comprehension by customers • Energy-saving/shifting tips included in customer’s event notifications, energy savings guide infographic mailed to customers, and a PTR checklist mailed to customers

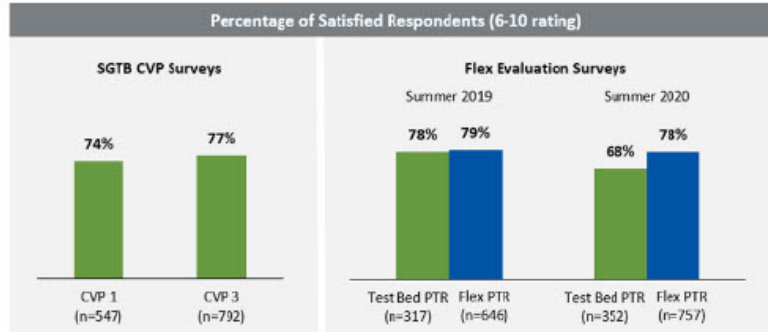
Source: PGE’s residential SGTB logic model, staff interviews, and Cadmus Flex evaluation surveys

Customer PTR Satisfaction Outcomes

In multiple surveys for this SGTB evaluation as well for the Flex evaluation, respondents rated their satisfaction with the PTR program using a 0 to 10 scale, where 0 meant *extremely dissatisfied* and 10 meant *extremely satisfied*. PGE defines a 6 to 10 rating as *satisfied*. Figure 14 shows the results for the percentage of satisfied respondents for each survey. SGTB customer satisfaction with the PTR program ranged from 68% to 78%. PGE did not meet its 80% customer satisfaction goal in any of the surveys but came very close with 78% in the Flex summer 2019 survey and 77% in the SGTB CVP 3 survey. Customer satisfaction with the PTR program did not significantly differ outside of the SGTB. Customer satisfaction ranged from 78% to 79% among those outside of the SGTB.

The evaluation expected to see a difference in customer satisfaction between Test Bed PTR and Flex PTR because Test Bed PTR customers were auto-enrolled compared to self-enrollment for Flex PTR. Self-enrolled customers typically observe higher program satisfaction, but the evaluation did not observe this difference. Test Bed PTR achieved customer satisfaction on par with Flex PTR.

Figure 14. Customer Satisfaction with PTR



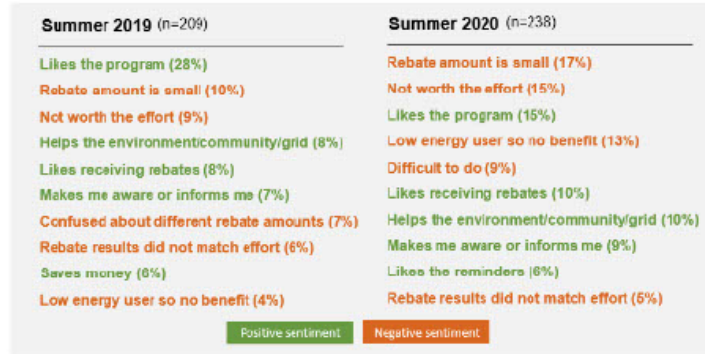
Source: Cadmus CVP1/CVP3 and Flex Evaluation Survey Question. "Please rate your overall satisfaction with PGE's Peak Time Rebates Program."

Test Bed PTR achieved levels of satisfaction that were unexpected for an auto-enrolled program, but was still short on meeting its customer satisfaction goal. In order to continue driving up satisfaction, the evaluation team analyzed the open-end responses to the question about rating satisfaction.³⁶ As shown in Figure 15, many customers in the SGTB had positive things to say about the PTR program. They frequently mentioned they liked the program, the program helps the environment, community, and/or grid, and they like receiving rebates. On the other hand, customers' negative comments frequently mentioned that the rebate amount is small, the program is not worth the effort, and rebate results did not match their level of effort.

PGE made efforts in 2020 to improve customer experience and satisfaction by sending customers same-day event notification reminders, working with TROVE Predictive Data Science to revise the baseline energy consumption methodology, and providing customers with tips and guides. Customers liked the new reminders. However, based on mentions about the small rebate amount, more work is needed to help customers earn more during events.

³⁶ The CVP surveys did not ask this question.

Figure 15. SGTB Customer Sentiments about PTR



Note: This was an open-end survey question. Respondents mentioned over 30 different topics. Top topics are shown.
 Source: Cadmus Flex Evaluation Survey Question. "Please tell us why you gave that rating for overall satisfaction."

Customer Resonance Insights: All-Event and Some-Event Participants

The high proportion of customers participating in some but not all PTR events warranted a closer look at understanding what might explain the participation rate differences. The evaluation team compared these two emergent groups in the CVP 1 and CVP 3 surveys.

The all-event and some-event participants shared similar values, beliefs, and reasons for event participation:

- Hate wasting money
- Try to be responsible citizens in their community
- Feel good when they find a deal to save a few dollars
- Want to do their part to conserve natural resources
- Prefer doing business with companies that give back to the community and do what they can to protect the environment

These participants also shared the same top three reasons for participating—to reduce their energy bill, to earn rebates, and because it does not cost them anything to participate. PGE can build on these five core values and three lead reasons as key points for SGTB messaging to engage customers.

Where the all-event and some-event participants differed was in the intensity of their values, beliefs, and participation reasons. As shown in Table 14, all-event respondents appeared to be *more* passionate about their values, beliefs, and participation reasons and were more likely to say the statement was "very true" for them. The some-event respondents were more likely to perceive lower benefits and higher costs of participating in PTR events.

Table 14. Comparison of SGTB Customers’ Values, Beliefs, and Participation Reasons by Self-Reported Event Participation

Percentage of Respondents Who Said the Statement Was “Very True”	CVP 1 Survey		CVP 3 Survey	
	All Events (n≤170)	Some Events (n≤286)	All Events (n≤275)	Some Events (n≤455)
Top Values and Beliefs				
I hate wasting money	86%	82%	83%*	73%
I try to be a responsible citizen in my community	84%	78%	77%	85%
I feel good when I find a deal to save a few dollars	79%	71%	72%	66%
It’s important for me to do my part to conserve our natural resources	71%	66%	73%	76%
I like to do business with companies that give back to the community	Not asked	Not asked	73%	75%
I prefer to do business with companies that do what they can to protect the environment	69%	67%	69%	72%
I hate to waste anything	68%	63%	67%	63%
I am always looking for ways to spend less money	64%	58%	62%	54%
Maintaining the comfort of my home is a big priority for me	62%	61%	61%	55%
I like to do business with companies that contribute to local nonprofits	Not asked	Not asked	55%	58%
I generally do what I can to reduce my carbon footprint	Not asked	Not asked	53%*	40%
Top Event Participation Reasons				
To reduce my energy bill	83%*	73%	76%*	68%
To earn rebates	80%*	64%	65%*	54%
It doesn’t cost me anything	71%*	59%	70%*	58%
To help save the planet	Not asked	Not asked	65%*	56%
To reduce my carbon footprint	66%*	49%	63%*	52%
To help build a cleaner energy future	65%*	53%	66%*	57%
To help keep electricity prices affordable for my community	62%*	49%	64%*	44%
To help the community avoid power shortages	57%*	40%	61%*	45%
It’s simple to shift my energy use	56%*	29%	54%*	29%

* Difference between all and some is significant with 90% confidence (p≤0.10).
 Source: Cadmus CVP1 and CVP3 Survey Questions. “Below are some statements that might describe you. Please indicate how well each statement describes you personally.” “Below are reasons people might decide to shift/reduce their energy use during the summer Peak Time Events. Please indicate how well each reason applies to you.”

The observations from the CVP 1 and CVP 3 surveys suggest an opportunity to shift a portion of the some-event participants to becoming all-event participants by tapping into their values and beliefs and/or addressing their event participation challenges. For example, closing the “simplicity gap” for the some-event participants—29% of some-event respondents and 59% of all-event respondents said “it’s simple to shift my energy use”—could increase their propensity to participate in more events. Also, reminding the some-event participants that those participating in all events are saving up to twice as much would speak to their values around not wasting money and could use social-norming to help motivate greater participation.

The higher level of passion and participation among the all-event respondents also correlated with a more positive relationship with PGE. As shown in Table 15, compared to the some-event respondents, all-event respondents tended to be more delighted with the PTR program and with PGE overall.³⁷ Brand satisfaction and, notably, the key points of brand salience were lower among some-event respondents.

Table 15. Comparisons between All-Event vs. Some-Event Participants

Category	Concept	All-Event Participants (n=184)	Some-Event Participants (n=291)
Satisfaction and PGE Brand Salience	Delight with PGE	57%	49%
	Delight with PTR	52%	35%
	Very likely to recommend PTR	60%	42%
Ease/Difficulty of Shifting Energy Use	Find it simple to shift energy	56%	29%
Age and Availability of Time	65 and older	29%	18%
	25-34	12%	19%
	Have more time to do things	63%	51%
Value of Special Offers and Discounts	Likely to take advantage of special offers	55%	36%
	Likely to use coupons	30%	17%
Value of Community and Environment	Care more about helping to keep electricity prices affordable for my community	62%	49%
	Care more about helping the community avoid power shortages	57%	40%
	Care more about reducing their carbon footprint	66%	49%
	Care more about helping to build a cleaner energy future	65%	53%
Openness to New Technology	More likely to try out new technologies and programs	40%	30%
	More likely to get involved in new technologies and programs after proven in by others	62%	71%
Awareness of Smart Thermostat DLC Program, Enrollment, and Barriers	Higher awareness of Smart Thermostat program	80%	70%
	Higher incidence of migration to Smart Thermostat program	9.2%	7.6%
	More concerned about giving up control to PGE	39%	48%
	More likely to say incentives are not big enough	27%	37%
	More concerned about compromising comfort	39%	59%
	More concerned about the mess of installing	47%	63%

Note: All-event vs. some-event differences listed in the table were significant with 90% confidence (p≤0.10).

There were also some distinct differences in demographics, values, and general behaviors. All-event respondents are older with more time on their hands and enjoy taking advantage of special offers and coupons. They place more value in helping the community and the environment. They like trying out new technology. Not surprisingly, given these characteristics, they had a higher awareness of the Smart Thermostat DLC program and a higher incidence of migration. This group, therefore, offers a robust opportunity for PGE to retain the high level of PTR engagement and to convert them to Smart Thermostat or other DLC programs.

³⁷ Respondents rated their satisfaction on a 0 to 10 scale, where 0 meant *extremely dissatisfied* and 10 meant *extremely satisfied*. PGE defined a 6 to 10 rating as *satisfied* and a 9 or 10 rating as *delighted*.

Some-event respondents were generally less satisfied with the PTR program and PGE. They are younger, feel time-constrained, and are less likely to find it simple to shift their energy use during PTR events. They are generally less likely to get involved in new technologies and programs until proven by others. Because they are time-constrained and find it less simple to shift energy use, some-event participants would be ideal candidates for the Smart Thermostat or other DLC programs, but barriers to migrate them are considerable. Notably, they are less satisfied customers, more concerned about giving up control to PGE, more likely to say the incentives are not big enough, more concerned about compromising comfort, and more concerned about the mess of installing.

