Portland General Electric Company
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April 26, 2022

Via Electronic Filing

Public Utility Commission of Oregon
Attn: Filing Center
201 High Street, S.E., Suite 100
P.O. Box 1088
Salem, OR 97308-1088

Re: UM 1976 Final Evaluation of PGE's Demand Response Testbed Project

Dear Filing Center:

In accordance with Commission Order Nos. 19-425 and 21-010 regarding PGE's Demand Response Testbed (a.k.a. Smart Grid Testbed or SGTB) Project in Docket UM 1976, enclosed is the Final Evaluation of the Project. PGE contracted with a third-party evaluator (Cadmus) to evaluate the effectiveness of the SGTB Pilot, gauging the effectiveness of targeted interventions such as customer value propositions (CVPs), assessing program enhancements, and documenting areas of future research. Cadmus' evaluation covers the entirety of program activities with a particular focus on those occurring since October 2020, which were not covered in the Mid-Program Evaluation.

The SGTB Project sought to accelerate the development and deployment of demand response and to demonstrate the ability of demand response to function as a grid resource. The SGTB Pilot was also intended to understand customer motivations and/or hesitancy related to participation in demand response programs, in order to inform product enhancements and enable program scaling. SGTB engagements were implemented in conjunction with one or more of PGE's existing programs (e.g., PGE's Peak Time Rebates or PTR, Smart Thermostats, Energy Partner). This evaluation focused on the impacts of the engagements; additional details about the program savings can be found in the product-specific evaluation reports. The SGTB Project also included several small-scale technology demonstrations that are not covered in this report. These demonstrations will be evaluated and filed separately from the core Pilot activities.

The Final Evaluation revealed numerous findings that will help enhance PGE's customer engagement strategies, as well as program design and delivery. At a high level, the final evaluation reinforced the midterm evaluation's findings that:

- Through the SGTB project, PGE has enhanced its ability to deliver demand response programs to residential customers. PGE has advanced its ability to serve environmental justice communities and improved the customer experience for participants in demand response programs.
- The SGTB Pilot 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 the high level of PTR retention (for behavior-based demand response) and the relatively high rate of migration of SGTB PTR customers to the smart thermostat direct load control pilot (for technology enabled demand response).

In addition to supporting the midterm evaluation findings, the final evaluation provided new, high-level insights that PGE can apply to scale demand response or other flexible load programs and improve the customer experience:

- PGE residential customers are motivated to participate in demand response programs because of specific values they hold about monetary incentives, the environment, and community. SGTB project initiatives were most successful in motivating customers to participate in demand response events, achieving demand savings, and migrating customers to firmer demand response programs when PGE marketing and messaging reflected its customers' values.
- Making enrollment the default option in the SGTB lifted PTR program enrollments and savings by adding residential customers to the program who would not have self-enrolled. These "complacent" customers remained in the program and provided meaningful and consistent demand savings. Auto-enrolling residential customers also increased migration to firmer kinds of demand response such as the Smart Thermostat program.
- Since the SGTB launched in 2019, awareness of inequities in the delivery of demand-side management programs to residential utility customers has grown. Low-income, renters, BIPOC (Black, Indigenous, People of Color), and elderly customers have historically participated in such programs at lower rates than other customers. By auto-enrolling customers in PTR, PGE lifted enrollment rates of these EJC groups and reduced disparities in program delivery. Moreover, EJC customers were equally or more motivated to save energy and engage with PTR than other customer groups. Auto-enrolling customers in PTR is a way to engage EJC customers in demand response who otherwise face barriers to self-enrolling.

These high-level findings, together with the detailed results in the attached report, point to the SGTB's value in providing insights into customers' perception of and engagement with PGE's demand response programs. As the SGTB Project transitions into its second phase, PGE will continue collaborating with the Demand Response Review Committee and community stakeholders to maximize its value in advancing PGE's demand response portfolio.

If you have any questions or require further information, please contact Alina Nestjorkina at (503) 464-2144. Please direct all formal correspondence and requests to the following e-mail address pge.opuc.filings@pgn.com.

Sincerely,

/s/ *Jaki Ferchland*
Jaki Ferchland
Manager, Revenue Requirement

Enclosure
cc: UM 1976 Service List
Kacia Brockman, OPUC

CADMUS

Smart Grid Test Bed Project Final Evaluation Report

Phase I: November 2020 – October 2021

Final Report Submitted on March 31, 2022

Prepared for

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ACRONYMS

Acronym	Definition
AMI	Advanced metering infrastructure
BIPOC	Black, Indigenous, People of Color
CBO	Community-based organization
CVP	Customer value proposition
DEI	Diversity, Equity, and Inclusion
DER	Distributed energy resource
DLC	Direct load control
DR	Demand response
EJC	Environmental Justice Communities
EPST	Energy Partner Smart Thermostat
HVAC	Heating, ventilation, and air conditioning
KPI	Key performance indicator
kW	Kilowatt
kWh	Kilowatt-hour
MW	Megawatt
OPUC	Oregon Public Utility Commission
PGE	Portland General Electric
PTR	Peak Time Rebates
SGTB	Smart Grid Test Bed (see *Test Bed* in Terms and Definitions for description)
TOU	Time-of-use

Terms and Definitions

Term	Definition
BIPOC	BIPOC stands for Black, Indigenous, People of Color. However, this term is used in this report to represent individuals who self-identify as African American, Black, American Indian, Native American, Aleut Eskimo, Asian, Asian American, Pacific Islander, Middle Eastern, Hispanic, Latino, multi-racial or multi-ethnic. The evaluation sourced survey responses to the race/ethnicity question.
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 enrollment outside of the SGTB.
Control Keepers	Control keepers refers to a segment of PTR enrollees that emerged from the SGTB evaluation surveys. These PTR enrollees cited concerns about ceding control of their thermostats as a reason for not participating in the Smart Thermostat program.
CVP	Customer value proposition refers to PGE messaging campaigns that are tested as a component of the SGTB project residential implementation.
Energy Partner	Energy Partner refers to PGE's nonresidential demand response programs for business customers, composed of Schedule 25 (Energy Partner Smart Thermostat program) and Schedule 26 (custom) offerings.
Environmental Justice Communities (EJC)	At the beginning of the SGTB Project in 2019, PGE identified traditionally underserved customer groups including low-income customers, People of Color, renters, seniors, and non-English speakers. Since then PGE has aligned with the Oregon House Bill 2475 (2021) relating to public utilities by recognizing Environmental Justice Communities (EJC), which include communities of color, communities experiencing lower incomes, tribal communities, rural communities, coastal communities, communities with limited infrastructure, 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.
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 (PTR), 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 unenrollment during a day divided by the starting enrollment for the day.
HVAC	Heating, ventilation, and air conditioning often refers to the type of equipment or fuel
Micro-Segment	A micro-segment is one of five PGE customer segments that characterize residential customer demand response savings potential: Big Impactors, Fast Growers, Middle Movers, Borderliners, and Low Engagers. See the *Impact Metrics* section for additional descriptions.
Migration	Migration occurs when a customer enrolled in PGE's PTR program unenrolls from PTR and enrolls in PGE's Smart Thermostat program.
PACE Model	A PACE model is a framework for efficient collaboration. PACE stands for Process Owner, Approver, Contributor, and Executor.
Peak Time Event	A Peak Time Event is a demand response event that usually lasts between one and three hours when PGE asks PTR participants to shift or reduce their energy usage.

Term	Definition
Schedule 25	Schedule 25 Energy Partner Smart Thermostat program is one of two nonresidential demand response programs and is available to small and medium-size business customers.
Schedule 26	Schedule 26 Energy Partner program is one of two nonresidential demand response programs and is available to large size 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 unenrollment due to service account closure or PTR ineligibility.
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, and 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.

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.[1] The directive was accompanied by the OPUC's order that PGE also obtain 77 MWs and 69 MWs of, respectively, winter and summer peak 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 PGE to develop new and innovative strategies for scaling its programs. Without such innovation, it will be difficult for PGE to enroll enough residential and nonresidential customers in direct load control (DLC), time-based pricing, and other types of demand response programs to meet the utility's demand response capacity, decarbonization, and flexible load objectives.

In July 2019, PGE launched Phase I of the PGE Smart Grid Test Bed (SGTB) project aimed at identifying and testing these strategies.[2] The project began with PGE automatically enrolling residential customers from three neighborhoods (roughly defined by electric substation boundaries) into the Flex 2.0 Peak Time Rebates (PTR) program. Through various customer value proposition (CVP) messaging campaigns, the project sought to spur residential customers to reduce demand during Peak Time Events and to enroll in PGE's Smart Thermostat program. Implementation of most Phase I nonresidential SGTB project components was delayed and did not progress significantly because of the COVID-19 pandemic, unexpected marketing pauses, and slower-than-expected enrollments.

This evaluation of Phase I of the SGTB project was designed to gain insights about customer behaviors, the customer experience, and how to engage customers in demand response, with the overarching goals of understanding the sources of value customers derive from participation in demand response and identifying the best ways for PGE to engage its customers. With these goals in mind, this final evaluation report covers the entirety of Phase I from the project's launch in July 2019 to October 2021 but focuses on the final 12 months, which included the CVP 4 (Giving Back) and CVP 5 (Renewables) campaigns. The Phase I interim evaluation report evaluated the first three CVP campaigns.[3]

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

2 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.

3 PGE submitted the interim SGTB evaluation report to the OPUC on January 29, 2021. https://edocs.puc.state.or.us/efdocs/HAD/um1976had1636.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	Identify best methods to engage customers in demand responses by evaluating SGTB messaging campaigns and changes in customer awareness	Provide insight into 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 outcomes as defined in PGE's residential SGTB logic model (see *Appendix A*). The logic model outcomes concerned SGTB customer awareness of demand response, demand response event participation, satisfaction with PTR, enrollment and retention in demand response programs, and community engagement, including diversity, equity, and inclusion (DEI).

Evaluating these outcomes and providing guidance about how to structure and scale PGE's demand response programs required multiple research activities. For this final report, the evaluation team analyzed data it gathered from research activities conducted from November 2020 through October 2021, after the submission of the interim evaluation report. The evaluation team then synthesized the findings from these research activities to draw conclusions about PGE's efforts and make recommendations for better engaging customers in demand response.

Evaluation Research Activities

Interim SGTB Evaluation

The interim report conclusions about the first 16 months of the SGTB project (July 2019–October 2020) remain valid and largely unchanged since the report was submitted.[4] The main takeaways from the interim evaluation were:

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

[4] PGE submitted the interim SGTB evaluation report to the OPUC on January 29, 2021. https://edocs.puc.state.or.us/efdocs/HAD/um1976had1636.pdf

- The SGTB project provided learnings 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 are high PTR retention and the relatively high rate of migration from the PTR program to the Smart Thermostat program for Test Bed PTR customers.

Outstanding questions from the interim evaluation concerned the content of messages that would be most effective in motivating customers to participate in demand response, the persistence of engagement with and savings from demand response for customers auto-enrolled in PTR, and the extent to which environmental justice communities (EJC) participated in the SGTB project.

Conclusions from Final SGTB Evaluation

Building on the takeaways from the initial evaluation, the last 12 months of the SGTB project evaluation provided new, high-level insights that PGE can apply to scale demand response or other flexible load programs and improve the customer experience:

PGE residential customers are motivated to participate in demand response programs because of specific values they hold about monetary incentives, the environment, and community. SGTB project initiatives were most successful in motivating customers to participate in demand response events, achieving demand savings, and migrating customers to firmer demand response programs when PGE marketing and messaging reflected its customers' values.

Making enrollment the default option in the SGTB lifted PTR program enrollments and savings by adding residential customers to the program who would not have self-enrolled. These "complacent" customers remained in the program and provided meaningful and consistent demand savings. Auto-enrolling residential customers also increased migration to firmer kinds of demand response such as the Smart Thermostat program.

Since the SGTB launched in 2019, awareness of inequities in the delivery of demand-side management programs to residential utility customers has grown. Low-income, renters, BIPOC (Black, Indigenous, People of Color), and elderly customers have historically participated in such programs at lower rates than other customers. By auto-enrolling customers in PTR, PGE lifted enrollment rates of these EJC groups and reduced disparities in program delivery. Moreover, EJC customers were equally or more motivated to save energy and engage with PTR than other customer groups. Auto-enrolling customers in PTR is a way to engage EJC customers in demand response who otherwise face barriers to self-enrolling.

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

SGTB Key Performance Indicator Goals

PGE met or partially met most of its KPI goals, including those for PTR program delivery and DEI.

As part of developing its residential sector logic model, PGE developed a total of 35 KPIs and set goals to assess SGTB performance during the two-year period. The evaluation team compared SGTB KPIs with the goals to determine if the goals were met. As of October 2021, PGE fully met the goals for 18 KPIs and partially met the goals for nine KPIs. Specifically, PGE met all its DEI-related KPI goals and most of its PTR-related goals. PGE set many ambitious goals for the five customer value proposition (CVP) campaigns it ran and did not achieve several of these goals.

Awareness of Demand Response

The SGTB achieved high awareness of demand response among residential customers.