PTR Enrollment and Retention

Summary of Goals, Barriers, Challenges, and Activities

GOALS	<ul style="list-style-type: none"> • Achieve a PTR retention rate of 80% by end of 2019
BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> • Many residential customers will not enroll in PTR even though they would benefit from enrolling and there are no risks from doing so • Customers unenroll from PTR • Do not understand why customers unenrolled from PTR because the reasons customers opt out are not tracked during the unenrollment process
ACTIVITIES PGE IMPLEMENTED TO OVERCOME BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> • Customers auto-enrolled in PTR rather than opting into PTR • Opt-out survey conducted to understand why customers unenrolled from PTR

Source: PGE's residential SGTB logic model and staff interviews

PTR Customer Enrollment and Retention Outcomes

Table 16 breaks down PTR enrollment activity for SGTB customers between July 13, 2019, and September 10, 2020. In July 2019, PGE auto-enrolled 12,897 residential SGTB customers who had not already enrolled themselves, resulting in a total of 13,981 PTR enrollees. Since then, PGE has continued to auto-enroll new residential customer accounts, bringing the total to 20,231 enrolled customers as of September 10, 2020. Meanwhile, the SGTB PTR program has lost accounts to customers migrating to the smart thermostat demand response program (n=277), customers opting out of the program (n=729), and customers closing their accounts (n=3,020), resulting in a PTR net enrollment in September of 16,205 customers.

Through September 2020, PGE has exceeded its PTR retention goal of 80%. When customers whose accounts closed since July 13, 2019, are excluded, over 94% of SGTB PTR customers remained in the program. When SGTB customers who migrated to the Smart Thermostat DLC program are also excluded, the retention rate rises to 96%.

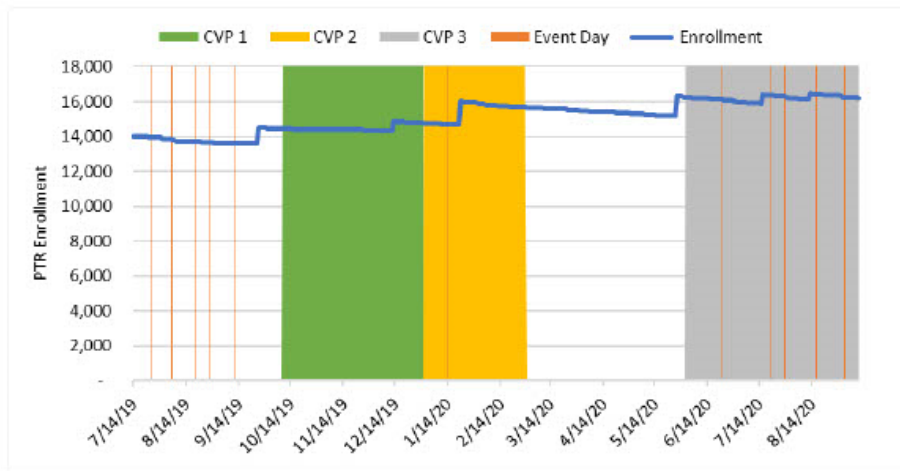
Table 16. PTR Program Enrollment and Unenrollment Breakdown

Category	Group	SGTB Customer Count
Enrollments	Beginning Enrollees (as of Test Bed auto-enrollment date: July 13, 2019)	13,981
	New Enrollees through Sep 10, 2020	6,250
	Total Enrollments (Gross) - by Sep 10, 2020	20,231
Unenrollments	Opt-Outs (total)	1,006
	Opt-Outs – migrated (to the Smart Thermostat program)	277
	Opt-Outs – non-migrated	729
	Account Closures	3,020
	Total Unenrollments (from July 13, 2019 to Sep 10, 2020)	4,026
Net Enrollment	Net Enrollment (Sep 10, 2020)	16,205
	Retention Rate	94.2%
	Retention Rate (adjusted for smart thermostat migration)	95.7%

Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data.

Though Table 16 shows enrollments at only two points in time, additional insights about PTR enrollment trends and the causes of unenrollment can be obtained by plotting enrollment over time. Figure 16 presents the cumulative Test Bed PTR enrollment from July 13, 2019, to September 10, 2020. This plot shows periodic increases in enrollment from PGE auto-enrolling new customer accounts intermixed with periods of steady decreases in enrollment from customer opting out and closing their accounts.

Figure 16. SGTB PTR Enrollment Over Time



Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data.

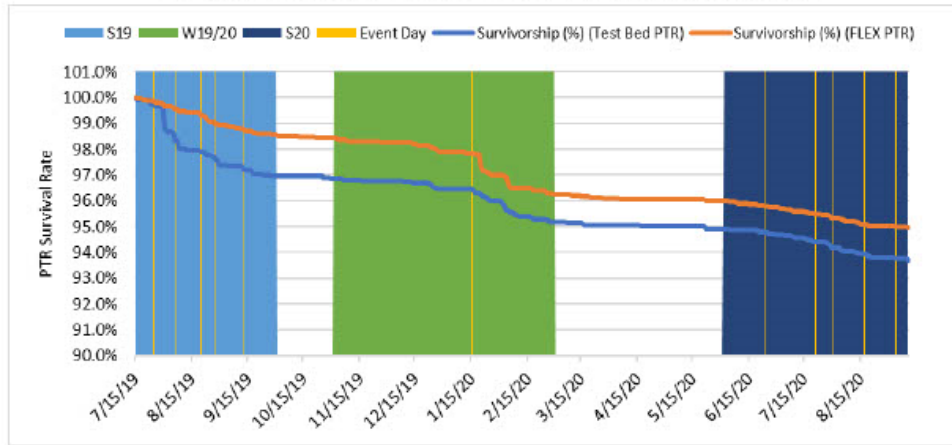
In Figure 16, the periodic auto-enrollment of new customer accounts and customer account closures obscures the trends in customer retention and unenrollment. To better illustrate the trend in customer retention, Figure 17 shows the retention for SGTB customers who were enrolled in the PTR program on July 13, 2019. This group includes auto-enrolled customers and customers who had previously enrolled

themselves before this date and excludes customers who accounts closed or were unenrolled because they were ineligible for the program during this period.

Retention is calculated as survivorship or the percentage of customers enrolled on July 13, 2019, who remained enrolled. Flex PTR participant survivorship is included as a point of comparison and calculated for customers enrolled in PTR on July 13, 2019. Again, the starting count excludes Flex PTR customers whose accounts later closed or who were later determined to be ineligible for PTR.

In the SGTB, most unenrollment during the 14-month analysis period was in the first two months following auto-enrollment, a total of about 3% from July 13, 2019, to September 30, 2019. There is a sharp drop of almost 1% following the first summer 2019 event day, and smaller but still noticeable drops after subsequent event days. Similarly, a large drop following the only event of the winter 2020 season is evident. There are smaller drops following summer 2020 event days. Overall, the survivorship for auto-enrolled SGTB PTR customers by the end of CVP3 was 93.7%.

Figure 17. PTR Enrollment Survival Rates for Test Bed PTR and Flex PTR



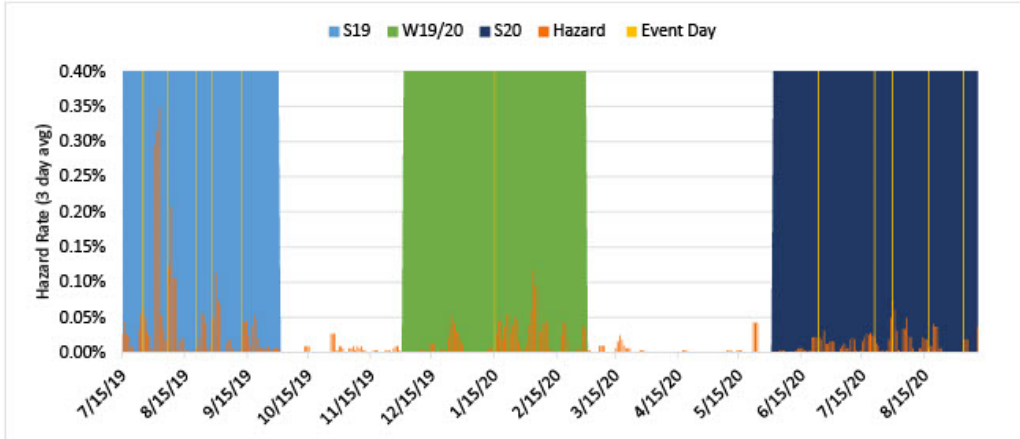
Note: S19 denotes summer 2019, W19/20 denotes winter 2019/2020, and S20 denotes summer 2020. The analysis shows the survival rate for SGTB customers who were enrolled in PTR on July 13, 2019, and whose accounts did not close and remained eligible during the analysis period. Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data.

The survival rate for Flex PTR customers followed a similar trend across most of the analysis period. The only period with a significant difference between the two survival rates was during the first half of the summer 2019 event season, where a larger percentage of auto-enrolled Test Bed customers unenrolled from the PTR program.

To better see the effects of demand response events on unenrollment from the PTR program, Figure 18 shows the hazard rate for the same cohort of SGTB PTR customers. The hazard rate is defined as the probability of unenrolling from the program conditional on being enrolled and is calculated as the number of customers who unenroll during a day divided by the day's starting enrollment. To smooth out

some of the noise from administrative delays in PGE’s unenrolling of customers, Figure 18 displays a three-day trailing moving average of the hazard rate. As expected, the largest spikes in unenrollment follow demand response events, with the largest probability of unenrollment occurring after the first summer 2019 event. This pattern continues through the winter 2020 and summer 2020 events, though the magnitude of the increases in unenrollment diminish.

Figure 18. SGTB PTR Unenrollment Hazard Rate



Note: S19 denotes summer 2019, W19/20 denotes winter 2019/2020, and S20 denotes summer 2020. The analysis shows the survival rate for SGTB customers who were enrolled in PTR on July 13, 2019 and whose accounts did not close and remained eligible during the analysis period. Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data.

Reasons for Opting Out of PTR

To understand what drove PTR customers to unenroll from the program, PGE administered a survey in Q4 2019 with SGTB PTR and Flex PTR customers who unenrolled. Though the survey gathered only 63 respondents, PGE found that reasons for opting out were primarily about the rebate amount and information:

- 64% were disappointed with the rebates they earned.
- 24% were either frustrated with or confused about how their rebates were calculated.
- 56% said higher rebates would likely motivate them to come back to the program.
- 47% said more information about how rebates are calculated would likely motivate them to come back to the program.

Smart Thermostat DLC Migration

Summary of Goals, Barriers, Challenges, and Activities

GOALS	<ul style="list-style-type: none"> • Through the CVP 1 campaign, attain 75% customer awareness of the Smart Thermostat DLC program • Through the CVP 1 campaign, get 2% of customers with eligible HVAC equipment to enroll in the Smart Thermostat DLC program
BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> • A large proportion of customers are not eligible for the Smart Thermostat DLC program because they do not have the qualifying HVAC system in their home • Customers are not sure if they have qualifying HVAC system for the Smart Thermostat DLC program • Lack of data on customers' HVAC system in the home • Customers have concerns about their data privacy and giving PGE control of their thermostat
ACTIVITIES PGE IMPLEMENTED TO OVERCOME BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> • Direct mailers, emails, and door hangers promoting the Smart Thermostat DLC program • Telemarketing conducted by PGE and CLEAResult • Focus groups with eligible customers who did not enroll in Smart Thermostat DLC program to gain deeper insights on barriers to Smart Thermostat and DLC migration • Load disaggregation and modeling conducted by Bidgely to identify major electricity end uses for residential customers, specifically HVAC fuel and equipment

Source: PGE's residential SGTB logic model, staff interviews, marketing reviews, Cadmus CVP 1 survey, and focus groups

CVP 1 Migration Outcomes

The CVP 1 monetary incentives campaign featured messaging to get PTR customers to switch to the Smart Thermostat DLC program. This was a test of the SGTB project theory that PTR could be used as a stepping stone to firmer types of demand response. The campaign used key phrases such as “greater/more rewards,” “less work,” and “advanced comfort” to communicate the program benefits. After running the campaign for four months, PGE exceeded the 2% migration goal. However, PGE did not achieve its 75% customer awareness goal—only 65% of CVP 1 survey respondents (n=699) said they had heard about the Smart Thermostat DLC program.