SGTB residential customers began exhibiting higher demand response concept awareness after the CVP 1 campaign, which took place a few months after the launch of the SGTB. The percentage of SGTB respondents who were aware of the concept of demand response increased significantly from the PGE demand response SGTB baseline survey (58%) to the CVP 1 survey (86%). Awareness has remained high since the CVP 1 survey. PGE administered another survey in spring 2021 to residential customers outside the SGTB. SGTB customers again exhibited higher demand response concept awareness in CVP 5 (91%) when compared with customers outside the SGTB (72%).

Having knowledge of grid operations is not required to spur customer event participation in PTR.

Customers' knowledge of grid operations had no consistent correlation with customer outcomes across the CVPs. Some aspects of their knowledge showed an improvement from the baseline while other areas showed no change or a decline. Customers' knowledge of grid operations was generally low, but this lack of knowledge did not have any bearing on PTR event participation and satisfaction. BIPOC respondents were less aware of the SGTB and the concept of demand response and less knowledgeable about grid operations than white respondents, yet BIPOC respondents participated in PTR events at the same or a higher rate than white respondents. Similarly, renters were less aware and knowledgeable than homeowners, but renters participated in PTR events at the same rate as homeowners.

PTR Awareness and Engagement

Residential customers in the SGTB had high awareness of PTR and high event participation.

At the end of the two-year period, nearly all SGTB customers had heard about PTR (98%). Self-reported event participation showed a statistically significant increase from CVP 1 (86%) to CVP 3 (92%) and then remained steady in CVP 4 (94%) and CVP 5 (95%).

Getting more residential customers to participate in all events remains a challenge.

Most respondents (over 50%) reported participating in some rather than all events, and this pattern remained constant throughout the two-year period. PGE implemented CVP campaigns over the two-year period, with learnings incorporated into the subsequent CVPs; however, none of the CVPs were able to increase the frequency of all-event participation. Since a large percentage of PTR customers participate in some events, retaining these customers in the program and engaging them more in demand response will remain key to the program's savings performance.

Seniors engaged in PTR the most of any customer group.

Based on the CVP 5 survey results, seniors had the highest all-event participation, earned rebates, and PTR satisfaction of any customer group. Almost all seniors reported participating in events—47% reported participating in some events and 51% reported participating in all events, which was substantially higher than the percentage of non-seniors participating in all events (30%). Also, in summer 2021, seniors averaged a significantly higher rebate ($13.40) than non-seniors ($9.65). Furthermore, the group of seniors is the only group where PGE is meeting its PTR satisfaction goal of 80%. A significantly higher proportion of senior customers said they were satisfied with PTR (84%) compared with non-seniors (75% satisfied). The CVP 5 survey results showed that senior customers appear to be better equipped to reap the benefits of PTR compared with other customer groups. A significantly higher percentage of seniors (80%) have air conditioning compared with non-seniors (63%).

Saving money consistently emerged as the top motivator of PTR event participation.

Across all CVP surveys, PTR event participation reasons about saving money consistently came out on top. Specifically, in the CVP 5 survey, the top three reasons overall out of 18 reason statements concerned money and were selected by the vast majority of respondents. These statements are "to reduce my energy bill" (70% of respondents), "it doesn't cost me anything" (66%), and "to earn rebates" (64%). Moreover, a multivariate regression analysis of CVP 3 survey responses found financial benefits as the top personal value correlated with PTR event participation.

Though not as influential as saving money, the environment strongly motivated customers to participate in PTR events.

The environment was the second strongest motivator for most customers. Specifically, in the CVP 5 survey, 59% of respondents selected "to support the use of clean energy," 58% selected "to help save the planet," and 57% selected "to create a healthier outdoor environment" as their reasons for participating in PTR events. PGE customers care greatly about a healthy outdoor environment, offering a strong sentiment for PGE to tap into. A CVP 5 randomized control trial experiment showed that environmental messaging raised PTR savings of SGTB customers with central electric HVAC systems by one percentage point or about 25% compared to savings of the control group. Moreover, the CVP 3 regression analysis that looked at which customer values strongly correlated with PTR event participation found that care for the environment was also a powerful personal value correlated with PTR event participation. Environmental messaging, with its various forms (carbon, renewables, natural resources, etc.), offers PGE a wide range from which to test and hone its communications.

PTR messaging emphasizing customer benefits rather than utility benefits resonated the most with residential customers.

"Helping PGE" fell to the bottom of the list of reasons to participate in PTR events, while reasons about benefits to the customer rose to the top ("To save on *my* energy bill," "It doesn't cost *me* anything," and "To earn rebates on *my* bill" [emphasis added]). Results from the CVP 4 campaign also exhibited this customer-benefit pattern; customers preferred to support nonprofits through direct, personal contributions rather than through PGE. The CVP 3 resonance assessment also revealed that customers who participated in PTR events view corporate social responsibility as equally important as care for the environment and care about what PGE is doing to help the environment and community. Customers prefer to hear about what PGE is doing for the environment and community rather than being asked to help PGE do these things.

Customers seem motivated to participate in PTR events partly by circumstances causing the event.

Results from the CVP 5 survey following summer 2021 showed a dramatic change in customer motivations, likely due in part to both the extreme heat and the shift in CVP 5 messaging language from "power shortages" to "power outages." In all other CVP surveys, saving money was the top motivator, followed by the environment. However, in the CVP 5 survey, the reason "to help the community avoid power outages" surpassed the environment-focused reasons. In addition, the proportion of respondents selecting this service protection messaging as their reason for PTR event participation significantly increased from the CVP 3 survey (51%) to the CVP 5 survey (60%). Moreover, in the extreme heat event survey Cadmus conducted for the Flex evaluation two days after the record-breaking Northwest heat wave, the service protection reason "to help the community avoid power outages" rose to the top (77%) and the money savings reasons "to reduce my energy bill" (65%) and "to earn rebates" (59%) fell to second and third. These results considered together show customer motivations can change based on language emphasizing personal concerns (a power outage is personal while a power shortage is a utility concern) and based on context (e.g., a recent weather event). Varying the PTR messaging to reflect the context of customer concerns at a given moment is an important tool for PGE to leverage in future communications.

SGTB Demand Response Savings

SGTB residential customers auto-enrolled in PTR saved during Peak Time Events, though by a smaller amount than self-enrolled Flex PTR customers outside the SGTB.

In summer 2021, SGTB PTR enrollees saved an average of 0.08 kW or 4% of baseline demand across all Peak Time Events. In winter, they saved an average of 0.05 kW or 3% of baseline demand. However, the PTR savings of SGTB customers were significantly less than the savings of self-enrolled Flex PTR customers, who saved an average of 0.12 kW or 6% of demand in summer 2021 and 0.13 kW or 7% of demand in winter 2020/2021.[5] While PTR savings were lower inside the SGTB than outside, the percentage PTR savings in the SGTB remained constant at about 4% over three summers from 2019 to 2021, showing that auto-enrolled residential customers continued to participate in demand response over the long term.

SGTB customers produced small average PTR demand savings because the program auto-enrolled a wide range of customers, many with low demand response savings potential.

Making PTR enrollment the default option resulted in enrollment of many customers who were not motivated to participate in demand response events or had low savings potential. Many Low Engagers and Borderliners, who have the lowest demand response savings potential, were auto-enrolled in the SGTB and saved little on average. These customers constituted 76% of SGTB PTR enrollees compared with just 57% of Flex PTR enrollees. The low savings potential of these customer groups may mean it is not cost-effective to auto-enroll all of them in PTR.

PGE customer messages emphasizing the benefits of demand response for integrating renewables and preserving the environment increased PTR savings for customers with central electric heating or cooling systems.

In a randomized experiment that was part of the CVP 5 marketing campaign, PGE tested the impacts on PTR demand savings of messaging emphasizing the environmental benefits of demand response program participation. The experiment ran during summer 2021 and involved sending five communications about the benefits of PTR savings for the environment and integrating renewable energy resources. The environment-focused savings lifted the PTR savings of customers with central electric heating or cooling systems by one percentage point or about 25% relative to baseline. The messaging had no effect on customers without central HVAC systems.

PTR Program Enrollment and Retention

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

At the end of October 2021, 90% of Test Bed customers who were automatically enrolled in PTR in July 2019 and remained eligible to participate in PTR and whose account remained active over this period remained in the PTR program. In comparison, at the end of October 2021, 12.3% of eligible customers outside of the Test Bed self-enrolled in PTR. This suggests that auto-enrolling customers is an effective strategy for scaling PTR enrollments. Most auto-enrolled customers did not unenroll and remained in the program for multiple years. Auto-enrollment takes advantage of consumer tendencies to adhere to the default option (in this case, enrollment in PTR).

[5] PGE called only one PTR event during the 2019/2020 winter season.

Auto-enrolled customers who would not have enrolled in PTR on their own realized electricity demand savings and provided a large portion of the PTR demand savings in the SGTB.

Customers automatically enrolled in PTR who would not have self-enrolled and who remained in the program saved an average of 0.069 kW per enrollee during summer PTR events, about 50% of the savings of customers who would have self-enrolled if they had not been auto-enrolled (0.14 kW). This shows that PGE increased PTR savings by making program enrollment the default option for residential customers. For PTR auto-enrollment to be a cost-effective strategy, the additional avoided energy and demand benefits from auto-enrolling complacent customers must exceed the cost of marketing, enrolling, and administering the program to them.

Smart Thermostat Program Migration

Targeted marketing of the Smart Thermostat program based on customer HVAC data increased the effectiveness of PGE's marketing.

In 2021, PGE acquired data on customer HVAC systems and began delivering messages encouraging enrollment in the Smart Thermostat program only to eligible customers. In surveys, the percentage of respondents indicating their home was not eligible for the program significantly dropped from 46% in the CVP 1 survey to 33% in the CVP 5 survey, suggesting targeted marketing helped increase the relevance of the messaging. Currently, PGE checks a customer's HVAC system compatibility only during the direct install scheduling process or the bring-your-own thermostat (BYOT) sign-up process, which comes *after* the customer has decided to sign up. Offering a reference tool during the marketing phase may be an effective way help customers determine their system compatibility.

PGE increased migration to the Smart Thermostat program for customers with eligible HVAC equipment by sending messages emphasizing the benefits of demand response for integrating renewables and preserving the environment.

As part of the CVP 5 marketing campaign, PGE conducted a randomized experiment in the SGTB to test the effectiveness of encouraging customers to enroll in PGE's Smart Thermostat program. The experiment included only SGTB PTR customers with eligible central cooling or electric heating systems and delivered messaging emphasizing the environmental benefits of enrollment. The experiment ran for approximately six weeks during summer and fall 2021. Only about 1% of treated PTR customers enrolled in the Smart Thermostat program, but depending on the measurement approach, these customers were between 160% and 200% more likely to enroll than similar customers in the control group who did not receive the messaging. This suggests that PGE can increase Smart Thermostat program enrollment by delivering environment-focused encouragement to PTR customers during event seasons.

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

Since the interim evaluation, enrollment rates of SGTB customers in the Smart Thermostat program remained higher than rates of similar customers outside the Test Bed. In a comparison of SGTB PTR customers with a group of matched nonparticipants outside the Test Bed (not enrolled in PTR or the Smart Thermostat program), the evaluation found that SGTB customers were about 30% more likely to enroll in the Smart Thermostat program. This enrollment lift measures the combined effects of auto-enrolling customers into PTR and encouraging them to enroll in the Smart Thermostat program.

Control keepers' concerns about ceding control and data security make them hard to migrate and present a barrier for increasing Smart Thermostat program enrollment.

Control keepers have concerns about giving PGE control of their thermostats. In the CVP 1 survey, this concern emerged as a top barrier to enrolling residential customers in the Smart Thermostat program. In the more recent CVP 5 survey and similar to the CVP 1 survey, control keepers made up 59% of program-eligible survey respondents. The CVP 5 survey also revealed that their concerns about control are tightly coupled with concerns about the security

and privacy of their data shared through smart devices. These respondents also tend to be happy with their current thermostats, so there is a considerable amount of inertia. When asked about the likelihood of enrolling in the Smart Thermostat program in the next 12 months, 38% of all program-eligible respondents said they were very likely or somewhat likely. Control keepers were much less likely to enroll—just 11% said they were likely to enroll.

Smart Thermostat Program Event Notifications

PGE tested innovations in the Smart Thermostat program delivery based on the findings of the interim evaluation report.

The SGTB is intended to spark and test innovations in PGE's delivery of flexible load programs. PGE adopted an interim evaluation recommendation to investigate whether maintaining consistency between PTR and Smart Thermostat program delivery could improve the customer experience and/or streamline PGE's demand response program implementation. As the previous report noted, one major inconsistency between the PTR and Smart Thermostat programs was the delivery of event notifications to participating customers. PTR customers receive day-ahead and same-day email/text notifications from PGE, while Smart Thermostat customers received none of these notifications directly from PGE. During summer 2021, PGE ran a randomized experiment involving Smart Thermostat program customers to test the impacts on demand savings, customer satisfaction, and overriding of thermostat settings of sending pre-event notifications to Smart Thermostat program customers.

Smart Thermostat program customers who received event notification emails liked receiving notifications, but the notifications did not increase their overall program satisfaction.

As expected, a significantly higher proportion of respondents who received the notification emails (86%) reported noticing the events compared with those who did not (60%). Nearly all respondents (98%) found the event notification emails useful and said they would like to continue receiving the event notifications. However, there were no significant differences in program satisfaction and utility satisfaction between those who received the notifications and those who did not. PGE is considering testing event notification emails again to confirm the findings.

Sending pre-event notifications reduced the frequency of overriding during Smart Thermostat program demand response events but did not increase demand response savings.

In the randomized experiment, PGE tested the impacts of sending pre-event notifications for six events. Across the events, the notifications reduced the rate of overriding the event control commands between three and six percentage points or between 15% and 24% of baseline. Demand response savings did not increase because the reduction in overriding resulting from the pre-event notifications tended to occur later in events.

Community Engagement and DEI

PGE continued implementing community engagement best practices and increased collaboration with community partners and DEI efforts.

PGE's DEI Community Outreach Consultants achieved the following during the second year of the SGTB:

- Applied an equity lens framework to several projects
- Researched EJC customer groups
- Identified a clear list of 18 community partners and forged relationships with most of them
- Established the SGTB Community Workgroup

Notably, the DEI Community Outreach Consultants worked with Energy Trust of Oregon and Community Energy Project to deliver weatherization and cooling workshops to low-income renters and homeowners. Moreover, PGE

completed development of the equity lens framework in early 2021 and applied an equity lens to the EV charging demonstration project within the SGTB, and outside the SGTB through the roundtables and public process for the 2021 Integrated Resource Planning. Finally, the DEI Community Outreach Consultants gathered feedback from EJC customers to identify disparities and participation barriers and brainstormed solutions for overcoming those disparities and barriers through the SGTB Community Workgroup.

EJC residential customers are highly engaged with PTR but have less capacity to save and earn less in rebates than other customers.

EJC customers—low-income, BIPOC, and renters—earned on average significantly less in rebates in summer 2021 compared with other customers. All three EJC groups were significantly less likely to have air conditioning or smart thermostats than other customers. In addition to providing personal comfort, air conditioning also offers opportunities for earning higher rebates during peak time events. Despite having lower savings capacity, EJC customer groups had self-reported event participation rates that were equal to or higher than those of other customers. Also, EJC customers cared more about improving their personal comfort and were more open to new technologies and programs than other customers. Overall, EJC customer groups seem highly engaged with PTR, and the program provides a way for these customers to participate in PGE's demand response program.

Nonresidential

The nonresidential component of the SGTB did not progress as planned due to the ongoing COVID-19 pandemic, unexpected marketing pauses, and slow enrollments.

Within the SGTB, PGE aimed to enroll 300 small and medium-size businesses into the Schedule 25 Energy Partner Smart Thermostat (EPST) program by the end of 2021 and ended up enrolling 106 businesses. As noted in the interim evaluation report, the COVID-19 pandemic slowed the progress of EPST enrollments during the first year of the SGTB. In the second year, PGE encountered two unexpected marketing pauses (stemming from ice storm outages in winter 2021 and internal program restructuring), which put the program farther behind in enrollment. The evaluation team was able to conduct focus groups with business customers who had not enrolled in EPST to gain insights on enrollment barriers. For the Schedule 26 Energy Partner program, PGE aimed to enroll five of 13 SGTB large businesses by the end of 2021 and ended up enrolling three businesses. Due to few Schedule 26 enrollments in the SGTB and the lack of any new/unique offerings that PGE could test and potentially apply outside the SGTB, no evaluation activities were conducted.

Small and medium-size business customers understand demand response, but the EPST program marketing has not broken through to them.

Seven of 10 focus group respondents (all EPST nonparticipants) were familiar with various aspects of demand response including peak demand, load reduction, grid resiliency, generation, shifting energy use, and connection to smart technology. However, these respondents had very low awareness of the EPST program despite records showing that their business had received marketing. Only one of 10 respondents said they had heard of the EPST program at first reference and only three of 10 respondents recalled the EPST program after being shown stimuli.

Small and medium-size business customers value reliability the most and are motivated to save money – they will do anything to keep their businesses up and running.

Six of 10 focus group respondents selected reliability as the most important factor for their business' energy use because of its connection to operations and productivity. When asked to choose one motivational statement, focus group respondents most frequently chose saving money.

Very few customer-side barriers to enrollment exist among small and medium-size business customers.

Focus group research suggests that business customers are not hesitant about adopting smart devices or the prospect of participating in the EPST program. The respondents liked the EPST program concept, expressed interest in enrolling, and said they did not need additional promotions or incentives to convince them to enroll. The one barrier uncovered was that business customers tend not to seek out information, thus these customers need to be actively pursued; focus group respondents indicated that in-person visits to the business site is the best way to reach customers. Furthermore, focus group respondents said the marketing pitch for the program needs to be memorable and tailored to their business needs and to reach the right people for in-person visits to be successful.

Barriers to EPST program enrollment (communication gaps, ineligibility) point to issues with the customer tracking data.

PGE tracking data showed that four of the 10 focus group respondents received the EPST marketing pitch, but all four respondents said they were unaware of the program. This suggests a gap in reaching the right decision-maker; the focus group recruitment process used a screener to identify the decision-maker at the business and the decision-maker participating in the focus group may not have been the person that the canvasser identified. The focus groups also uncovered missed opportunities for enrollment and ineligible businesses making it into the EPST-eligible list.

Recommendations

This evaluation presents the following sets of recommendations to maximize residential customer engagement with demand response and to assist in scaling PGE's flexible load programs.[6]

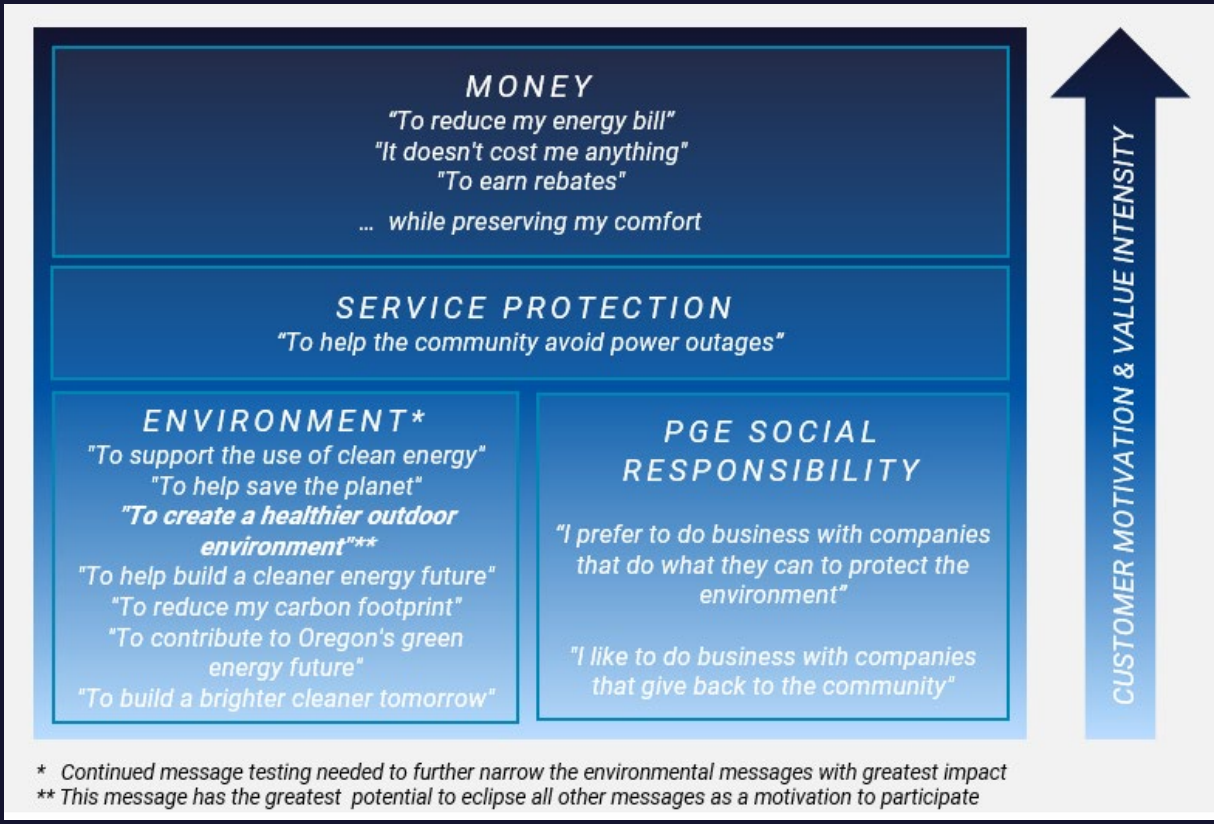
Strategically expand the PTR auto-enrollment model across the service territory

- Depending on the results of PGE's cost-effectiveness analysis, decide whether it would be more beneficial to auto-enroll all customers or to target specific customer segments for auto-enrollment
- Update the program design to PTR auto-enrollment with an option for customers to unenroll based on the results of the cost-effectiveness analysis
- With auto-enrollment, eliminate communication phases that aim to educate customers about grid operations and enroll customers in PTR, leapfrogging directly to PTR program benefits and actions

[6] This final evaluation report does not contain any recommendations for the nonresidential sector due to the dearth of research activities for that sector.

Distill messaging and communications to what motivates and reminds customers to act

- Focus on the customer benefits that matter most to customers
- Couple the PTR communications messages (money savings + environment or money savings + service protection) and adjust the messaging to speak to what is relevant at that time rather than repeating the same messaging
- Eliminate messaging about how customers can help PGE
- Conduct further research and testing to identify how customers' outsized interest in a healthy outdoor environment can be used as a motivator for participating in PTR
- Inject communications about PGE's corporate social responsibility investments into the residential customer communications stream to showcase what PGE is doing to help the environment and the community



Deepen understanding of PTR participants who do not participate in some but not all events

- Conduct further research about increasing participation, including testing more communications to see which messages lead to increased frequency of PTR event participation. Insights from the CVP 3 and CVP 5 survey analyses suggest that more imagery around savings may be compelling and messaging around the environmental risks of carbon should be avoided. Recognizing limitations on customers' time may also be a valuable avenue to explore, and the Smart Thermostat program may be a compelling option to close the gap on savings and time.
- Develop strategies to identify and communicate with customers who participate in some but not all events

Target Smart Thermostat program communications to qualified households

- Continue to refine/improve HVAC data for targeting and consider adding other parameters such as home ownership data and profiles of customers who participate in only some events
- Showcase a quick reference tool for customers who are uncertain if they qualify
- Tackle the barriers of control, data security, and thermostat complacency

Deepen PGE's relationship with community partners to address disparities in demand response participation among EJC customer groups

- Continue to partner with Energy Trust of Oregon and Community Energy Project on delivering low-income weatherization and cooling workshops and disseminate energy-shifting messaging through workshops
- Collaborate on ways to promote efficient cooling equipment to EJC customer groups
- Collaborate on educating EJC customers on ways to use cooling equipment more efficiently
- Share and exchange data with community partners to recruit more EJC customers for demand response pilot projects

Future Research

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

- **Understand how to increase the participation of PTR customers who participate in some but not all events.** More than 50% of all SGTB PTR customers report participating in fewer than all events. The resonance assessment showed these some-event customers are less committed to PTR than all-event customers. To obtain more PTR savings, PGE should conduct additional research about how to motivate further this large group of customers.
- **Understand how to break through the two most powerful customer barriers to scaling the Smart Thermostat program.** Customers who lack confidence that their smart device data is secure or do not like the idea of ceding control to the utility need reassurance, and PGE needs to gain their trust. PGE should conduct further research to develop messaging strategies that build customers' trust and encourage them to participate in the Smart Thermostat program.

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, create 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. 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 to establish high customer participation in demand response resources.

PGE outlined the following goals for Phase I in its proposal to the OPUC:[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 this information into cost-effective strategies across the service territory
- 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

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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

- Coordinate new program development with other demand-side measure providers such as Energy Trust of Oregon
- Study and understand the system operational implications of high levels of demand response and 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

After the launch of the SGTB, PGE added the goal of using the SGTB to build and expand diversity, equity, and inclusion (DEI) capacity and learnings.

PGE concentrated the first 16 months of Phase I of the project (July 2019–October 2020) 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 area of focus, PGE experimented with an array of marketing and outreach efforts to engage and recruit nonresidential customers for demand response.

During the final 12 months of Phase I of the SGTB Project (November 2020–October 2021), PGE maintained its focus on engaging customers in demand response, migrating them to firmer kinds of demand response, and applying learnings from the interim evaluation to continuously improve.

This final evaluation report documents the activities and findings for Phase I of the SGTB project during the 12 months from November 2020 through October 2021. The interim evaluation report presents findings about the Phase I SGTB from the project launch in July 2019 through October 2020.[11]

[11] PGE submitted the interim SGTB evaluation report to the OPUC on January 29, 2021. https://edocs.puc.state.or.us/efdocs/HAD/um1976had1636.pdf

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 distributed energy resources (DER).