As of September 2020, PGE participant tracking data showed that 2.17% of all residential Test Bed PTR customers enrolled in the Smart Thermostat DLC program. When the analysis is restricted to customers with eligible HVAC equipment (i.e., central cooling and/or electric heating), 3.64% of SGTB PTR customers migrated to the Smart Thermostat DLC program. Table 17 provides a breakdown of Smart Thermostat program enrollments in relation to the CVP campaign periods and the total cumulative migration as of September 2020.

**Table 17. SGTB PTR Migration to Smart Thermostat DLC Program –
Percentage Migration out of HVAC-Eligible Customers**

Location	Enrollment Baseline (by 7/13/19)	HVAC-Eligible Customer Migration				Cumulative Migration Total (by 9/10/20)	All Customers Cumulative Migration Total (by 9/10/20)
		Before CVP1 (7/13/19 - 10/9/19)	During CVP 1 (10/10/19 - 1/31/20)	During CVP 2 (1/31/20 - 2/29/20)	During CVP 3 (3/1/20 - 9/10/20)		
All	3.20%	0.55%	0.98%	1.22%	1.01%	3.64%	2.17%
Hillsboro	4.77%	0.85%	1.46%	1.92%	1.39%	5.42%	4.50%
Milwaukie	1.95%	0.32%	0.63%	0.66%	0.55%	1.97%	1.12%
N. Portland	3.19%	0.54%	0.96%	1.25%	1.21%	3.96%	1.98%

Note: Percentage of SGTB customers enrolling in the Smart Thermostat DLC program is relative to the total eligible customers based on HVAC assignments derived from a load disaggregation study PGE conducted within the Test Bed in 2020, which identified approximately 60% of SGTB customers as HVAC-eligible (83% for Hillsboro, 53% for Milwaukie, and 50% for North Portland). Note, columns may not sum to cumulative total due to changing denominator of eligible customers over time.

Source: Cadmus analysis of PGE PTR program tracking and enrollment data

To measure the SGTB’s net effect on enrollment in the smart thermostat demand response program, the evaluation team compared migration rates in and outside of the SGTB. This reflects the combined influence from auto-enrollment in PTR, encouragement to enroll in the Smart Thermostat DLC program (CVP1), and other SGTB messaging through September 2020.

This analysis uses the matched comparison group from the Flex 2.0 PTR evaluation to construct a baseline. The matched comparison group comprises residential customers who enrolled in neither PTR nor the smart thermostat program as of summer 2019. As shown in the Flex 2.0 evaluation report, Test Bed PTR customers and the matched comparison group are very well balanced on electricity consumption and other observable characteristics.³⁸

Table 18 compares the smart thermostat enrollment rates of the two groups for three periods of the Test Bed. Each period begins on the Test Bed PTR auto-enrollment date (July 13, 2019), so the enrollment rates are cumulative from this date.

The enrollment rates before the first period were zero for both groups as only customers not enrolled in Smart Thermostat were included in this analysis. After the first period, about 0.3% of Test Bed PTR customers migrated to Smart Thermostat, which was about four times the enrollment rate for the control group (0.1%). At the end of CVP1, 1.3% of Test PTR customers had enrolled since July 13 compared to 0.3% for the matched control group. By September 10, 2020, 2.3% of Test PTR customers had enrolled compared to just 0.7% for the control group.

Across all periods, the results show that Test Bed PTR customers were over two times more likely to enroll in PGE’s Smart Thermostat program than the matched comparison group. The percentage difference in enrollment rates between the Test Bed PTR group and the matched control group and the

³⁸ Cadmus. 2020. Flex 2.0 evaluation report: <https://edocs.puc.state.or.us/efdocs/HAH/um1708hah16432.pdf>

percentage increase in enrollment of Test Bed PTR customers from the previous period were greatest during the CVP1 marketing campaign.

Table 18. SGTB PTR Migration to Smart Thermostat DLC Program – CVP1 Migration Lift Compared to General Population (Baseline)

Group	Customer count	Metric	Period		
			PTR Auto-Enrollment (7/13/19 – 10/9/19)	CVP1 (7/13/19 – 12/31/19)	CVP2 + CVP3 (7/13/19 – 9/10/20)
Test Bed PTR	n = 11,587	Enrollment rate	0.32%	1.32%	2.29%
		Enrollment count	37	153	265
Matched Non-Participants	n = 9,657	Enrollment rate	0.08%	0.27%	0.68%
		Enrollment count	8	26	66
Absolute difference in migration rate between TB PTR and matched control customers			0.24%†	1.05%†	1.60%†
Percentage difference in migration rate			300%	389%	237%

† Indicates statistical significance at the 99% confidence level ($p < 0.01$). Calculated using t-test on the difference in sample means. The Test Bed PTR and matched nonparticipant populations were customers in each group who were *not* enrolled in PGE’s smart thermostat demand response program prior to July 13, 2019, when SGTB customers were automatically enrolled in the PTR program. The matched nonparticipants were selected as a matched comparison group for the Flex 2.0 impact evaluation and include customers from outside of the SGTB that were not enrolled in PTR and were matched to Test Bed PTR customers based on consumption and other demographic characteristics. See Cadmus’ Flex 2.0 impact evaluation study (2020) for details. Migration is defined as a customer who is enrolled in PGE’s PTR program prior to enrolling in PGE’s Smart Thermostat demand response program. The counts and migration rates are cumulative since July 13, 2019 and omit accounts that closed before the end of the CVP3 period (Sep. 10, 2020).

Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data; Cadmus SGTB comparison group selection (Flex 2.0 Evaluation).

HVAC Market and Data Barriers to DLC Migration

Only customers with an electric heating and/or cooling system are eligible for the Smart Thermostat DLC program. Migration to the program could have been higher had the CVP 1 campaign launched toward the beginning of summer to take advantage of customers with eligible cooling systems. Instead, the campaign was after the end of the first summer season and closer to winter when recruitment potential is limited because most customers have gas space heating. The CVP 1 survey revealed that fewer respondents had a program-compatible heating system (14%, n=697) than respondents with a program-compatible cooling system (40%, n=694).

Moreover, PGE ran the campaign with limited customer information. Early in the SGTB project, PGE had very limited data on customers’ HVAC systems and could not identify how many of its customers qualified for the Smart Thermostat DLC program and, therefore, which to target. Consequently, PGE promoted the DLC program offer to all customers who had not yet enrolled even if they were ineligible. To help close the gap on limited data, PGE hired Bidgely to conduct load disaggregation and modeling to identify major electricity end uses for residential customers, including home heating fuel and heating and cooling equipment types. Should PGE run another Smart Thermostat DLC migration campaign in the future, it now has better data for targeting the right customers for the program and helping customers determine their eligibility.

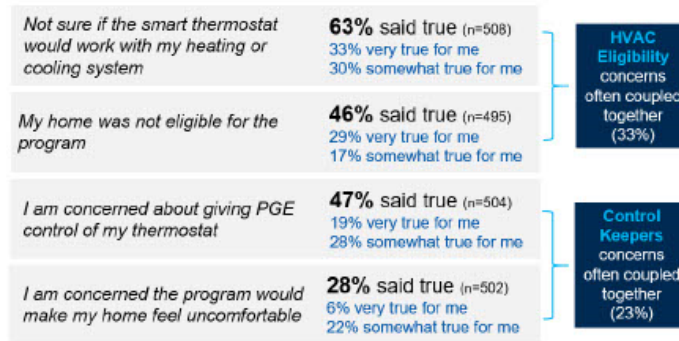
Customer Barriers to DLC Migration

Customers’ perceived program ineligibility and ceding control of their thermostat emerged as the top barriers to customer enrollment in a DLC program.

As shown in Figure 19, 63% of CVP 1 survey respondents said they were not sure a smart thermostat would work with their HVAC system. These respondents were often the same respondents who said their home was not eligible for the program. By comparing survey responses to questions about the HVAC system type, the evaluation team found that a majority of respondents appeared to correctly assess they were ineligible for the program (69% correctly assessed their cooling system’s eligibility and 87% correctly assessed their heating system’s eligibility). However, up to a third of respondents (31%) incorrectly assessed their eligibility. Customers whose systems are incompatible with the Smart Thermostat DLC program represent a large portion of SGTB customers (around 60%), so nurturing their PTR engagement and retention will be important.

Figure 19 also shows that 47% of CVP 1 survey respondents were concerned about giving PGE control of their thermostat. These respondents, referred to as control keepers, were often the same respondents who expressed concern the program would make their home feel uncomfortable. From these findings, the evaluation team identified control keepers as a key customer group for PGE to consider in efforts to maximize customer enrollment in a DLC program.

Figure 19. Top Reasons for Not Enrolling in Smart Thermostat DLC



Source: Cadmus CVP1 Survey Question. “Below are possible reasons people might decide not to enroll in the Smart Thermostat Program. Please indicate how well each reason applies to you.”

As shown in Table 19, control keepers are less satisfied PGE customers, care less about the environment and community, and are less trusting of new technology compared to the self-disqualifiers (customers who perceived they were ineligible for the program). Control keepers *were* also more likely to participate in some PTR events while self-disqualifiers were more likely to participate in all PTR events. PGE has a clear opportunity to build greater engagement and trust with control keepers.

Table 19. Characteristics of Self-Disqualifiers and Control Keepers

Category	Concept	Self-Disqualifiers (n=319)	Control Keepers (n=237)
Satisfaction and PGE Brand Salience	Delight with PGE	57%	37%
	Dissatisfaction with PTR	29%	40%
	Very likely to recommend PTR	43%	34%
Home Characteristics	More likely to rent their home	48%	41%
	More likely to own their home	51%	59%
	More likely to live in multi-family residence	49%	39%
	More likely to live in single-family residence	50%	60%
	More likely to use electricity for heating	55%	46%
	More likely to have central air conditioning	25%	35%
	More likely to afford monthly bills with no problem	33%	25%
	Value of Community and Environment	Prefer to do business with companies that do what they can to protect the environment	66%
Care more about doing their part to conserve our natural resources		60%	52%
Care more about helping PGE rely more on renewable energy during peak times		51%	42%
Care more about helping the community avoid power shortages		47%	39%
PTR Event Participation	More likely to participate in all PTR events	38%	31%
	More likely to participate in some PTR events	54%	60%
Awareness of Smart Thermostat Program	Higher awareness of Smart Thermostat program	67%	60%
Openness to New Technology	Tendency to distrust new technology	18%	31%

Note: Differences between self-disqualifiers and control keepers were significant with 90% confidence (p<0.10).

The identification of the control keepers group led the evaluation team to conduct focus groups with this group along with a general customer group who were not identified as control keepers. Cadmus conducted four online focus groups with 24 PTR participants in the SGTB; the participants comprised 11 control keepers and 13 general customers. The focus groups were intended to gain a better understanding of control keepers and what efforts will encourage them and general customers to participate in a DLC program like Smart Thermostat.

During the focus groups, respondents expressed simple barriers to participation, such as not being sure how to check if they were eligible for the program. General customers and control keepers had different data security and privacy barriers to participating. General customers had concerns about data privacy

“[Deciding about participating] would depend on more information about the timing [of events] and [my ability to] override the temperature change.”
 – General Customer

and giving PGE control of their thermostat, but these concerns could be quelled by providing more information and increasing transparency. In particular, general customers wanted to know more about the timing of the events, the limit of PGE’s control, how and when PGE would be controlling their thermostat, what kind of data PGE would collect from them, and if they would be able to override the

control during an event. Control keepers also wanted more information about the program, but they added it still would not be enough to get them to enroll. Most control keepers are not interested in the program because they do not trust large corporations, such as PGE, and the motivations of these

corporations for establishing such a program. Additionally, many control keepers, and some general customers, were not likely to purchase a smart thermostat due to lack of need or interest in owning the technology.

Despite these barriers, some customer values and motivations would attract general customers and control keepers to a DLC program like Smart Thermostat. Respondents, mostly control keepers, said being able to contribute to the “greater good” in programs like PTR was the reason they enjoyed participating. Because control keepers expressed these values more often than general customers while also expressing a distrust of large corporations, they may be more motivated to participate if they knew that the Smart Thermostat DLC program was designed to provide benefits to the greater community.³⁹

“When I made my kids sweeter [during an event], we saved 15 cents. They didn’t feel like their sacrifice was worth it. But if I could say ‘look, we [as a collective] saved 200 salmon!’ they might think it was worth it.”

– Control Keeper

All focus group respondents were familiar with and generally enjoyed participating in PTR events. A possible advantage of the Smart Thermostat DLC program would be that participants could “set it and forget it,” that is, not needing to take any action to participate but still benefit. For general customers, this concept was appealing; in particular, they were more likely to explain that a main reason they did not participate in PTR events was because they forget about them.

However, this had less appeal for control keepers in the focus groups who said they are motivated to participate in demand response programs because they derive satisfaction from taking actions to reduce demand during events. All focus group respondents said they were sure they still wanted notifications of an event, whether or not they had to take any action during one. Many focus group respondents across both groups said being able to participate in a hybrid program with PTR and Smart Thermostat would be as appealing, if not more so, than solely the Smart Thermostat DLC program.

“I wish there was a combination of the two. We haven’t really participated a lot, but the times we have, we’ve gotten back maybe 75 cents. I see that and think ‘well, that was a waste of time.’ But if I knew I’d get more money, I might be more motivated.”

– General Customer

Customer Engagement Gaps in Smart Thermostat DLC Program

Differences in the customer engagement approach between the PTR and Smart Thermostat DLC programs may be another concern for PGE as customers migrate from PTR to DLC. These differences are listed in Table 20. PGE currently implements many communication touchpoints with customers in PTR to keep them highly engaged. In contrast, the Smart Thermostat DLC program, with its “set it and forget it” approach, has very few communication touchpoints with customers. The focus groups revealed that customers who migrate from PTR to DLC may expect or want the same communication touchpoints as

³⁹ The evaluation acknowledges that control keepers in the focus groups may not be representative of the population of control keepers.

before. Focus group respondents said they liked PTR’s pre-event notifications and events and wanted more events. They valued active participation and knowing what was going on with events and the program.

Table 20. Differences in Customer Engagement Approach between PTR and Smart Thermostat DLC

Customer Engagement Aspect	PTR Program	Smart Thermostat DLC Program
Customer receives a pre-event notification	Yes	Depends on device
Customer receives post-event results	Yes	No
PGE provides customer with an event performance history web page	Yes	No
PGE provides educational materials on how to save/shift in events	Yes	No
PGE tests various CVP messaging on customers	Yes	No
PGE has a SGTB engagement plan for these customers	Yes	No

Source: Stakeholder interviews

Migration Confusion

The CVP 1 campaign’s messaging may not have been sufficiently clear that customers can participate in only one program. In the CVP 1 survey, most respondents who said they enrolled in the Smart Thermostat DLC program thought they were still enrolled in the PTR program (92%, n=48). To understand why, the evaluation team reviewed the CVP 1 marketing collateral closely.

The marketing review showed that the two emails offering the Smart Thermostat DLC program referred to the plural—“two ways to save,” “get more,” “rewards”—which could have made customers think they were adding DLC on top of PTR rather than switching programs. Furthermore, the sentence using the term “switch” appears later in both emails and in smaller print. Though PGE envisioned a transition from PTR to DLC for its customers, customers may envision a hybrid program experience instead.

Community Engagement and DEI

Summary of Goals, Barriers, Challenges, and Activities

GOALS	<ul style="list-style-type: none"> Identify and build durable relationships with key community stakeholders Identify disparities in service or program participation Leverage community engagement best practice Establish PACE (Process Owner, Approver, Contributor, Executor) model and facilitate implementation of community and key stakeholders’ feedback Demonstrate a commitment to continuous improvement
BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> Unclear how demand response programs and products meet needs of underserved customer groups The SGTB project involves a diverse group of stakeholders, each with different levels of influence, impact, and energy system awareness; relationship- and trust-building is a complex undertaking
ACTIVITIES PGE IMPLEMENTED TO OVERCOME BARRIERS AND CHALLENGES	<ul style="list-style-type: none"> DEI Community Outreach Consultants hired and DEI team created at PGE Partnerships with cities and CBOs and ongoing communication with partner cities and CBOs Community Engagement Strategic Plan created to organize goals and outline responsibilities Ongoing tracking of feedback from the SGTB communities and stakeholders

Source: PGE’s residential SGTB logic model, staff interviews, and community engagement documents

Broad Outcomes

Through the SGTB project, PGE has made notable progress in advancing its community engagement practices in the Test Bed neighborhoods and more broadly across PGE. From the start of SGTB project planning, PGE identified the importance of effective community engagement to ensure program success and, in turn, took relevant initiatives to ensure an equitable opportunity to participate in its SGTB project. **In just one year, PGE created for the first time a community outreach team and hired new team members; established a diversity, equity, and inclusion (DEI) framework to help shape project design; and crafted a Community Engagement Strategic Plan.** Thanks to these changes driven by the SGTB project, community engagement is now a key component across PGE’s broader business strategy and programs.

In the Community Engagement Strategic Plan, PGE outlined these five goals:

- Identify and build durable relationships with key community stakeholders
- Identify disparities in service or program participation
- Leverage community engagement best practice
- Establish PACE model and facilitate implementation of community and key stakeholders’ feedback
- Demonstrate a commitment to continuous improvement

The evaluation team assessed PGE’s progress toward these five goals, described in the next sections. **PGE is currently meeting all five goals.**

Goal 1: Identify and build durable relationships with key community stakeholders

Goal 1 has two components—to identify and create an inventory of priority stakeholders with which DEI Community Outreach Consultants can establish regular communication and to build relationships with these priority stakeholders.

Stakeholder Identification

To address the first component, the DEI Community Outreach Consultants for each Test Bed neighborhood collaborated with other PGE staff to generate a map detailing more than 100 stakeholders and relevant attributes for each, such as the primary point of contact, organization mission, population and Test Bed neighborhoods served, rationale for importance of stakeholder, and level of priority for connecting with stakeholder. Stakeholders span city government agencies, community-based organizations (CBOs), environmental advocacy groups, religious organizations, and more.

In spring 2020, DEI Community Outreach Consultants for each Test Bed neighborhood and additional PGE staff leading DEI initiatives developed a Priority Stakeholder Outreach Plan detailing the approach

for establishing strategic partnerships to develop more effective, equitable energy programs. The plan includes the following:

- Background information on PGE’s equity statement, DEI strategy, and relevant regulatory and community motivators
- Identified priority stakeholders
- Approaches for developing authentic, responsive, and long-lasting engagement with these stakeholders
- Overview of the PACE framework (defined in Goal #4 below)
- Plans to develop an Engagement Toolkit to provide additional guidance on effective stakeholder engagement

Relationship-Building

Through interviews with the DEI Community Outreach Consultants and a review of their workplans, the evaluation team found that each Test Bed neighborhood has made progress in connecting with priority stakeholders. Table 21 shows the priority stakeholders, including CBOs and community partners, that Test Bed neighborhoods reported working with as part of the SGTB project as well as the key activities used to establish and build these relationships. The DEI Community Outreach Consultants reported close working relationships with their Test Bed neighborhoods as well as with Community Energy Project and Energy Trust of Oregon.

Table 21. Community Stakeholders by Test Bed Community

Test Bed Community	Priority Stakeholders	Activities to Establish and Grow Relationships
Hillsboro	<ul style="list-style-type: none"> • City of Hillsboro • Community Energy Project • Energy Trust of Oregon 	<ul style="list-style-type: none"> • Outreach to, and conversations with, priority stakeholders to raise awareness about the SGTB project and its benefits • Periodic luncheons with City sustainability staff and representation on the City’s Sustainability Team • Event attendance: State-of-the-City event
North Portland	<ul style="list-style-type: none"> • The Center for Self Enhancement • City of Portland and the Portland Clean Energy Community Benefits Fund (PCEF) • Community Energy Project • Energy Trust of Oregon • Sunrise Movement PDX • Verde 	<ul style="list-style-type: none"> • Outreach to, and conversations with, priority stakeholders to raise awareness about the SGTB project and its benefits • Event attendance: City of Portland Sustainability Fair, Neighborhood District Association meetings
Milwaukie	<ul style="list-style-type: none"> • City of Milwaukie, Community Engagement and Sustainability staff • Clackamas County Energy Assistance staff • Community Energy Project • Energy Trust of Oregon • Milwaukie Center (N. Clackamas Parks and Recreation) • NW Housing Alternatives • Wichita Center 	<ul style="list-style-type: none"> • Outreach to, and conversations with, priority stakeholders to raise awareness about the SGTB project and its benefits • Periodic lunch-and-learn sessions with City staff and representation on the City’s Sustainability Team • Event attendance: Neighborhood District Association meetings, City Plaza event

DEI Community Outreach Consultants emphasized that transparency and consistency are key to building strong, lasting relationships. They pointed to the need to establish a quicker feedback loop and response process to create trust across customers in the Test Bed neighborhoods and to the importance of building credibility by mindfully engaging with stakeholders to create authentic, mutually beneficial relationships. They acknowledged the obstacles the COVID-19 pandemic created with trying to maintain regular, in-person engagement with key community stakeholders. The fact that the SGTB project involves a diverse group of stakeholders, each with different levels of influence, impact and energy system awareness, adds to the complexity of relationship- and trust- building across stakeholders.

DEI Community Outreach Consultants agreed there is a need to build stronger relationships with CBOs, given the strength of these organizations in reaching underserved customers and connecting customers to additional financial assistance.⁴⁰ Overall, they acknowledged it takes time and effort to build trust and PGE is still in the process of developing and refining relationships with CBOs.

Goal 2: Identify disparities in service or program participation

The priority for Goal 2 is collecting available data—such as customer demographics, program participation data, and customer feedback—then analyzing these data to uncover disparities in service or program participation, particularly for traditionally underserved customers.