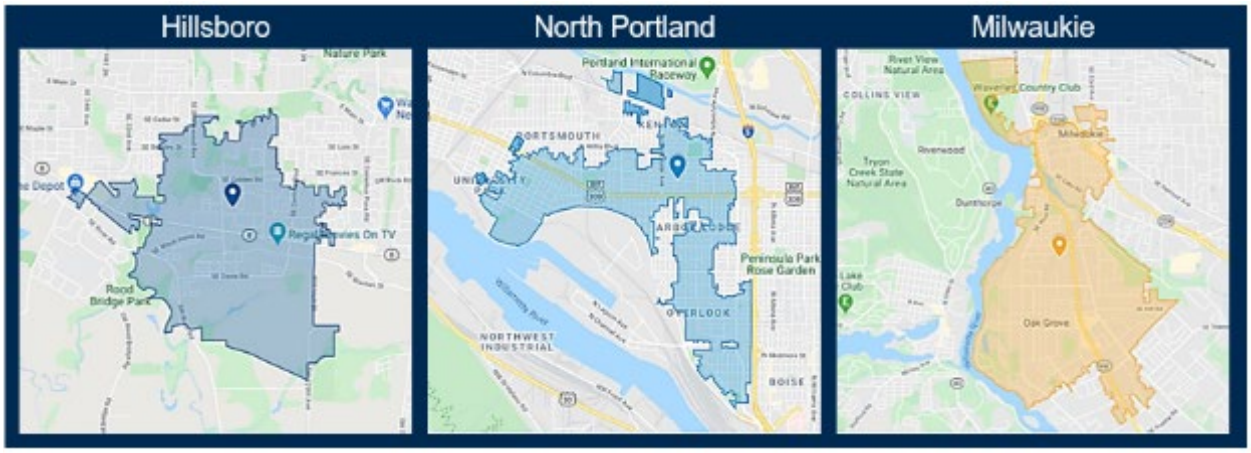
Figure 1. Neighborhoods Selected for the SGTB

ROSEWAY SUBSTATION	DELAWARE SUBSTATION	ISLAND SUBSTATION
• 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	• More urban and younger • Low to medium income level • High concentration of single-family homes, but homes are older, smaller, and more affordable (by Portland standards) • Higher green affinity • More likely to have non-electric heating, therefore lower PGE bill	• 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 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) contributed to the SGTB planning and

advised PGE. PGE internal staff—including product managers, marketers, and outreach team members—coordinated with each other on demand response program offerings and SGTB activities. Partners collaborated with PGE on customer/community outreach and research opportunities. Implementation contractors supported and executed the delivery of specific demand response offerings and outreach to PGE customers. Table 1 describes the roles and responsibilities of the parties involved with the SGTB project.

Table 1. SGTB Organization and Roles

Oversight	
Demand Response Review Committee	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, including PGE staff. Met every quarter to review SGTB progress and advised PGE.
PGE	
SGTB Program Manager	Responsible for overall management and implementation of the SGTB Project and representation to internal and external stakeholders. Managed other team members and coordinated with PGE product managers on demonstrations development, research, operations, evaluation, and stakeholder engagement.
Senior Project Manager	Managed day-to-day SGTB operations including tracking, reporting, and coordination.
Residential Marketing Lead	Planned and managed residential demand response marketing activities. Created new SGTB brand and localized content. Developed the CVP messaging and strategy.
Energy Partner Product Manager	Oversaw Schedule 25 and Schedule 26 (collectively marketed as "Energy Partner").
Energy Partner Marketing Lead	Planned and managed Energy Partner marketing and outreach activities. Created new SGTB brand and localized content.
Diversity, Equity, and Inclusion (DEI) Community Outreach Consultants	Made up of three members (one for each SGTB neighborhood) and a team leader. Coordinated with city partners and organizations to build relationships with their community. Reviewed communications, planning, and research for any equity issues.
Ambassadors	Made up of 10 to 20 PGE employees who live in the SGTB neighborhoods. Gathered neighborhood feedback and reported back to DEI Community Outreach Consultants.
Partners	
Energy Trust of Oregon	Administrator of energy efficiency programs in PGE service area. Teamed with PGE on deployment of smart thermostats, Energy Partner program, and SGTB demo projects.
City of Hillsboro/Milwaukie/Portland	Coordinated with DEI Community Outreach Consultants on city's sustainability and/or climate goals. Helped connect DEI Community Outreach Consultants to key city members, stakeholders, and community organizations. Teamed up on city projects, education, and messaging.
Community-based Organizations	Locally based, nonprofit agencies. Coordinated with DEI Community Outreach Consultants on education, outreach, and messaging.
Northwest Energy Efficiency Alliance	Provided resources to utilities and program administrators to transform the energy efficiency market in the Northwest. Brought to the SGTB insights into how to align program activities with broader regional market transformation efforts.
Implementation Contractors*	
CLEAResult	Coordinated installation appointments and enrollment and performed smart thermostat installations for Schedule 25. Identified opportunities, conducted customer outreach and recruitment, and guided customers through the enrollment and enablement process for Schedule 26.
E Source**	Served as an implementation contractor for PGE's Flex 2.0 Peak Time Rebates (PTR) pilot. Calculated the baseline energy consumption for each customer, the customer's energy savings, and rebates resulting from the peak time events.
Oracle	Served as an implementation contractor for PGE's Flex 2.0 PTR pilot through winter 2020/2021. Sent pre-event notifications and post-event results to customers. Starting in summer 2021, PGE used internal systems to dispatch events and communications.
Green Mountain Energy	Conducted canvassing activities such as the door-to-door outreach for Schedule 25.

* Implementation contractors listed here provided demand response products and services both in and outside of the SGTB.
** In early 2020, E Source acquired TROVE Predictive Data Science. TROVE served as an implementation contractor for PGE's Flex 2.0 PTR during summer 2019 and winter 2019/2020.

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 in 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. PGE notifies customers about a peak time event in advance via email and/or text and sends their event performance results one 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 that 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 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 as illustrated in Figure 3.

Figure 3. SGTB Residential Approach and Envisioned Customer Journey

Residential SGTB Engagement Activities

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

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 customer value proposition (CVP) messaging campaigns. In the last 12 months of the SGTB project, PGE carried out two more CVP messaging campaigns. The CVP campaigns aimed to test customer reactions to different motivational messaging types: Monetary Incentives, Giving Back (to the community, two separate campaigns), Carbon (emissions reductions), and Renewables.

Table 2 describes the residential SGTB engagement activities across the entire span of the project. Specific goals tied to each engagement activity and their outcomes are described in the *Residential Evaluation Findings* section of this report.

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	• SGTB mailers and email in English, Spanish, and Russian • SGTB billboards in neighborhoods • Community outreach events conducted by DEI Community Outreach Consultants • 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 program and persuade customers they can earn more by switching from PTR to smart thermostat DLC	• Mailers and email 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 nonprofits of their choice	• Email and mailers co-branded with partner nonprofits • Digital banner ads and social media from PGE and partners • PGE website page • DEI Community Outreach Consultants informed ambassadors • PGE matched a total of $5,000 in donations across three nonprofits
CVP 3 Carbon (included a randomized experimental design)	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	• PTR checklist mailer • Amazon gift card sweepstakes and 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
CVP 4 Giving Back with Learnings	Nov. 2020 through Feb. 2021	Give customers the ability to donate their rebates to local nonprofits, and increase PTR satisfaction	• Email and mailers co-branded with nonprofit partners • YouTube video • PGE website • Pandora radio ads • Digital banner ads and social media from PGE and partners • PGE matched a total of $6,000 in donations across three nonprofits
CVP 5 Renewables (included a randomized experiment design)	June 2021 through Sept. 2021	Increase PTR event participation, increase awareness of renewables messaging tagline, and determine if CVP 5 messaging affects migration more or less than CVP 1 messaging	• Email and mailers • Billboards • Spotify ads • Digital banner ads and social media • B-line trike ads • Green Mountain Energy booths • SOLVE events and Milwaukie tool exchange event

Also, during the two-year period of the SGTB, PGE launched multiple 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 of Oregon), heat pump water heater controls, monitoring of electric vehicle use and charging, and battery storage. These demonstration projects operate as mini pilots and are not covered in this SGTB evaluation. PGE plans to conduct a separate evaluation of these demonstration projects once participant uptake increases.

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 reaching business customers because it lacks email addresses and current contact information for decision-makers. Business customers also have a longer program onboarding process than 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.

PGE offered two nonresidential demand response programs to business customers—Schedule 25 Energy Partner Smart Thermostat (EPST) program and Schedule 26 Energy Partner custom program. Jointly marketed as Energy Partner, Schedule 25 and Schedule 26 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 EPST program targets small and medium-size businesses (less than 200 kW) with a Wi-Fi network and ducted electric HVAC systems.[12] Businesses that enroll receive one or more complimentary smart thermostats along with installation services 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-size eligible businesses in the SGTB, PGE aimed to enroll 300 into Schedule 25 by the end of 2021.[13]

Table 3 summarizes the engagement activities conducted to recruit decision-makers at small and medium-size businesses. The effectiveness and outcomes of these activities are described in the *Nonresidential Evaluation Findings* section of this report.

[12] PGE began allowing business customers with ductless heat pump or mini-split systems into the program in mid 2021.

[13] During the interim evaluation report period, PGE set the enrollment goal at 460 businesses. PGE later adjusted the goal to 300 because of slow enrollment and unexpected marketing pauses.

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	Send letters from PGE's Energy Efficiency and Service team. Recruit businesses to enroll
Telemarketing by CLEAResult	Q3 to Q4 2020	Contact 500 businesses to recruit for enrollment
Door-to-door outreach by Green Mountain Energy	Q3 to Q4 2020 and Q2 2021	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.
Revised email campaign	Q4 2020 to Q2 2021	Recruit businesses to enroll; highlight new COVID-19 health and safety installation protocols that PGE is implementing
Bill inserts	Q2 to Q3 2021	Recruit businesses to enroll

Very few engagement activities took place during the first quarter (Q1) of 2021. After the February 2021 ice storm caused widespread power outages, PGE halted all Schedule 25 marketing activities for several weeks to assist customers and restore power. Schedule 25 marketing activities were put on pause again during most of Q3 as PGE worked internally to restructure the EPST program.

Schedule 26 SGTB Engagement Activities

Schedule 26 Energy Partner program targets medium-size and 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 recruit decision-makers at these 13 candidate businesses. Very little activity occurred during the second year of the SGTB for Schedule 26 because of the small number of candidate businesses available and the lack of any new/unique offerings that PGE could test and potentially apply outside the SGTB. Instead, PGE focused on preparing the businesses it had already recruited to participate in peak time events.

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	Q3 2019 to Q1 2021	Conduct 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 Q1 2021	Conduct a one-on-one discussion with businesses to go over the program, benefits, and custom plan

EVALUATION OBJECTIVES AND APPROACH

PGE hired Cadmus and its subcontracting partner Larkspur Energy as the evaluator of the SGTB project for Phase I. PGE specified the following general research questions for this phase:[14]

- 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:[15]

- 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 program 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 program?
- Do SGTB customers achieve different demand response savings than other customers?
- Can customer engagement with energy management be measured in other ways (e.g., by the frequency of customers' online energy tracking)?
- Does SGTB messaging affect customer awareness and comprehension of demand response and smart grid concepts?

Evaluation Design

The Cadmus team designed the SGTB project evaluation to answer these research questions. The evaluation was organized around assessing the short-term and mid-term outcomes in PGE's residential SGTB logic model. (PGE's residential SGTB logic model can be found in *Appendix A*.)

Evaluating these outcomes required gathering and analyzing data from the customer and utility perspectives. The evaluation team collected and analyzed data on SGTB customer values, knowledge, motivations, and behaviors regarding demand response from several sources, including customer surveys, focus groups, metered electricity consumption data, rebate data, and randomized experiments. Cadmus and PGE collaborated in the design and implementation of several randomized experiments to test the impacts of different customer messaging or innovations in program delivery. The team also met with PGE SGTB managers and reviewed meeting notes and presentations given to external stakeholders. The team synthesized the findings from these different activities and sources to draw conclusions and make recommendations.

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[14] Source: PGE. July 1, 2019. *PGE Requirements Document.*

[15] Source: Ibid.

Evaluation Activities

Table 5 lists the research activities the evaluation team completed over the two-year span of the SGTB evaluation. (*Appendix B* describes evaluation activities completed in last 12 months in more detail.) This evaluation has also incorporated research and findings from PGE-administered surveys and the residential Flex 2.0 PTR evaluations and Smart Thermostat evaluations.

Table 5. SGTB Evaluation Activities

Activity	Timing and Frequency	Description and Purpose
Residential CVP Surveys	CVP 1 survey (Feb. 2020, n=699) CVP 2 survey cancelled CVP 3 survey (Oct. 2020, n=891) CVP 4 survey (Mar. 2021, n=685) CVP 5 survey (Oct. 2021, n=1,078)	Online surveys launched at the end of a CVP campaign. 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 program participation and in response to PGE communications; and specific aspects of CVP campaigns.
Marketing Reviews	Conducted after SGTB launch, CVP 1, CVP 2, CVP 4, and CVP 5	Systematic review of all customer-facing SGTB marketing collateral. Identify marketing treatments that would inform the survey results and resonance assessment for evaluating which messages/marketing collateral are working, for whom, and why.
Impact Metrics Analysis	Assessed metrics at the end of each CVP campaign	Compilation of PGE SGTB tracking data. Summarize statistics to track SGTB KPIs and assess metrics by different customer segments.
AMI Hourly Consumption Analysis	Summer 2019, Winter 2019/2020, Summer 2020, Winter 2020/2021, and Summer 2021	SGTB evaluation uses the consumption analysis conducted under the Flex 2.0 evaluation to assess load impacts associated with PTR enrollees in the SGTB. Performed regression analysis using matched comparison groups to estimate average hourly load impacts of PTR events. Estimate load impacts associated with PTR enrollee by PTR event and season.
Residential Resonance Assessments	Conducted after CVP 1 survey and CVP 3 survey	A multivariate analysis of the CVP survey data. Uncover correlations between PGE communications, customer values, motivations, and behaviors. Gain insights on ways to improve communications.
Residential Focus Groups	Sept. 2020 (n=24 customers)	Four online focus groups. Assess barriers to Smart Thermostat enrollment by comparing control keepers to a general nonparticipant group. Explore customer values, motivations, and enrollment barriers. Test Smart Thermostat program concept.
Nonresidential Walk-Alongs	Oct. 2020 (19 small and medium businesses visited)	Staff walk-alongs with Green Mountain Energy in the three SGTB neighborhoods to observe EPST outreach. Gauge business customers' awareness of SGTB, successes/challenges of door-to-door outreach, motivations/barriers for participation.
Nonresidential Focus Groups	Apr. 2021 (n=10 customers)	Two online focus groups with small-to-medium business customers located in the SGTB who have not enrolled in EPST. Understand the barriers to enrollment, demand response awareness, values, motivations, and messaging. Test EPST program concept.
Logic Model Review & Update	First review and update in 2020. Final review and update in 2021.	Assessment of whether the SGTB operated and produced results as theorized. Documentation of KPIs and goal outcomes.

Evaluation research activities mostly focused on the residential sector because the implementation of the nonresidential SGTB did not progress as planned, which limited and sometimes cancelled evaluation research opportunities. Therefore, this report focuses mainly on the findings from the residential sector.

Data Sources

This evaluation collected and analyzed a variety of data, including from customer advanced metering infrastructure (AMI) electricity meters, customer surveys, rebates paid to PTR customers, customer focus groups, field visits to nonresidential Test Bed customers, and other sources.[16] 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)	CVP 1, CVP 3, CVP 4, and CVP 5 surveys
SGTB Residential and Nonresidential Focus Groups	SGTB evaluation (Cadmus)	Recordings, transcripts, and analysis from online 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
Demand Response Program Tracking Data	PGE and implementation contractor	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 Presentations and Staff Notes	PGE	Includes presentations PGE gave to the Demand Response Review Committee, email communications, and written summary reports
PGE Hourly AMI Consumption Data	PGE	Used to estimate hourly load impacts for the Flex 2.0 PTR evaluation
PGE Demand Response Surveys (2019 and 2021)	PGE	PGE provided completed survey data used for baseline awareness estimates

[16] 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
Flex 2.0 Customer Surveys (Summer 2019 to Summer 2021)	Flex 2.0 evaluation (Cadmus)	Administered an event and/or end-of-season experience surveys to assess customer experience for that season. Sampling included customers inside and outside the SGTB.
Smart Thermostat Summer 2021 Event Surveys	Smart Thermostat evaluation (Cadmus)	Administered two event surveys during summer 2021—one for July 30th event and the other for August 13th—to assess customer experience and impacts from the event notification experiment.
Smart Thermostat Telemetry Data	PGE and implementation contractor	Used to estimate impact of CVP 5 messaging on customer overriding of smart thermostat demand response events.

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 reveal motivations for saving, but the motivations of survey respondents may differ from those of the overall SGTB customer population.

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 program migration
- Community engagement and DEI

SGTB Key Performance Indicator (KPI) Goals

As part of developing its residential sector logic model, PGE developed a total of 35 KPIs and set goals to assess the SGTB performance during the two-year period. Table 7 through Table 10 present the residential KPIs and their final outcomes for goals based on topic area. The evaluation team determined the final outcomes for goals using the evaluation research activities. As of October 2021, PGE had fully met the goals for 18 KPIs and had partially met the goals for nine KPIs. Specifically, PGE met all of its DEI-related KPI goals and most of its PTR-related goals. PGE set many ambitious goals for the five CVP campaigns it ran and did not achieve several of these goals.

Table 7. PGE Residential SGTB KPIs – Overall

KPI Name	Metric Description and Goal	Final Outcome
Demand Response Concept Awareness	Statistically significant increase within SGTB over baseline survey (58% aware)	DR concept awareness ranged from 86% to 92%, a significant increase over baseline. *Source: PGE DR Baseline Survey (2019) and Cadmus CVP Surveys*
PTR Event Participation	At least 50% of SGTB customers earn a rebate during each demand response season and for each event	• Summer 2019: 97% earned in season (5 events), 48% earned per event • Winter 2020: 62% earned in season (1 event), 62% earned per event • Summer 2020: 94% earned in season (5 events), 53% earned per event • Winter 2021: 78% earned in season (2 events), 58% earned per event • Summer 2021: 96% earned in season (7 events), 56% earned per event *Source: Cadmus analysis of PGE PTR program tracking and rebate data*
PTR Event Load Impacts	Per-customer PTR kW higher in 2020 than 2019, and higher in 2021 than 2020 (Note: may be influenced by event day temperatures)	Savings increased, but the increase was not statistically significant. • Summer 2019: 0.06 kW • Winter 2020: 0.02 kW • Summer 2020: 0.08 kW • Winter 2021: 0.05 kW • Summer 2021: 0.08 kW *Source: Cadmus load impact analysis from Flex evaluation*
PTR Retention	80% of SGTB customers are still enrolled in PTR by the end of 2019	As of October 2021, SGTB customer retention in PTR was 86.8% (or 88.8% when adjusted for smart thermostat migration). *Source: Cadmus analysis of PGE PTR program tracking*
Grid Operations Awareness	Statistically significant increase within SGTB over baseline survey (Note: comprises five grid operations knowledge questions. See Table 11.)	Customers' knowledge of grid operations had no consistent pattern across the CVPs. Some areas showed an improvement from the baseline while other areas showed no change or showed a decline (Table 11). *Source: PGE DR Baseline Survey (2019) and Cadmus CVP Surveys*
SGTB Awareness	75% of SGTB customers have heard about the project	SGTB awareness ranged from 50% to 55%. *Source: Cadmus CVP Surveys*
PTR Satisfaction	At least 80% SGTB customer satisfaction with PTR for each event season	Customer satisfaction ranged from 72% to 77%. *Source: Cadmus CVP Surveys*

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

Table 8. PGE Residential SGTB KPIs – CVP-Specific

KPI Name	Metric Description and Goal	Final Outcome
CVP 1 Monetary Incentives – Smart Thermostat Migration	2% of SGTB customers with eligible HVAC enroll in Smart Thermostat program	3.6% migrated to Smart Thermostat program. *Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data*
CVP 1 Monetary Incentives – Smart Thermostat Program Awareness	75% of SGTB eligible customers heard about Smart Thermostat program (considered by PGE to be a stretch goal)	65% were aware. *Source: Cadmus CVP 1 Survey*
CVP 2 Giving Back – Partnering	Delivery of co-branded materials (PGE and the three nonprofits) and social media sharing	Ran co-branded emails, direct mail, and digital ads. Shared on Facebook and Twitter. *Source: Cadmus review and analysis of PGE SGTB marketing collateral and data*
CVP 2 Giving Back – Enrollment	2% enrollment rate	2.3% enrollment rate *Source: PGE PTR and Smart Thermostat program tracking and enrollment data*
CVP 2 Giving Back – Awareness	25% email open rate with 2% click through rate	28.7% email open rate and 1.06% click through rate. *Source: Cadmus review and analysis of PGE SGTB marketing collateral and data*
CVP 2 Giving Back – PTR Satisfaction	Satisfaction with PTR 5% higher for Giving Back enrollees than non-enrollees	Unable to measure this as no winter 2020 survey was conducted
CVP 3 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. *Source: Cadmus CVP 3 Survey*
CVP 3 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. *Source: Cadmus load impact analysis from Flex 2.0 Evaluation*
CVP 4 Giving Back with Learnings – Awareness	50% aware of opportunity to donate	54% were aware. *Source: Cadmus CVP 4 Survey*
CVP 4 Giving Back with Learnings – Enrollment	4% enrollment rate	1.1% enrollment rate *Source: PGE CVP 4 donation enrollment tracking data*
CVP 4 Giving Back with Learnings – Satisfaction	Giving Back enrollees' satisfaction with PTR five percentage points higher (relative measure) than other customers'	Enrollees 87% satisfied and non-enrollees 70% satisfied. *Source: Cadmus CVP 4 Survey*
CVP 5 Renewables – PTR Event Participation	Self-reported PTR participation in events (all and some events combined) four percentage points higher for treatment group	Among Smart Thermostat program–ineligible customers, 93% of PTR treatment group participated in events compared with 95% in control group. Among eligible customers, 96% of PTR treatment group and 94% of migration treatment group participated in events, compared with 96% in control group. *Source: Cadmus CVP 5 Survey*
CVP 5 Renewables – Awareness of Renewables Messaging Tagline	Awareness of tagline *Shifting Energy = Supporting/More Renewables = Healthier Environment* statistically higher among treatment group who received the messaging compared with control group	Among Smart Thermostat program–ineligible customers, 27% of PTR treatment group remembered the tagline compared with 24% in control group. Among eligible customers, 21% of PTR treatment group and 28% of migration treatment group remembered, compared with 25% in control group. *Source: Cadmus CVP 5 Survey*
CVP 5 Renewables – Smart Thermostat Migration	Determine if CVP 5 renewables messaging affects smart thermostat migration more/less than CVP 1 monetary incentives messaging	Sending only renewables messaging to PTR customers eligible for the Smart Thermostat program did not increase the migration rate to the Smart Thermostat program. However, the renewables messaging paired with encouragement to migrate significantly lifted enrollment in smart thermostats. *Source: PGE PTR and Smart Thermostat program tracking and enrollment data*
CVP 5 Renewables – Smart Thermostat Notification	Determine if advanced event notification email causes statistically significant decrease in overriding	The treatment group consistently overrode less frequently than the control group. *Source: Resideo telemetry data*

Green = Met goal Yellow = Partially met goal 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	Final Outcome
Customer Insights Resources	Delivery of customer insights findings in PowerPoint presentation and/or report format after each CVP campaign	PGE and Cadmus delivered customer insight 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) and to test CVP 5 (Renewables). PGE also tested event notification emails for the Smart Thermostat program
DEI – Partners Identified	List of prioritized community stakeholders with assigned PGE relationship owners (2019) and Salesforce dashboard tracking (2020)	Both goals were met. See Figure 37 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)	All three goals were met. See *Establishment of SGTB Community Workgroup* and *Application of Equity Lens Framework* sections
DEI – PACE Model for Community Feedback	Create priority stakeholder outreach strategy (2019) and community-based organization (CBO) partnership strategy developed and initiated (2020)	Both goals were met. See *Identification of Community Partners and Relationship Building* section
DEI – Service and Participation Disparities Identified and Shared	Participation barriers for specific DEI communities identified and documented in Equity Lens repository, with recommendations for overcoming shared via Community Snapshots, Quarterly Community Insights Meetings	All goals were met. See *Outcomes of Community Engagement Practice* Section.
DEI – Continuous Improvements	Maintain repository of lessons learned and successful outreach strategies	PGE's DEI Community Outreach Consultants drafted a DEI report in Q4 2021 that summarized learnings

Source: Stakeholder interviews, notes from program staff, and PGE presentations

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

Table 10. PGE Residential SGTB KPIs – Demonstration Projects, Delivery Improvements, and Distribution System

KPI Name	Metric Description and Goal	Final Outcome
EV Programs Awareness	25% awareness among electric vehicle (EV) drivers in the Test Bed	PGE plans to administer a survey in 2022
EV Program Adoption	25 enrollees in each Test Bed area	PGE is currently recruiting customers
Residential Storage Pilot Awareness	50% awareness among existing solar PV households	PGE plans to administer a survey in 2022
Residential Storage Pilot Adoption	20 enrollees by end of 2020, increasing to 200 enrollees in 3 years	PGE is currently recruiting customers
Scalable Program Design and Delivery Improvements	Apply Test Bed learnings and suggested improvements from Cadmus' evaluation and PGE research territory-wide by end of 2021	PGE is currently reviewing Cadmus' final evaluation recommendations
DR/DER Distribution System Impacts Assessment	Quantify locational DR/DER impacts on the grid for planning and cost effectiveness purposes starting in 2021	PGE plans to do this for Phase II of the SGTB

Source: Notes from program staff, and PGE presentations

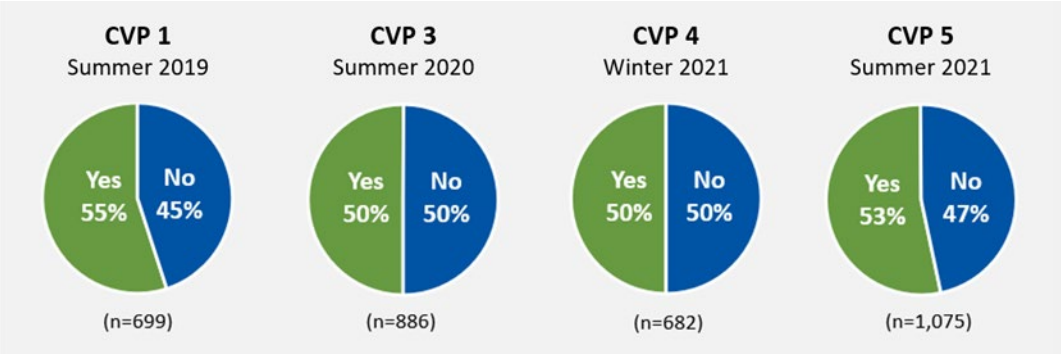
Green = Met goal Yellow = Partially met goal or in progress Purple = Did not meet goal Grey = Cannot determine/no data

Awareness and Knowledge

Customer Awareness of the SGTB and PTR

Residential customer awareness of the SGTB remained steady at around 50% over the two-year period, as shown in Figure 4. At the end of CVP 5—the last survey—53% of respondents were aware of the SGTB, which fell far short of PGE's goal of 75% customer awareness. However, PGE conducted marketing activities for the SGTB only during the initial launch of the SGTB, which explains why respondents' awareness of the SGTB itself did not change.