Data Collection

DEI Community Outreach Consultants and fellow PGE staff reported using the following data sources to better understand Test Bed neighborhoods and participation barriers:

- **Customer data** from PGE, community partners, and contractors (e.g., Cadmus, Green Mountain Energy) on indicators such as energy burden, housing stock, income, demographics, racial inequality, and marketing tactic performance
- **Community surveys** developed by DEI Community Outreach Consultants that solicit feedback on customer satisfaction, customer experiences, and perceptions of PGE
- **Test Bed customer surveys** administered by Cadmus that explore awareness of the SGTB project; personal values, priorities, and preferences; awareness of PGE marketing activities and their impact; customer satisfaction; and demographics and home characteristics
- **Qualitative data** gathered through customer conversations and events, including lunch-and-learns, listening sessions, events, and workshops

⁴⁰ Underserved customers, as defined by PGE, include low-income customers, non-English speakers, people of color, and renters.

- **Insights from PGE Ambassadors** who are in the neighborhood and can collect direct customer feedback⁴¹

PGE has also been developing a SGTB Workgroup to better engage customers, solicit feedback from underserved communities, and increase awareness and understanding of the SGTB project and the benefits of energy-shifting behaviors. This workgroup will consist of 12 individuals living or working in one of the three Test Bed neighborhoods who are also a member of, or represent, Environmental Justice⁴² or people of color communities. The workgroup will meet monthly from November 2020 through December 2021, with all members receiving a \$5,000 stipend for participating.

Identification of Disparities and Barriers

DEI Community Outreach Consultants attend a quarterly community insights meeting to share findings regarding customer feedback and internal setbacks that have created program challenges. Regarding disparities in access to services or programs and barriers faced by environmental, social, or climate justice communities, the DEI Community Outreach Consultants and the evaluation team uncovered the following:

- **Ownership barriers.** Driving participation in smart thermostat programs among renters is challenging, given the need for landlord approval before installing new appliances and devices.
- **Structural barriers.** There are still structural barriers to participating in demand response programs; specifically, older homes that lack quality weatherization face logistical challenges with shifting energy use while maintaining comfort because of heating and cooling leaks.
- **Language barriers.** Educational materials on demand response have been limited largely to English; the one exception is PTR, which PGE markets in both English and Spanish. This situation means non-English speaking customers are less likely to be aware of the availability and functionality of PGE’s full suite of demand response programs, such as the Smart Thermostat program.

Goal 3: Leverage community engagement best practice

Goal 3 focuses on identifying and applying community engagement best practices, including applying an equity lens to all engagement activities. In its Community Engagement Strategic Plan, PGE defines the equity lens as: *“A transformative quality improvement tool used to improve planning, decision-making, and resource allocation leading to more racially equitable policies and programs.”* The

⁴¹ PGE Ambassadors are PGE staff who reside in one of the SGTB neighborhoods. They test new products and services being provided in the SGTB and engage with and collect feedback from customers, such as during in-person events. Ambassadors are expected to share feedback with DEI Community Outreach Consultants and other PGE staff to inform more effective program design and delivery.

⁴² Environmental justice communities include communities of color, communities experiencing lower incomes, tribal communities, rural communities, frontier communities, coastal communities and other communities traditionally underrepresented in public processes and adversely harmed by environmental and health hazards, including but not limited to seniors, youth and persons with disabilities.

overarching goal is to use these community engagement best practices to identify participation barriers and inform more effective and equitable demand response program development.

Identification of Best Practices

The focus in 2020 was on determining community engagement best practices, and PGE identified three:

- Develop a collective community engagement workplan, as well as Test Bed-specific workplans (created in Q4 2019)
- Develop an Equity Lens Toolkit (to be created in Q1 2021)
- Start to implement the toolkit and operationalize DEI learnings (to be completed in 2021)

Application of Best Practices

Levels of progress varied across each of the three best practices.

Best Practice #1: Develop a collective community engagement workplan, as well as Test Bed-specific workplans. In spring 2020, PGE completed its Community Engagement Strategic Plan. Each Test Bed neighborhood also created a workplan to track the status of deliverables and activities related to the five goals listed in the strategic plan. DEI Community Outreach Consultants have been tracking these goals against the KPIs to ensure alignment with the strategic plan.

Best Practice #2: Develop an Equity Lens Toolkit (to be created in Q1 2021). PGE and the Test Bed neighborhoods are also developing an engagement toolkit, which will provide guidance on best practices that also ensure the application of an equity lens and a commitment to DEI goals. More specifically, as stated in the Priority Stakeholder Outreach Plan, the toolkit will contain the following:

- List of CBOs, their mission, and opportunities for collaboration with PGE
- Engagement worksheet
- Modified version of the International Association for Public Participation’s Spectrum of Engagement, tailored to PGE
- Possible engagement activities (e.g., listening sessions, forums, panels)
- Overview of the equity lens

Initial steps for establishing this toolkit have involved exploring approaches used by other companies and community partners. It has also involved consulting CBOs and other partner organizations to determine the best avenues to engage with and collect feedback from environmental and climate justice communities across the Test Beds, such as community events, workshops, and surveys. Toolkit development is still underway, although the aim remains to produce a complete toolkit in the beginning of 2021 and maintain it as a living document that PGE updates to reflect lessons learned.

Best Practice #3: Start to implement the Toolkit and operationalize DEI learnings (to be completed in 2021). Although the toolkit is not yet complete, PGE staff, including DEI Community Outreach Consultants, reported they have already begun applying an equity lens to the SGTB project, beginning

with CVP 3, and to demonstration projects in the SGTB (e.g., ductless heat pump controls). As stated in PGE’s Community Engagement Strategic Plan, this equity lens focuses on the following:

- Deconstructing what is not working around racial equity
- Reconstructing and supporting what is working
- Shifting the way PGE makes decisions and think about this work
- Healing and transforming our structures, our environments, and ourselves

In alignment with its equity lens, PGE is also committed to improving the incorporation of DEI principles across its programs. In fall 2020, PGE finalized its DEI definition and framework, after collaborating with DEI Community Outreach Consultants, other members of the DEI corporate team,⁴³ and utility partners such as Energy Trust on the development process. The framework aims to address systemic inequities that create barriers for certain customers to provide input on, and participate in, energy-saving and clean energy programs. The CVP 4 campaign, Giving Back with Learnings, will be the first to officially integrate this new DEI framework. Meanwhile, PGE has been taking steps to determine how best to meet its DEI objectives by testing different marketing tactics used in the Test Bed neighborhoods. For example, for CVP 3, select marketing materials, including emails and digital ads, included both an English and Spanish translation.

DEI Community Outreach Consultants reported that attention to DEI concerns, such as those related to racial justice, has risen across the Test Bed neighborhoods in 2020. In fall 2020, DEI Community Outreach Consultants began reporting to PGE’s corporate DEI team. Whereas the DEI team had previously often been internally focused, this transition provides an opportunity to advance the incorporation of DEI in externally focused projects, such as the SGTB project.

However, DEI Community Outreach Consultants also acknowledged several setbacks in achieving community engagement best practices. Outside circumstances, particularly the COVID-19 pandemic and wildfires, have prevented in-person events, which are ideal for building relationships and trust with customers. Instead, DEI Community Outreach Consultants often led virtual events or relied on other engagement tactics such as surveys.

Goal 4: Establish PACE model and facilitate implementation of community and key stakeholders’ feedback

This goal focuses on bringing together PGE teams across various departments to review community feedback (from partners and customers) and discuss ways to shape more effective products and services. The aim is to ensure appropriate PGE departments and partners receive relevant insights from Test Bed neighborhood engagement. In particular, the application of a PACE framework seeks to ensure

⁴³ The DEI corporate team is part of PGE’s human resources team. Before bringing the DEI Community Outreach Consultants onto this team in fall 2020, the team focused largely on internal DEI initiatives.

more efficient collaboration and avoid duplication of efforts by identifying the following actors, as stated in PGE's Community Engagement Strategic Plan:

- **Process Owner:** Somebody who manages a task or project from end to end
- **Approver:** The person who makes the final decision on go or no-go
- **Contributor:** The person or people who contributes to task or project
- **Executor:** The person or people who do the work for the task or project

PGE presents community feedback through weekly SGTB meetings and regular marketing meetings that include relevant PGE staff and DEI Community Outreach Consultants. PGE also hosts quarterly community insights meetings to bring together representatives from these PGE teams: Product Development, Program Operations, Rates & Regulatory, Customer Insights, Customer Resources, DEI, Financial Planning & Forecasting, Segment Marketing, Customer Experience, and Product Marketing. At these meetings, DEI Community Outreach Consultants share "community snapshots" that synthesize community insights gathered through customer conversations, listening sessions, and other events.

Although PGE has described Goal 4 as still a work-in-progress, its application to the SGTB project has led to organizational changes that have fostered greater collaboration across teams at PGE and helped break down silos that have traditionally existed across departments.

Goal 5: Demonstrate a commitment to continuous improvement

The fifth and final goal of the Community Engagement Strategic Plan focuses on continually seeking opportunities to improve PGE engagement strategies and plans. PGE aims to test new approaches, collect qualitative and quantitative data on these approaches, analyze the information collected, collaborate on opportunities for improvement, then applying lessons learned to implement better approaches.

PGE has demonstrated its commitment to continuous improvement in several ways. These are two examples:

- The second value proposition tested in the SGTB project (CVP 2) was charitable giving. Based on insights collected through customer feedback and participation data, PGE will soon test a new value proposition, referred to as Giving Back with Learnings (CVP 4), with plus referring to the integration of lessons learned from CVP 2.
- PGE has used the Test Bed neighborhoods to assess the effectiveness of different marketing and outreach tactics designed to overcome barriers to project awareness and participation and ensure that traditionally underserved communities have equal access to PGE's programs and services. As previously mentioned, for several CVPs in its SGTB project, PGE has developed marketing materials (emails, digital ads, and door hangers) in English, Spanish, and Russian translations and monitored marketing performance to apply learnings to future CVPs.

NONRESIDENTIAL EVALUATION FINDINGS

This section presents the detailed evaluation findings on the SGTB project for nonresidential customers, which consists of small, medium, and large commercial and industrial businesses. Sections are organized by the program offering type (Schedule 25 and Schedule 26).⁴⁴

Schedule 25 Energy Partner Smart Thermostat Program

The evaluation team based the findings for Schedule 25 from staff interviews and observational walk-alongs and, therefore, has limited information from the customer perspective.⁴⁵ Focus group research with business customers is planned for Q1 2021.

Broad Outcomes

Schedule 25 was offered to business customers in and out of the SGTB project, with no changes to program design. PGE set a goal of enrolling 25% of eligible SGTB businesses (about 460 of 1,848 business premises) in Schedule 25 by the end of 2021.⁴⁶ As of October 2020, through combined efforts with the program implementer CLEAResult, PGE had enrolled 44 business premises, resulting in the installation of 77 smart thermostats.

PGE believes it is still on track to achieve the adjusted goal of 460 enrollments by the end of 2021, as long as there are no major impediments to program marketing (similar to the impact of COVID-19 throughout 2020).

The slow progress in enrollments for Schedule 25 was largely from PGE's inability to roll out some of its planned activities on time because of the COVID-19 pandemic. Though digital and direct mail marketing paused for a few months in early 2020, no in-person outreach and thermostat installations were possible for several months, given public health concerns. In addition, PGE saw a decline in leads during the start of the pandemic as businesses temporarily closed. During this time, PGE and CLEAResult changed their focus to establishing health and safety procedures for when thermostat installations could resume.

Additionally, PGE put marketing on hold for several weeks in Q3/Q4 2020 due to Oregon wildfires and other PR issues.

⁴⁴ PGE has yet to develop a SGTB logic model for the nonresidential sector but plans to develop one in 2021.

⁴⁵ Cadmus had surveys planned with Schedule 25 participants and nonparticipants in the SGTB. However, due to slow customer enrollment and COVID-19 related marketing pauses, Schedule 25 in the SGTB did not have a large enough participant count to justify conducting surveys.

⁴⁶ This goal could be revised due to business closures from the COVID-19 pandemic.

Ultimately, the pandemic led to only short delays in installations as it was easier to safely resume on-site work with business customers than with residential customers once the former reopened (June-July 2020). CLEAResult reported a backlog in installations due to the program's pause.

Marketing and Outreach Learnings

Schedule 25 operates in the same way in and outside the SGTB, except for that different marketing and outreach tactics were used in the SGTB.

Effective Channels

PGE reported that it has been difficult to get the attention of businesses because business owners are busy and receive a variety of marketing materials from other companies. Many marketing tactics PGE tried in 2019-2020 did not effectively drive participation. Direct mail, email, and telemarketing proved ineffective in driving sign-ups, in part due to a lack of customer contact data for key decision-makers. CLEAResult administered telemarketing in Q4 2020, which led to only five enrollments of 500 businesses. CLEAResult said the phone numbers they had were general business phone numbers rather than the phone numbers of the key decision-makers.

Door-to-door marketing was the most effective tactic to directly engage with and inform decision-makers. PGE contracted with Green Mountain Energy to complete this in-person outreach. After postponing outreach while PGE focused on communications pertaining to its financial losses and the wildfires, Green Mountain Energy began outreach in September 2020. PGE reported positive feedback from businesses, with 10 enrollments during just the first two days of site visits in Milwaukie.

CLEAResult stated that collaboration between PGE's Energy Efficiency and Service team and Energy Trust was most useful in securing valuable leads. Approximately 90% of leads have come through this collaboration. Two other sources—leads from service providers and KCMs at PGE—returned only a small number of leads.

Customer Contact Data and Key Decision-Makers

The quality of customer contact data and challenges reaching key decision-makers have been two other barriers to securing enrollments. PGE's customer contact database could be improved, as typos and duplicate entries have been reported. In addition, PGE has email addresses for only approximately 25% of eligible business customers, and emails and mailing addresses often list the individual who pays the PGE bill rather than the business owner or primary decision-maker. Although PGE purchased contact information through ZoomInfo to try to create a more comprehensive database of customer contact information, PGE has not yet begun using it for direct outreach to businesses.

Language Barrier

In October 2020, the evaluation team walked alongside Green Mountain Energy as the company completed door-to-door outreach designed to drive sign-ups in Schedule 25. During this outreach, the team assessed customers' awareness of the SGTB, Schedule 25, and smart thermostat technology as well as determining motivations and barriers for participation in the program. Although findings are limited to observational data from just 19 businesses visited on that day since many of the 61 target

businesses were not open or did not have available staff, the evaluation team discovered that a language barrier prevented Green Mountain Energy from collecting email addresses for decision-makers from four of the businesses. Being able to converse with customers in Spanish, as well as translating leave-behind materials into Spanish, may help secure greater program enrollment. PGE currently has a Spanish program fact sheet available on its website.

Customer Awareness, Motivations, and Concerns

Implementers reported challenges with convincing businesses they could change their thermostats. Low levels of awareness about the SGTB and Schedule 25 was a barrier to enrollment. During the walk-alongs with Green Mountain Energy, the evaluation team observed that 15 of the 19 businesses were not at all familiar with the program.

More broadly, businesses often do not understand how demand response programs work nor how they can benefit. CLEAResult found that, upon learning more about the program, many businesses were concerned about how peak time events could impact their business operations and, in turn, customer satisfaction and, therefore, they decided not to enroll. For similar reasons, businesses were often hesitant to be the first to try a new program and wanted to see similar businesses take on the risk and not experience negative impacts before deciding to participate themselves. Many businesses have not outright refused to sign up for the program but rather wanted additional time to consider. PGE has identified increasing education and awareness as a key strategy for driving greater enrollment in Schedule 25.

Screening criteria is also important, as PGE and the implementers also encountered physical and logistical limitations that prevented certain businesses from enrolling. For instance, thermostats require a dedicated onsite Wi-Fi to control the smart thermostat, which some businesses lack. HVAC systems for commercial buildings are often located on rooftops so the installation would require access to the rooftop, which some businesses did not have. Most importantly, many businesses do not have qualifying HVAC systems so are ineligible for the program. During the walk-alongs, four of the 19 businesses did not have qualifying HVAC systems.

Businesses that did opt to enroll in Schedule 25 gave various reasons for signing up—wanting to save money and energy, wanting a thermostat upgrade, and believing the program sounded good and worthwhile. During the one day of walk-alongs, the evaluation team observed three of 19 businesses sign up.

Future Activities and Considerations

PGE is continuing to ramp up its door-to-door outreach with Green Mountain Energy. It is also currently testing more innovative marketing tactics to catch the attention of businesses and explain the benefits more clearly. After delaying the spring outreach to August 2020, PGE began outreach to secure participants in a Chinook coupon book, which provides free advertising for 25 retail businesses in the SGTB if they participate in Schedule 25. PGE also plans to create business recognition print ads in local publications, such as St. John's Review, Clackamas Tribune, and Hillsboro Tribune.

PGE also aims to complete additional market research and data analysis to better understand and overcome enrollment barriers. The evaluation team plans to conduct focus groups with Schedule 25 participants and nonparticipants in the SGTB in Q1 2021.

Schedule 26 Energy Partner Program

Cadmus based the findings for Schedule 26 from staff interviews only and, as a result, has limited information from the customers' perspective.⁴⁷

Broad Outcomes

Schedule 26 was offered to business customers in and out of the SGTB project, with no changes to program design. PGE's goal is to enroll 40% of eligible SGTB customers in Schedule 26 by the end of 2021. To date, PGE has recruited three of the 13 eligible SGTB customers (referred to as candidates), for 23% enrollment. PGE recruited Tri-Cities Wastewater Treatment Plant, Oak Lodge, and University of Portland. Each is at a different stage in the program pipeline:

- Oak Lodge is the furthest along, having already completed the site assessment and is on track for demand response enablement in Q4 2020.
- Tri-Cities Wastewater Treatment Plant completed its site assessment but will not be ready for demand response enablement until Q1 2021 when its renovation project is complete.
- The University of Portland is only in the initial stages, having signed an agreement to participate but not having yet completed the site assessment.

Marketing and Outreach Learnings

Schedule 26 operated in the same way both in and outside the SGTB, including the marketing and outreach tactics used.

Effective Outreach

KCMs manage accounts with business customers and have been instrumental in handling business outreach and communications with program targets. They use phone calls, emails, and in-person visits to connect with customers. In-person visits have been most effective at driving enrollment, followed by referrals from partner organizations like Energy Trust, Energy350, and Cascade Energy. Unlike with Schedule 25, a lack of updated contact information was not a concern. Instead, the greater challenge was identifying who in the organization was the primary decision-maker. Given the critical role KCMs play as the gateway to customers, implementers also highlighted the importance of marketing the benefits of Schedule 26 to KCMs so that they, in turn, can drive excitement among customers.

⁴⁷ Cadmus had in-depth interviews planned with Schedule 26 candidates in the SGTB. Due to slow customer enrollment and COVID-19 related marketing pauses, PGE requested Cadmus to postpone the interviews.

Limitations with Candidates in the SGTB

PGE acknowledged that the 13 candidates in the SGTB are not ideally suited for Schedule 26 but were selected because of their presence in the SGTB. Most are healthcare facilities and data centers. Both types of businesses face obstacles with demand response due to their unique operational practices and energy use patterns. Recruiting these two types of businesses would likely require operational changes to the program, such as exploring battery storage backup during peak times, despite its higher cost.

Customer Awareness, Motivations, and Concerns

PGE and the evaluation team have not yet collected data on awareness of the SGTB and demand response among the Schedule 26 candidates. The team plans to conduct interviews with the candidates in 2021 to gather these insights.

The components of Schedule 26 that appealed most to customers were often opportunities to advance sustainability, such as earning LEED points, making progress toward corporate sustainability goals, and securing incentives and saving money. On the other hand, the following were customer concerns that prevent program enrollment:

- **Impact on business operations.** Some businesses were worried about the effects on production schedules, and this concern increased after the COVID-19 pandemic began, given the greater uncertainty many businesses face about the future of their operations.
- **Time, money, and effort.** Prior to the COVID-19 pandemic, many businesses had expressed apathy toward demand response, seeing it as an added chore. Other businesses were hesitant because of the upfront capital cost associated with installing new technologies.
- **Logistical challenges.** Certain types of businesses, such as manufacturing facilities and shipyards, faced added logistical challenges with demand response because of unique work hours. Storage and office facilities faced the least logistical challenges because their operations are automated.

Implementers reported that authentic, uninterrupted conversations with business customers to provide education about Schedule 26 and its benefits is critical for securing program enrollment. Implementers must build trust among hesitant customers and those who believe the program may be “too good to be true.”

Future Activities and Considerations

PGE has been considering several new approaches to drive enrollment and participation in the SGTB for 2021. New approaches include having PGE fund a portion of equipment upgrades, offering signing bonuses upon program enrollment, and providing short-term boosts to incentives. Implementers propose testing larger operational changes. These include offering battery storage backup during peak times to help persuade specific customers to participate in Schedule 26. This would better accommodate customers like healthcare facilities and data centers that cannot easily reduce their energy use during peak times. Implementers also propose exploring whether direct access customers, who are on PGE’s grid but do not buy power from PGE, could be made eligible for Schedule 26 since they could offer sizeable opportunity for energy curtailment.

Appendix A. Residential SGTB Logic Model

PGE developed an initial logic model in 2019 outlining outputs and outcomes associated with the SGTB projects' residential sector activities. The Cadmus evaluation team reviewed the initial logic model and associated key performance indicators (KPIs) for completeness and evaluability. The review uncovered the following gaps, which PGE addressed in its revised logic model.

- **The initial logic model captured most of the key elements except the Diversity, Equity, and Inclusion (DEI) framework.** PGE had not established a DEI framework at the time when the logic model was initially drafted. Once the DEI framework was established, PGE updated the logic model to include this component.
- **KPIs had not been fully developed and PGE needed assistance with developing KPIs that can be evaluated (i.e., can be measured or quantified).** KPI goals should be quantifiable or measurable, as well as specify a timeframe. The Cadmus evaluation team suggested KPIs to PGE to consider. PGE reviewed the KPI suggestions and later finalized the KPIs and evaluable KPI goals.

Table A-1 shows the latest version of PGE's residential SGTB logic model as of October 2020. The evaluation team will continue to review the logic model and assess whether PGE met its intended outcomes and KPI goals.