Figure 4. Residential Customer Awareness of the SGTB

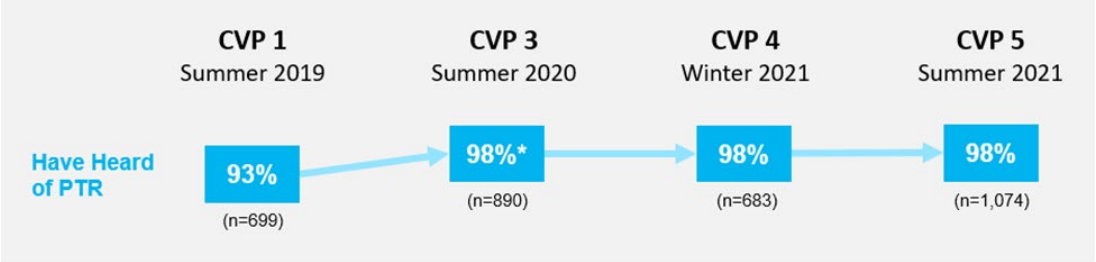


Note: CVP 2 (winter 2020) is not shown here because this survey was cancelled.

Source: Cadmus CVP Survey Question. "The images above represent the three neighborhoods that are part of PGE's Smart Grid Test Bed. Before today, have you heard about the Smart Grid Test Bed?"

PGE opted to focus its communication efforts instead on PTR, the Smart Thermostat program, and the CVPs—the more critical aspects of the SGTB—which proved to be an effective strategy. PGE achieved near universal customer awareness of the PTR program. Figure 5 shows that at the end of CVP 5, 98% of respondents had heard of PTR.

Figure 5. Residential Customer Awareness of PTR Program



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

Note: CVP 2 (winter 2020) is not shown here because this survey was cancelled.

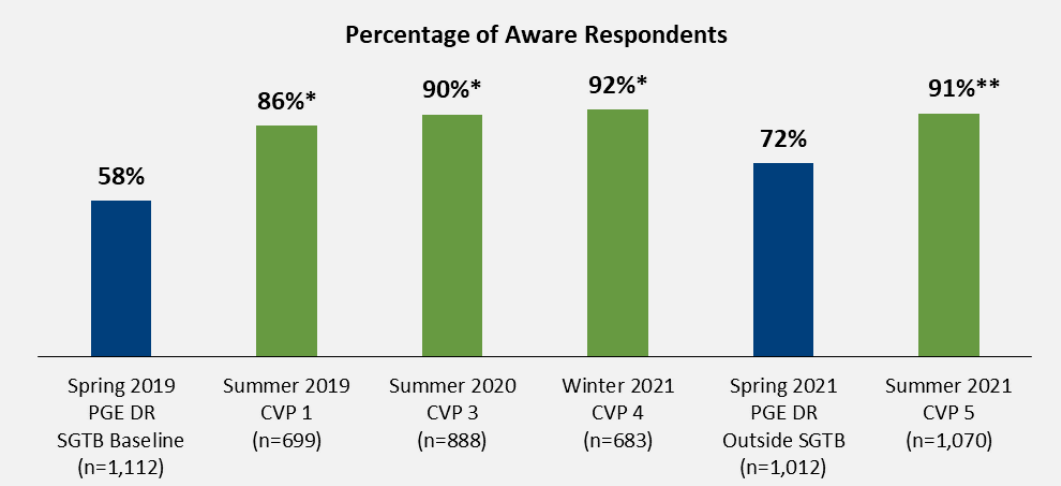
Source: Cadmus CVP Survey Question. "Peak Time Rebates is a program from PGE that rewards you for shifting your energy use for a few hours during times when energy use spikes. Do you remember hearing about Peak Time Rebates?"

Customer Awareness of Demand Response and Knowledge of Grid Operations

Early in the SGTB project, PGE met its goal of increasing customer awareness of demand response. Figure 6 shows that SGTB customers began exhibiting higher demand response concept awareness after the CVP 1 campaign, a few months after the launch of the SGTB. The percentage of SGTB respondents who were aware of the concept of demand response increased significantly from the PGE DR SGTB Baseline survey (58%) to the CVP 1 survey (86%). Awareness has remained high since the CVP 1 survey.

PGE administered another survey in spring 2021 to customers outside the SGTB. SGTB customers again exhibited higher demand response concept awareness in CVP 5 (91%) when compared to customers outside the SGTB (72%). The experience of customers participating in the PTR program (such as receiving peak time event notifications and performance results) and PGE's demand response campaign during 2019 likely contributed to the high level of awareness.

Figure 6. SGTB Customer Awareness of Demand Response Concept



* Difference from 2019 PGE DR SGTB Baseline survey is significant with 90% confidence (p≤0.10).
** Difference from 2021PGE DR Outside SGTB survey is significant with 90% confidence (p≤0.10).
Source: PGE DR Surveys and Cadmus CVP 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 did not meet its goal of increasing customer awareness of grid operations from the baseline. Customers' knowledge of grid operations had no consistent pattern across the CVPs. Some areas showed an improvement from the baseline while other areas showed no change or a decline (Table 11). The CVP communications to customers have not included information on grid operations other than on peak demand times, which explains the inconsistencies in customers' knowledge of grid operations.

Table 11. SGTB Customer Knowledge of Grid Operations

Grid Operations Question	Percentage of Respondents with Correct Answer					
	PGE 2019 DR SGTB Baseline (n=1,124)	CVP 1 (n≤697)	CVP 3 (n≤888)	CVP 4 (n≤681)	PGE 2021 DR Outside SGTB (n=1,012)	CVP 5 (n≤1,074)
Do you believe that PGE's cost to provide electricity is the same at all times of the day?	74%	74%	64%*	66%*	58%	62%
What part of the day do you think the most electricity is used in your community?	68%	78%*	80%*	79%*	65%	81%**
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%*	59%*	58%	63%**
Agree or disagree statement: PGE can store electricity and use it when there are times of high demand for electricity.	46%	48%	48%	48%	54%	51%
How much of the energy generated by PGE comes from renewable sources such as hydro, wind or solar power?	10%	7%	11%	11%	13%	8%**

* Difference from 2019 PGE DR SGTB Baseline survey is significant with 90% confidence (p≤0.10).

** Difference from 2021 PGE DR Outside SGTB survey is significant with 90% confidence (p≤0.10).

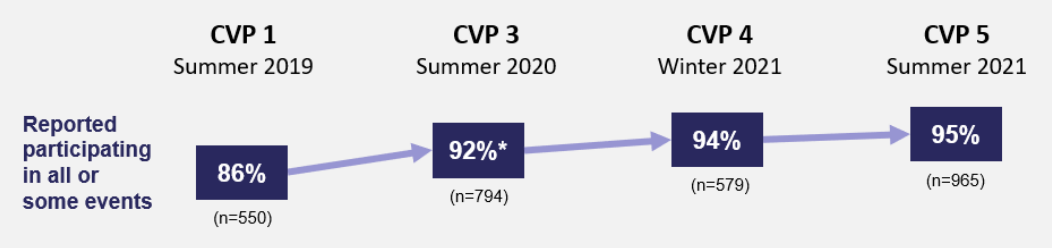
Source: PGE DR Surveys *(2019 and 2021) and Cadmus CVP Survey Questions.*

PTR Event Participation and Load Reduction

Self-Reported Event Participation Outcomes

Based on self-reports, most SGTB customers participated in PTR events. As shown in Figure 7, at the end of the two-year period, 95% of CVP 5 survey respondents reported participating in all or some of the PTR events. Self-reported event participation showed a statistically significant increase from CVP 1 (86%) to CVP 3 (92%) then remained steady in CVP 4 (94%) and CVP 5 (95%).[17]

Figure 7. SGTB Customer Self-Reported Participation in PTR Events



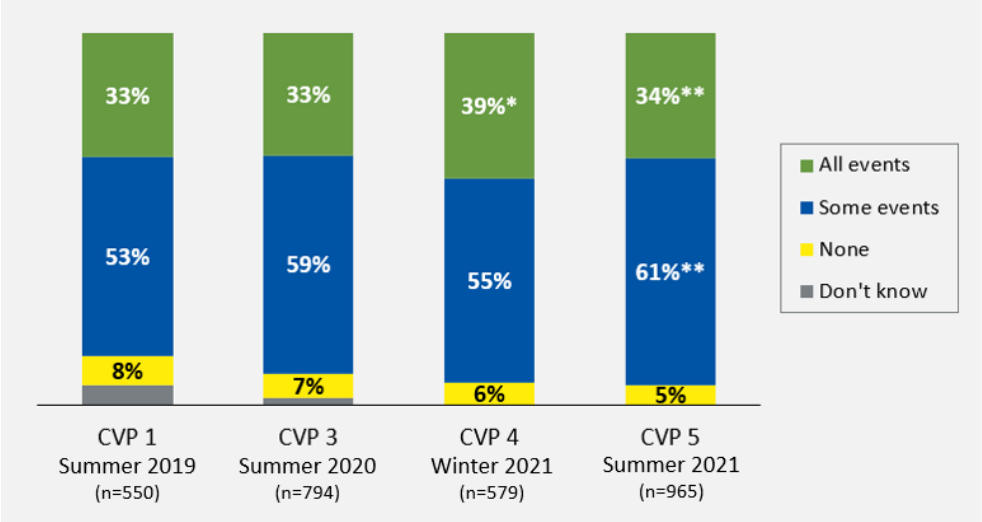
* Difference between CVP 1 and CVP 3 is significant with 90% confidence (p≤0.10).

Source: Cadmus CVP Survey Question. "Did you or others in your household do anything to shift/reduce energy use during the summer/winter Peak Time Events?"

[17] Survey respondents may be slightly more engaged with PTR than the average PTR enrollee. In the SGTB, the average rebate for summer 2021 was $8.50 for all SGTB customers and $10.22 for SGTB survey respondents.

Most respondents reported participating in some rather than all events, and this pattern remained constant, as shown in Figure 8.[18] PGE tested CVP campaigns over the two-year period, incorporating learnings from the previous campaigns; however, none of the CVPs were able to increase the percentage of participation in all events. The percentage of respondents who participated in all events did increase once from CVP 3 (33%) to CVP 4 (39%), but this was likely due to seasonal differences between CVP 3 and CVP 4 and to the number of PTR events in that time period. The CVP 4 campaign took place during a winter season while all other CVP campaigns took place during a summer season. CVP 4 also had the fewest number of PTR events called (two events) compared with the other CVPs, which had about six events.

Figure 8. SGTB Customer Self-Reported Participation in All vs. Some PTR Events



* Difference between CVP 3 and CVP 4 is significant with 90% confidence (p≤0.10).

** Difference between CVP 4 and CVP 5 is significant with 90% confidence (p≤0.10).

Source: Cadmus CVP Survey Question. "Did you or others in your household do anything to shift/reduce energy use during the summer/winter Peak Time Events?"

Event Participation Reasons and Motivations

The CVP surveys asked SGTB customers who participated in PTR events their reasons for participating. To gauge the impact of specific CVP messaging, the surveys used the actual phrases from the CVP communications in the list of reasons for event participation. The event participation reason question was asked only in the CVP 1, CVP 3, and CVP 5 surveys pertaining to a summer season.[19]

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[18] 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 with $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.

[19] The CVP 2 and CVP 4 campaigns focused on charitable giving and took place during a winter season with very few events. The CVP 2 survey was cancelled.

Figure 9 shows a summary of the top 10 event participation reasons across these three CVPs.

Figure 9. SGTB Customers' Top PTR Event Participation Reasons and Motivations

CVP 1 Survey (n≤417)

Rank	% of Respondents Who Said the Statement Was "Very True"
1	To reduce my energy bill (77%)
2	To earn rebates (70%)
3	It doesn't cost me anything (63%)
4	To help build a cleaner energy future (58%)
5	To reduce my carbon footprint (55%)
6	To help keep electricity prices affordable for my community (54%)
7	To help shape the future of how we consume energy in Oregon (52%)
8	To help PGE rely more on renewable energy during peak times (50%)
9	To help the community avoid power shortages (46%)
10	It's simple to shift my energy use (39%)

CVP 3 Survey (n≤489)

Rank	% of Respondents Who Said the Statement Was "Very True"
1	To reduce my energy bill (71%)
2	It doesn't cost me anything (62%)
3	To help build a cleaner energy future (60%)
4	To help save the planet (60%)
5	To earn rebates (58%)
6	To reduce my carbon footprint (56%)
7	To build a brighter cleaner tomorrow (54%)
8	To help keep electricity prices affordable for my community (52%)
9	Because the little things I do can make a big impact (51%)
10	To help the community avoid power shortages (51%)

CVP 5 Survey (n≤911)

Rank	% of Respondents Who Said the Statement Was "Very True"
1	To reduce my energy bill (70%)
2	It doesn't cost me anything (66%)
3	To earn rebates (64%)
4	To help the community avoid power outages (60%)
5	To support the use of clean energy (59%)
6	To help save the planet (58%)
7	To create a healthier outdoor environment (57%)
8	To help build a cleaner energy future (56%)
9	To reduce my carbon footprint (56%)
10	To contribute to Oregon's green energy future (56%)

Motivation Typology Key: Money | Service Protection | Environment | Social Responsibility | Other

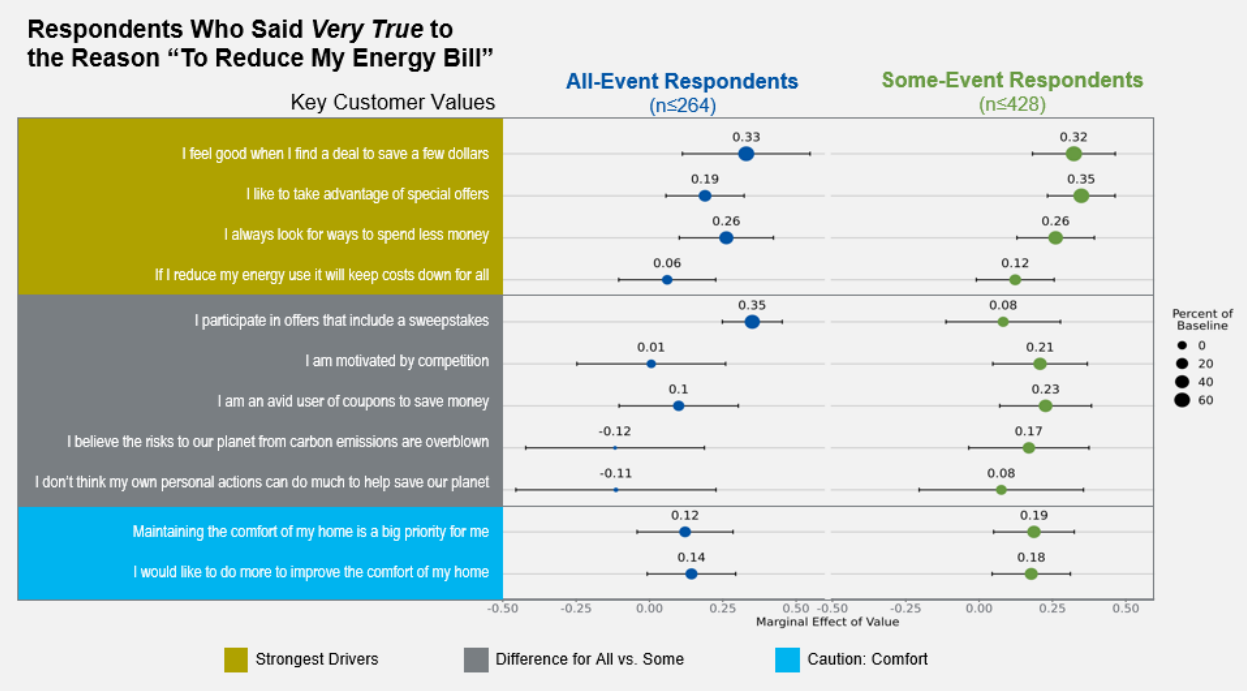
Note: The CVP surveys used actual phrases from CVP communications in the list of participation reasons that respondents rated. PGE repeated some phrases across CVPs but also introduced new phrases.

Source: Cadmus CVP 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."

Saving Money

Figure 10 shows that PTR event participation reasons about saving money consistently came out on top across CVP 1, CVP 3, and CVP 5 surveys. In all these surveys, the top two or three reasons were "to reduce my energy bill," "it doesn't cost me anything," and "to earn rebates." Moreover, a multivariate regression analysis of CVP 3 survey responses found financial benefits as the top personal value correlated with PTR event participation. Respondents who selected "to reduce my energy bill" as their reason for event participation had strong money-saving values (e.g., "I feel good when I find a deal to save a few dollars"). Money-saving values had the strongest relationship to respondents' event participation than any other personal value.

Figure 10. Correlation of Reason "To Reduce My Energy Bill" to Customer Values



Source: Cadmus CVP 3 Survey Questions. "Below are some statements that might describe you. Please indicate how well each statement describes you personally." and "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 effect of having each value on the probability of giving the participation reason ("Reduce My Energy Bill") was estimated in a separate OLS regression.

The Environment

PTR event participation reasons about the environment ranked second for most customers. As shown in Figure 9, above, the reason statements that ranked right below the money-saving statements were "to help build a cleaner energy future," "to help save the planet," and "to reduce my carbon footprint." The reason "to create a healthier outdoor environment," which PGE tested for the first time during CVP 5, showed promising potential. Not only did 57% of respondents select this reason, 83% of respondents said *very true* to the personal value statement "it's important to me to preserve a healthy outdoor environment in Oregon." Most notably, this personal value of a healthy outdoor environment emerged as the top value statement in the CVP 5 survey (Table 12). PGE customers care greatly about a healthy outdoor environment, offering a strong sentiment for PGE to tap into.

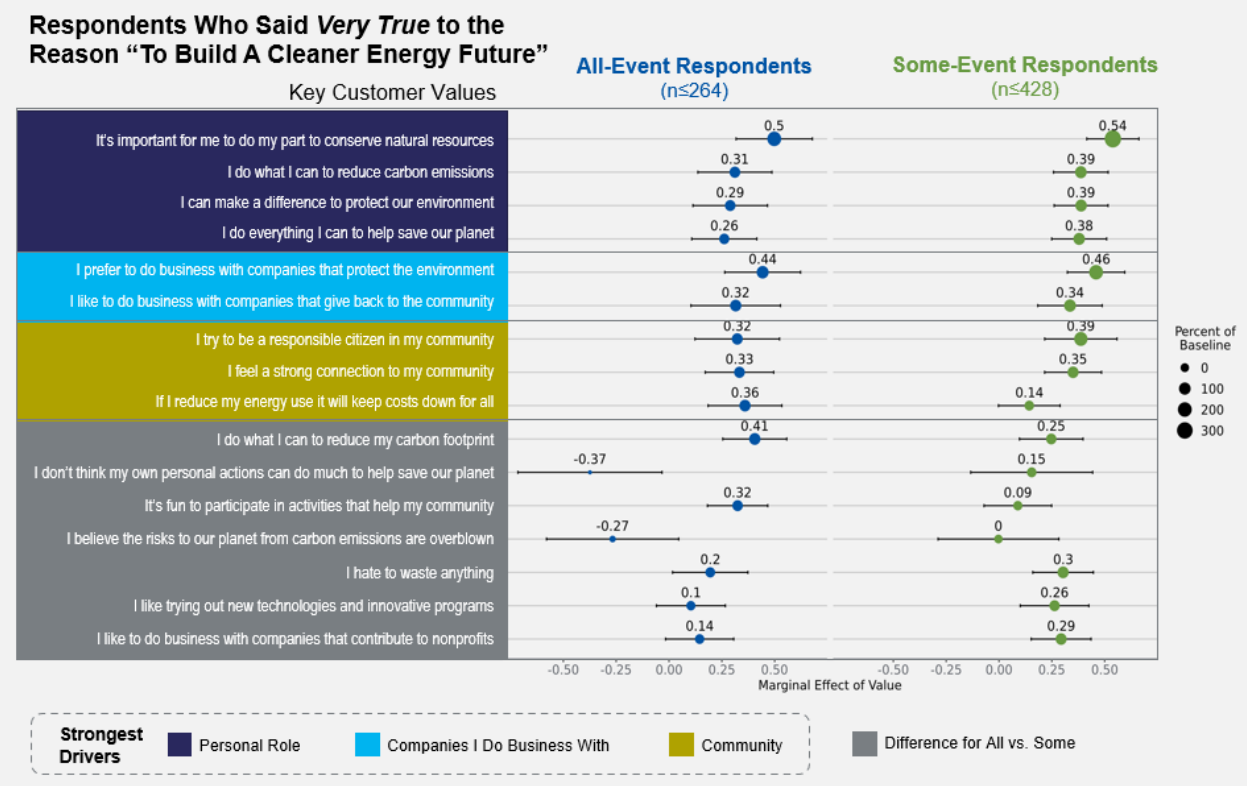
Table 12. SGTB Customers' Top Personal Value Statements from CVP 5 Survey

Personal Value Statement	% of Respondents Who Said "Very True" (n=1,073)
It's important to me to preserve a healthy outdoor environment in Oregon	83%
I hate wasting money	77%
I try to be a responsible citizen in my community	72%
It's important for me to do my part to conserve our natural resources	68%
I prefer to do business with companies that do what they can to protect the environment	66%
I like to do business with companies that give back to the community	66%

Source: Cadmus CVP 5 Survey Question. "Below are some statements that might describe you. Please indicate how well each statement describes you personally."

A multivariate regression analysis of CVP 3 survey responses showed that care for the environment was also a powerful personal value correlated with PTR event participation. As shown in Figure 11, respondents who selected "to build a cleaner energy future" as their event participation reason had strong personal agency values tied to the environment (e.g., "I do what I can to reduce carbon emissions"). These respondents also had strong values tied to corporate social responsibility (e.g., "I prefer to do business with companies that protect the environment").

Figure 11. Correlation of Reason "To Build a Cleaner Energy Future" to Customer Values



Source: Cadmus CVP 3 Survey Questions. "Below are some statements that might describe you. Please indicate how well each statement describes you personally." and "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 effect of having each value on the probability of giving the participation reason was estimated in a separate OLS regression.

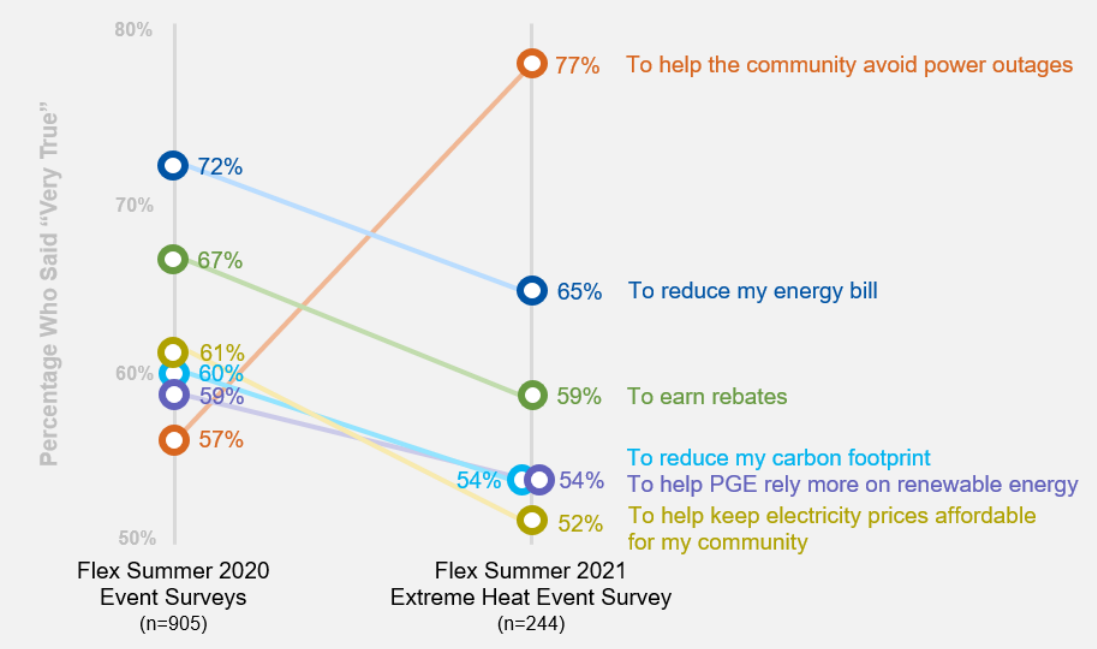
Service Protection and Extreme Heat

As mentioned earlier, saving money was the top reason for SGTB customers' PTR event participation, followed by the environment. However, the reason "to help the community avoid power outages" surpassed the environment reason only in CVP 5 (Figure 9, above). Also, the proportion of respondents selecting "to help the community avoid power outages" increased significantly from the 51% in CVP 3 to 60% in CVP 5. The extreme heat wave of summer 2021 likely explains the rise of this reason.