Table A-1. PGE’s SGTB Residential Logic Model

Barriers	PGE and stakeholders do not fully understand the distribution system impacts of DR/DER technology	PGE and stakeholders do not share the same vision of what DR products and programs to offer	The customer value proposition(s) for participation in DR programs is poorly defined	Lack of clear information on DR and grid operations to educate customers	Unclear how DR programs and products meet the needs of underserved customer groups	Insufficient or constrained implementation resources (e.g., funding, IT, PGE personnel, data, vendors)
Activities	Research, planning, and stakeholder engagement		Development of CVPs and marketing plan to test with residential customers	Customer education materials, outreach, and DR awareness tracking surveys	Partner with cities, CBOs and other stakeholder groups representing underserved groups	Program design and implementation Evaluation
Outputs	Formation of Demand Response Review Committee. Feedback and guidance on Test Bed objectives, CVPs, data collection and DR product demonstrations.		CVP marketing campaigns developed and deployed (customer segmentation, messaging strategy, and targeting)	DR education communications and collateral developed and deployed. Baseline data on customer awareness of demand response and grid operations.	PGE DEI consultants hired; Community Engagement Strategic Plan created	Opt-out PTR selected as foundational demand response measure. PTR communications developed and deployed. Evaluation reports documenting Test Bed impact metrics and learnings
Short-Term Outcomes (Year 1)	1. Test Bed customers participate in PTR events, remain in PTR, learn about other DR programs, and enroll	2. Customers are satisfied with PTR and other DR options (if enrolled)	3. Increased customer awareness of Test Bed, DR and grid operations	4. Community partners identified for DEI; community engagement best practices initiated; PACE model for community feedback developed		5. Insights on customer values/barriers that inform marketers and program/product developers; PGE learnings about marketing messages and delivery channels
Mid-Term Outcomes (Year 2)	6. Customer DR communications refined; New CVPs tested	7. Increased number of customers enroll in DLC programs and new Test Bed demonstrations	8. Customers continue to reduce load	9. DEI service/participation disparities identified and shared; DEI continuous improvement initiated	10. Application of customer insights from evaluation on outreach and program design/delivery	11. Distribution System Planning modeling (DR/DER locational impacts)
Longer-Term Outcomes (Year 3+)	12. DR/DER participation rate goals achieved			13. Long-term lessons are catalogued and inform new approaches to accelerate DR/DER		14. Test Bed Project insights affect DR product, program and marketing planning

Source: PGE

Appendix B. Evaluation Methodology

This appendix describes the Cadmus evaluation team’s research activities and methodology for evaluating the SGTB project.

Stakeholder Interviews

During the first 16 months of the SGTB project, the evaluation team conducted a total of 20 interviews with various stakeholders including PGE staff, implementers, and partners. The objective was to fully understand the SGTB implementation; to understand each stakeholder’s role, implementation successes, and challenges; and to gather information to update and review the residential SGTB logic model. These interviews were conducted in three rounds. The evaluation team drafted a structured interview guide with questions tailored to each stakeholder. Each interview lasted 30 to 60 minutes, and stakeholders were provided with the questions in advance. Table B-1 lists the stakeholders who were interviewed and the timing of the interviews.

Table B-1. Summary of Stakeholder Interviews Completed

Interview Timing	Stakeholders Interviewed
Winter 2019	<ul style="list-style-type: none"> • PGE SGTB Manager (1 contact, in-person) • PGE Residential SGTB and Energy Partner Marketing Leads (2 contacts, in-person) • PGE Energy Partner Product Manager (1 contact, in-person) • PGE DEI Community Outreach Consultants (4 contacts, in-person) • Energy Trust of Oregon Residential and Renewables Sector Leads (3 contacts, phone) • Energy Trust of Oregon Commercial and Industrial Sector Leads (2 contacts, phone) • City of Hillsboro Point of Contact (1 contact, email) • City of Milwaukie Point of Contact (1 contact, email)* <p>Total of 8 interviews completed</p>
Spring 2020	<ul style="list-style-type: none"> • PGE SGTB Manager (1 contact, phone) • PGE Residential SGTB Marketing Lead (1 contact, phone) • PGE Energy Partner Marketing Lead (1 contact, phone) • PGE DEI Community Outreach Consultants (4 contacts, phone) • PGE Energy Partner Product Manager (1 contact, phone) <p>Total of 5 interviews completed</p>
Fall 2020	<ul style="list-style-type: none"> • PGE SGTB Manager (1 contact, phone) • PGE Residential SGTB Marketing Lead (1 contact, phone) • PGE Energy Partner Marketing Lead (1 contact, phone) • PGE DEI Community Outreach Consultants (4 contacts, phone) • PGE Energy Partner Product Manager (1 contact, phone) • CLEAResult Energy Partner Schedule 25 Team (2 contacts, phone) • CLEAResult Energy Partner Schedule 26 Team (2 contacts, phone) <p>Total of 7 interviews completed</p>

*The Cadmus Evaluation team did not speak with the point of contact for the City of Portland. At the time of the winter 2019 interviews, PGE had not identified the point of the contact for the City of Portland.

Residential Marketing Reviews

The purpose of conducting marketing reviews was to identify the market treatments that would inform the resonance assessment evaluation activity. Market treatments are the various communication stimuli that customers receive from PGE and implementers. This largely consisted of marketing collateral. The

evaluation team used the information from the marketing reviews in the resonance assessment to evaluate and communicate to PGE and implementers on what is working, for whom, and why.

The evaluation team systematically reviewed all customer-facing SGTB marketing collateral. As part of the review, the team documented the content that goes to customers and at what stage of the customer journey the content was received. The steps, shown in Table B-2, systematically review SGTB marketing content. The team conducted marketing reviews for the SGTB launch and the three customer value proposition (CVP) messaging campaigns (CVP 1, CVP 2, and CVP 3). Key information (see Step 2 in Table B-2) was tracked in an Excel spreadsheet and this spreadsheet was shared with PGE following the completion of each CVP campaign.

Table B-2. Systematic Marketing Reviews

Step	Description		
Step 1	<ul style="list-style-type: none"> Gather customer-facing marketing collateral (print, digital, and broadcast media) for each Customer Value Proposition (CVP) campaign 		
Step 2	<table border="0"> <tr> <td> Document key information: <ul style="list-style-type: none"> Channel and medium Customer journey point Target audience Marketing analytics results from PGE </td> <td> <ul style="list-style-type: none"> Key words and phrases Call to action Images used </td> </tr> </table>	Document key information: <ul style="list-style-type: none"> Channel and medium Customer journey point Target audience Marketing analytics results from PGE 	<ul style="list-style-type: none"> Key words and phrases Call to action Images used
Document key information: <ul style="list-style-type: none"> Channel and medium Customer journey point Target audience Marketing analytics results from PGE 	<ul style="list-style-type: none"> Key words and phrases Call to action Images used 		
Step 3	<ul style="list-style-type: none"> Look for marketing attributes or content patterns, including at the customer group level or journey point level Connect impact metrics back to specific marketing content 		

Impact Metrics

The evaluation team centralized data management to support assessment and reporting of the impact and performance metrics required for the SGTB evaluation. For this task, the team aggregated various data sources (detailed in Table 6, in main report) to calculate key impacts metrics. A set of key metrics were identified and tracked over time (upon receipt of a new PGE data extract at the beginning/ending of a CVP campaign) and by key customer segment. Metrics were calculated for all PTR enrollees in the SGTB overall, by SGTB neighborhood (North Portland, Milwaukie, and Hillsboro), micro-segment, and several key demographic categories including tenure (in multifamily), age (if senior), language (English vs. non-English, and income (low vs. non-low-income). Metrics tracked over time include enrollment statistics (status of PTR enrollment and Smart Thermostat migration), average seasonal PTR rebate, percentage of PTR enrollees earning seasonal rebates, and CVP-specific metrics (e.g., percentage of SGTB customers who enrolled in the Charitable Giving offer).

Before summer 2019, PGE segmented its customers into five micro-segments reflecting potential demand response program savings and engagement. This customer segmentation was developed specifically for the Flex 2.0 pilot to facilitate targeted marketing and more insightful evaluation. Table B-3 provides a description of these micro-segments.

Table B-3. Residential Demand Response Micro-Segments

Micro-Segments	Description
Big Impactors (highest potential)	Larger single-family dwellings, high income ranges, highest energy bills, busy households and typically have digital subscription activity
Fast Growers	Tends to track tightly with Big Impactors, except shows the most engaged with technology behaviors. Most likely to make online purchases.
Middle Movers	Will track with Fast Growers, proportionally lower values on housing sizes, income, notably close with respect to technology
Borderliners	Individuals in this group are split, some may tend by value to lean into Low Engagers, while some are aligned more with Middle Movers, a key may be viewing this group as potential Middle Movers, tend to rent
Low Engagers (lowest potential)	Most likely to interact with newspapers, flyers and traditional media, least technologically engaged, tendencies to live in smaller square foot housing, lower household income and comparatively older demographic with fewer children living at home

Source: PGE

Residential CVP Surveys

The Cadmus evaluation team administered two CVP surveys with residential customers in the SGTB:

- CVP 1 survey (fielded January 30, 2020 through February 10, 2020)
- CVP 3 survey (fielded October 5, 2020 through October 15, 2020)

A CVP 2 survey was not administered due to there being only one peak time event during the winter 2019/2020 season and a limited number of enrollees in the charitable giving offer.

Survey Design

The CVP survey questions were designed to collect information on the following:

- **Awareness and knowledge.** Customer understanding of demand response and grid concepts and awareness of demand response programs
- **Messaging and channels.** Resonance of CVPs and specific content from PGE communications, as well as channels through which messages delivered
- **Values and attitudes.** What matters to customers in general, and where does energy/PGE/SGTB fit into the broader context of customers’ lives, values, priorities, and concerns
- **Motivation.** Why customers chose to act or not act in response to PGE communications
- **Satisfaction and brand salience.** How satisfied are customers with PGE and the demand response programs, and what are the most important attributes that drive positive PGE brand affinity and experience

The evaluation team administered the surveys online in English and Spanish. The CVP 1 survey launched soon after the CVP 1 campaign ended and the CVP 3 survey launched soon after the CVP 3 campaign ended. Both surveys took 12-15 minutes for customers to complete. Customers were offered a chance to enter in a gift card drawing for completing the survey.

Survey Sampling and Response Rates

For the CVP 1 survey, the evaluation team sampled customers based on the following criteria:

- Be in the SGTB and have an active account with PGE
- Were either still enrolled in PTR or migrated to Smart Thermostat DLC during the CVP 1 campaign timeframe
- Have an email address and were not on any do-not-contact list

A sample of 7,100 records were selected for the CVP 1 survey. All records in the smallest subpopulation groups (such as Spanish, low-income, multi-family, and Big Impactors) were selected while the remaining records in larger subpopulation groups were randomly selected. Table B-4 shows the number of customers contacted and the response rates for the CVP 1 survey. The survey gathered a total of 699 survey completes and achieved an overall response rate of 10%.

Table B-4. Residential SGTB CVP 1 Survey Sample

	Population	Sample Frame	Number of Completes	Response Rate
Overall	10,783	7,100	699	10%
By SGTB Neighborhood				
N. Portland	4,260	2,285	222	10%
Milwaukie	3,996	2,854	298	11%
Hillsboro	2,527	1,961	179	9%
By Language				
English	10,629	6,946	691	10%
Spanish	134	134	8	6%
Other	20	20	0	0%
By Income Group				
Non-Low-Income	6,829	4,064	524	13%
Low-Income	1,110	1,110	162	15%
Null	2,844	1,926	13	1%
By Dwelling Type				
Single-Family	7,954	4,329	396	9%
Multifamily	2,670	2,670	292	11%
Manufactured	152	98	11	11%
Null	7	3	0	0%
By Micro-Segment				
Big Impactors	363	363	23	6%
Fast Growers	627	627	41	7%
Middle Movers	1,383	791	61	8%
Borderliners	2,414	1,432	147	10%
Low Engagers	5,437	3,515	397	11%
Null	559	372	30	8%
By Program				
PTR	10,738	7,055	550	8%
Smart Thermostat (migrated)	45	45	48*	107%*

* The CVP 1 survey asked a program enrollment verification question. The verification question led to finding more customers having enrolled in Smart Thermostat DLC than what the program tracking data indicated at the time when the evaluation team pulled the survey sample.

The evaluation team sampled customers for the CVP 3 survey based on the following criteria:

- Be in the SGTB and have an active account with PGE
- Were still enrolled in PTR
- Have an email address and were not on any do-not-contact list

A sample of 7,506 records were selected for the CVP 3 survey. Unique to the CVP 3 survey sampling, PGE requested the evaluation team to capture more responses from people of color and ethnic minorities. The evaluation team stratified the sampling by race/ethnicity and micro-segment. All records in the smallest subpopulation groups (such as people of color/ethnic minorities and Big Impactors) were selected while the remaining records in larger subpopulation groups were randomly selected. Table B-5 shows the number of customers contacted and the response rates for the CVP 3 survey. The survey gathered a total of 891 survey completes and achieved an overall response rate of 12%, higher than that of the CVP 1 survey.

Table B-5. Residential SGTB CVP 3 Survey Sample

	Population	Sample Frame	Number of Completes	Response Rate
Overall	10,248	7,506	891	12%
By SGTB Neighborhood				
N. Portland	3,925	2,904	382	13%
Milwaukie	3,576	2,757	319	12%
Hillsboro	2,252	1,845	190	10%
By Race/Ethnicity				
White	7,569	4,827	680	14%
People of Color/Ethnic Minority*	1,257	1,257	162	13%
No answer	1,422	1,422	49	3%
By Language				
English	10,095	7,371	882	12%
Spanish	133	121	9	7%
Other	20	14	0	0%
By Carbon CVP 3 Assignment				
Treatment Group	4,842	3,499	406	12%
Control Group	4,911	3,597	426	12%
Null	495	410	59	14%
By Income Group				
Non-Low-Income	9,051	6,657	595	9%
Low-Income	1,197	849	242	29%
By Dwelling Type				
Single-Family	7,579	5,513	624	11%
Multifamily	2,501	1,864	186	10%
Other	168	129	81	63%

	Population	Sample Frame	Number of Completes	Response Rate
By Micro-Segment				
Big Impactors	138	138	10	7%
Fast Growers	740	740	108	15%
Middle Movers	2,042	1,761	203	12%
Borderliners	2,764	2,315	268	12%
Low Engagers	3,491	2,479	296	12%
Null	73	73	6	8%

Note: The number of completes for Race/Ethnicity, Income Group, and Dwelling Type were based on respondents' answers to the survey's demographic questions rather than sourcing the program tracking data. *People of Color/Ethnic Minority includes those who self-reported as African American, Black, American Indian, Native American, Aleut Eskimo, Asian, Asian American, Pacific Islander, Middle Eastern, Hispanic, Latino, multi-racial or multi-ethnic.

Survey Data Analysis

To analyze the survey data, the evaluation team compiled frequency outputs, coded open-end survey responses according to the thematic similarities, and ran statistical significance tests. To determine whether survey results significantly differed between groups, the team compared survey results at the 90% confidence level (or $p \leq 0.10$ significance level). When applicable to the analysis, statistical weights were applied to the survey results.

Resonance Assessment

The resonance assessment was a multivariate analysis that used a combination of customer activity data and market research survey results to uncover how and why specific stimuli drive certain customers to act, and what may be preventing others from taking the desired actions. The resonance assessment aimed to show the extent to which PGE is succeeding in engaging customers through its SGTB messaging and what PGE can do to amplify the resonance of its communications.

To conduct the first phase of the resonance assessment, the evaluation team analyzed the relationships among dozens of variables drawn from the findings of the marketing review, the impact metric analytics, and the Residential CVP 1 Survey. The variables examined in the resonance assessment included the following:

- Values, attitudes, beliefs and priorities
- General communication preferences and communication behaviors
- General bill paying preferences and bill paying behaviors
- Awareness of SGTB initiative and SGTB communications
- Awareness of PTR and Smart Thermostat programs
- Program participation levels and reasons for participation or lack of participation
- Satisfaction with PGE and brand salience
- Program satisfaction and likelihood to recommend

- Demographics, dwelling type, fuel type, and heating and cooling systems
- PGE market segments and demand response micro-segments

The output of the resonance assessment was two-fold:

- **Audience actions.** These showed which customers responded to the PTR events and the call to enroll in the Smart Thermostat DLC program, and how these customers clustered into self-defining “emergent groups” that exhibit similar behaviors in response to the communications.
- **Audience engagement.** This illuminated the customer characteristics and messaging components that were most relevant among customers taking like actions or not taking action. These insights were drawn, for example, from examining what they care about (core values and attitudes), who they are and how they live (demographics and housing attributes), awareness of PGE offers, reasons for taking action, satisfaction with PGE and salience of PGE brand attributes.

Subsequent phases of the SGTB evaluation will build on these findings as new CVP campaigns and new programs and offers are introduced. In the meantime, these initial findings will help shape ongoing SGTB communications.

Residential Focus Groups

The evaluation team conducted four online focus groups with two types of customers who did not migrate to the smart thermostats program. Customers who agreed with the statement “I am concerned about giving PGE control of my thermostat” in the CVP 1 Survey were identified as control keepers; those who did not agree were considered general customers. The focus groups sought to address these four research objectives:

- Assess customers’ understanding of and attitudes towards demand response and load control events
- Explore customer barriers to giving PGE control of their smart thermostats and migration to the Smart Thermostat Program
- Identify value statements that drive customers to enroll in the Smart Thermostat DLC program
- Understand customer motivations and willingness to participate in the Smart Thermostat Program and other direct load control programs

Sampling and Recruitment

The evaluation team recruited participants for the focus groups over the telephone from a list of 101 control keepers and 83 general customers identified from the CVP 1 survey. Customers were offered a gift card incentive for their participation. Customers had to pass the following screening criteria before they were eligible to participate in a focus group:

- Be a residential PGE customer in the SGTB
- Enrolled in PTR but not in Smart Thermostat DLC
- Participated in the CVP 1 Survey and answered the control question
- Be a household decision-maker involved with paying the electric bills

- Not be a PGE employee or affiliated with a PGE employee
- Reside in a single-family detached home
- Have an HVAC system eligible for the Smart Thermostat DLC program (i.e., central AC, ducted heat pump, or electric furnace)
- Have computer and internet that meets virtual focus group technology requirements
- Be able to openly articulate thoughts/opinions and speak clearly with ease in English

The evaluation team designed the recruitment script and discussion guide to minimize bias and had each reviewed by PGE’s DEI Community Outreach Consultants before moving forward with each step of the research. PGE and the team acknowledge that these focus groups were conducted online in English only. Some customers (potentially seniors, those with a lower income, and non-English speakers) may not have been able to participate due to technological and language barriers.

Table B-6 shows details of the focus groups, including date, time, and number of participants. The demographics of the customers who were recruited and attended are shown in Table B-7.

Table B-6. Focus Group Information

Segmentation	Date and Time (PT)	Number of Participants Recruited	Number of Participants Attended
Control Keepers 1	9/22, 5:30-7:00pm	8	6
General Customers 1	9/22, 7:30-9:00pm	8	8
General Customers 2	9/23, 5:30-7:00pm	8	5
Control Keepers 2	9/23, 7:30-9:00pm	8	5
Total		32	24

Table B-7. Demographics of Customers Who Attended the Focus Groups

Category	Control Keepers 1	General Customers 1	General Customers 2	Control Keepers 2
Ethnicity				
Caucasian or White	3 (50%)	5 (62.5%)	4 (80%)	3 (60%)
African American, Black, Asian, Asian American, Pacific Islander, Hispanic, Latino, multi-ethnic, or other	3 (50%)	2 (25%)	0	1 (20%)
Prefer not to answer	0	1 (12.5%)	1 (20%)	1 (20%)
Income				
Non-low income	5 (83%)	6 (75%)	3 (60%)	4 (80%)
Low income	1 (17%)	2 (25%)	2 (40%)	1 (20%)
Age				
Non-senior (under 65)	5 (83%)	6 (75%)	4 (80%)	5 (100%)
Senior (65 and over)	1 (17%)	2 (25%)	1 (20%)	0

Category	Control Keepers 1	General Customers 1	General Customers 2	Control Keepers 2
HVAC System Eligibility*				
Central AC	5 (83%)	7 (87.5%)	4 (80%)	3 (60%)
Electric Furnace	5 (83%)	8 (100%)	4 (80%)	4 (80%)
Heat Pump	2 (33%)	2 (25%)	0	1 (20%)
Has a Smart Thermostat?				
Yes	0	2 (25%)	2 (40%)	3 (60%)
No	6 (100%)	6 (75%)	3 (60%)	2 (40%)

*Totals may exceed 100%. Participants can have more than one HVAC system.
 Note: All recruited participants (100%) live in a single-family detached home.

Focus Group Discussion

To frame the focus group discussion, the evaluation team developed a guide to answer the four research objectives with respect to DEI using activities and questions that allow all focus group respondents to contribute to the conversation. Each focus group lasted 90 minutes and comprised a pre-group polling activity, introductions, a discussion on demand response awareness and PTR, a discussion on smart technology barriers and opportunities, concept testing of the Smart Thermostat DLC program, and a discussion on motivations and values. During the focus group, the moderator ensured that all respondents felt heard and valued.

Analysis

To conduct the analysis on the focus group findings, the evaluation team used the qualitative software tool DeDoose. The team developed a codebook and coded every response in accordance with the codebook. The use of a codebook ensured that each focus group and question were analyzed in a consistent manner. Then, the team systematically identified trends and differences among respondent groups and segments and drew out key findings and quotes that exemplified respondent thoughts.

Nonresidential Schedule 25 Walk-Alongs

In October 2020, Green Mountain Energy went door-to-door to visit local businesses in the SGTB with an aim of improving contact information for key decision-makers and securing sign-ups for PGE’s Energy Partner Smart Thermostat program. A Cadmus field staff attended these walk-alongs to achieve the following:

- Gauge business customers’ awareness of the SGTB, Smart Thermostat program offering, and smart thermostat device
- Identify any successes and challenges in conducting the door-to-door outreach
- Understand the motivations for and barriers to participation of business customers

Green Mountain Energy targeted 61 businesses for recruitment during this outreach effort; however, based on the number of businesses that were open and had available contacts to speak with, the evaluation team was only able to observe 19 business interactions during one day of visits across North

Portland, Milwaukie, and Hillsboro. The team collected data and organized notes using an observation guide, and then analyzed the data by running frequencies, text analysis, and crosstabs and tying results back to outreach and research objectives. The observation guide covered firmographics, customer awareness, marketing, motivations and barriers to enrollment, and outreach successes and challenges.

To avoid disrupting Green Mountain Energy's outreach activities, the evaluation team member could not speak directly with business customers during the walk-alongs; therefore, data collected were based only on observations and, as a result, could be incomplete and/or inaccurate. Furthermore, because observations took place during only one day of visits and were limited to the number of open businesses and available business staffs, evaluation field staff observed only 19 businesses. This selection of businesses is a small sample, meaning we cannot generalize findings to the population.