The evaluation found the summer 2021 extreme heat wave impacted customer motivations. Cadmus conducted an extreme heat event survey as part of the Flex evaluation two days after the record-breaking Northwest heat wave. In that survey, the service protection reason "to help the community

avoid power outages" emerged on top (77%) and the money-saving reasons "to reduce my energy bill" (65%) and "to earn rebates" (59%) fell to second and third, respectively. Figure 12 illustrates the dramatic change in customers' event participation motivations during the extreme heat events by comparing results to the summer 2020 event surveys. Summer 2020 did not have an extreme heat wave. Most notably, the reason "to help the community avoid power outages" appeared at the bottom on the list of participation reasons in the summer 2020 survey (57%) and then surged to the top in the 2021 extreme heat event survey (77%). These results suggest that customer motivations are dynamic and can change based on context.

Figure 12. Changes in Customers' Event Participation Reasons During Extreme Heat



Note: The results include SGTB PTR and Flex PTR respondents.

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

Earned Rebates

PGE met its goal of at least 50% of customers earning a rebate during each demand response season. Analysis of PGE's PTR rebate data found that 97% of SGTB customers in summer 2019, 62% in winter 2019/2020, 94% in summer 2020, 78% in winter 2020/2021, and 96% in summer 2021 earned rebates.[20]

Table 13 provides additional detail for SGTB PTR and Flex PTR customers on average rebate amounts per event and per season and on the proportion of customers who received rebates per event and per season.

Table 13. 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	Average Rebate Per Event	Average 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
Winter 2020/2021	78%	58%	$0.85	$1.70
Summer 2021	96%	56%	$1.21	$8.50
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
Winter 2020/2021	80%	60%	$1.09	$2.19
Summer 2021	94%	56%	$1.21	$8.49

* 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

[20] The percentage of customers receiving rebates may not be an accurate indicator of how many customers 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)= $1 - 0.5^5$) = 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.

Peak Time Rebates Demand Savings

As part of the Flex 2.0 PTR evaluation, Cadmus estimated PTR savings for SGTB customers.[21] The electricity demand savings in winter and summer from PTR in the Test Bed are of interest because of PGE's auto-enrollment of residential customers in the program and the uncertainty about how much auto-enrolled customers would save.

Winter 2020/2021

In winter 2020/2021, PGE called two PTR events on weekdays from 5 p.m. to 8 p.m. Figure 13 shows the average demand savings (kW) per Test Bed PTR enrolled customer and the percentage savings (the kW savings relative to baseline demand) for each of the events. The PTR savings per enrolled customer were 0.06 kW (3%) for Event 1 and 0.04 kW (2%) for Event 2.

[21] 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.

Figure 13. SGTB Demand Savings – Winter 2020/2021

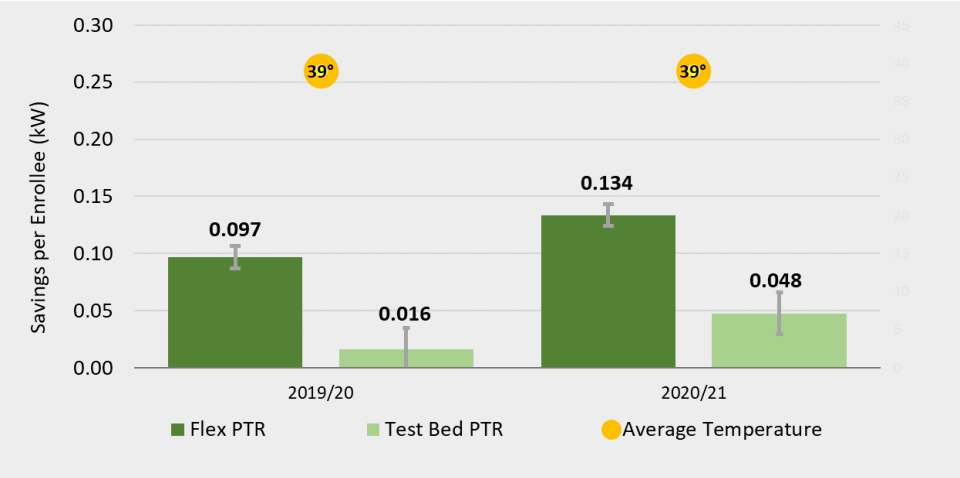
Note: Estimates based on Cadmus analysis of AMI meter data from the winter 2020/21 event season for Flex 2.0 PTR enrollees and matched comparison group. Each winter 2020/2021 event occurred on a weekday beginning at 5 p.m. and lasted three hours. Error bars indicate 90% confidence intervals based on standard errors clustered on customers. Percentage savings were calculated by dividing the kW savings by baseline demand.

Figure 14 compares the demand savings in winter 2020/2021 and winter 2019/2020 for PGE residential PTR customers inside (TB PTR) and outside (Flex PTR) the Test Bed. [22] Flex PTR customers self-enrolled in the program. Average demand savings per SGTB PTR enrollee increased from 0.02 kW in winter 2019/2020 to 0.05 kW in winter 2020/2021. As temperatures were the same across the two seasons, this increase in savings was likely driven by other factors, such as greater engagement with the program.

[22] Details about the PTR savings of SGTB customers in the summer 2019 and winter 2019/2020 seasons can be found in the publicly available Flex 2.0 evaluation report: 2020 Flex 2.0 Demand Response Pilot Evaluation Report (June 2020). Available at https://edocs.puc.state.or.us/efdocs/HAQ/um1708haq124912.pdf.

Savings also increased from 1% to 3% of demand.[23] Flex PTR participants saved more (0.13 kW per enrollee or 7% of baseline demand) than SGTB PTR customers. This is likely attributable to the self-enrollment of Flex PTR customers in the program and the auto-enrollment in the SGTB of many customers with little interest in participating or low savings potential.

Figure 14. SGTB PTR and Flex PTR Demand Savings (kW) – Winter



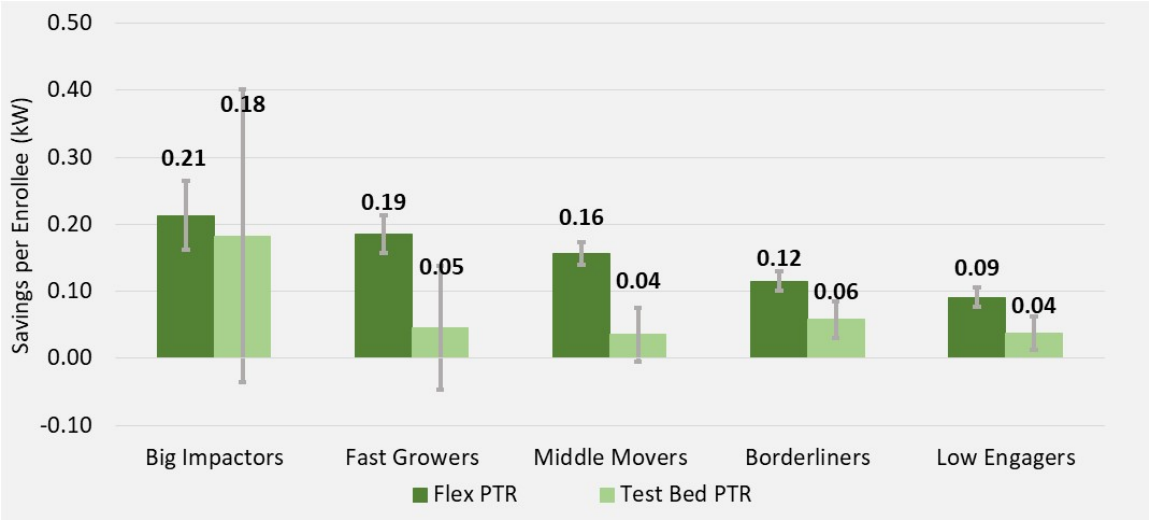
Note: Estimates based on Cadmus analysis of AMI meter data from the winter 2019/2020 and winter 2020/2021 seasons for Flex 2.0 PTR enrollees and matched comparison group.
Winter 2020/2021 events started on weekdays beginning at 5 p.m. and lasted three hours.
Winter 2019/2020 events started at 4 p.m. and lasted three hours.
Error bars indicate 90% confidence intervals based on standard errors clustered on customers.

There was substantial heterogeneity in savings among Test Bed PTR enrollees. Figure 15 presents the winter 2020/2021 average demand savings per enrolled customer for SGTB PTR and Flex PTR customers by residential customer demand response micro-segment. Savings estimates are ordered from left to right by customer segments with the highest to lowest demand response savings potential.

Low Engagers and Borderliners saved less than other micro-segments, though the differences were more pronounced outside the SGTB. This finding suggests that the micro-segment groups outside the SGTB are more predictive of savings potential than those inside the SGTB. However, the less pronounced differences in the SGTB may also be due to the relatively small sample sizes, as many of the SGTB savings are imprecisely estimated.

[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.

Figure 15. Demand Response Micro-Segment Demand Savings – Winter 2020/2021



Note: Estimates based on Cadmus analysis of AMI meter data from W20/21 for Flex PTR and SGTB PTR enrollees and matched comparison group. Error bars indicate 90% confidence intervals based on standard errors clustered on enrolled customers.

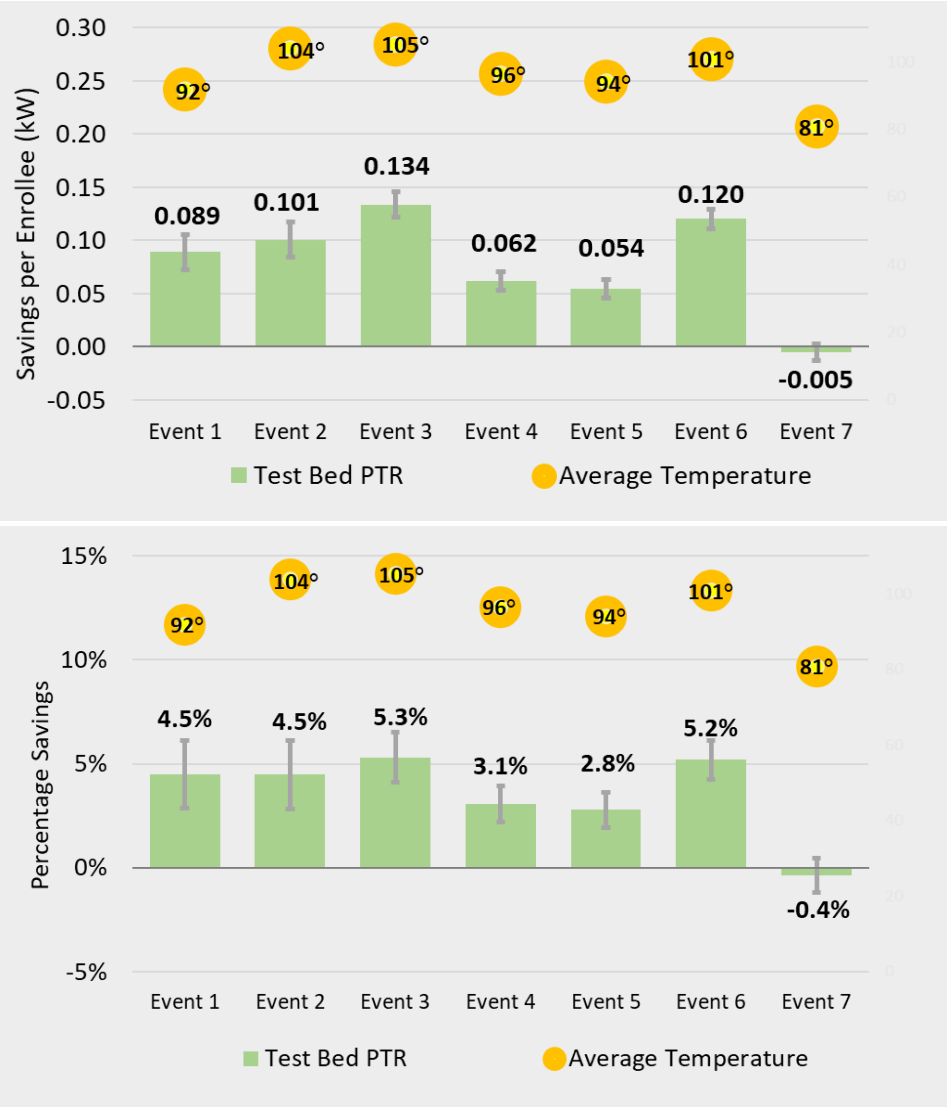
Summer 2021

In summer 2021, PGE called seven PTR events, including on two extreme heat days when the temperature broke all-time records (Events 2 and 3). In addition, Event 2 was called on a Saturday.

Figure 16 shows the average demand savings (kW) per Test Bed PTR enrolled customer and the percentage savings (the kW savings relative to baseline demand) for each of the seven summer 2021 events.[24] The SGTB PTR savings ranged from 0.05 kW (3%) for Event 5 to 0.13 kW (5%) for Event 3. More details about the PTR savings of SGTB customers may be found in the Flex 2.0 evaluation report, which is expected to be publicly available in 2022.

[24] The events occurred from 5:00 p.m. to 8:00 p.m. on June 21, 2021, June 26, 2021, June 28, 2021, July 29, 2021, August 4, 2021, August 12, 2021, and September 9, 2021. Cadmus provided evaluated savings for SGTB customers in the Flex 2.0 PTR program in a PowerPoint presentation to PGE on December 17, 2021. These results will be included in a final Flex 2.0 evaluation report, expected to be filed with the OPUC in 2022.

Figure 16. SGTB Demand Savings – Summer 2021

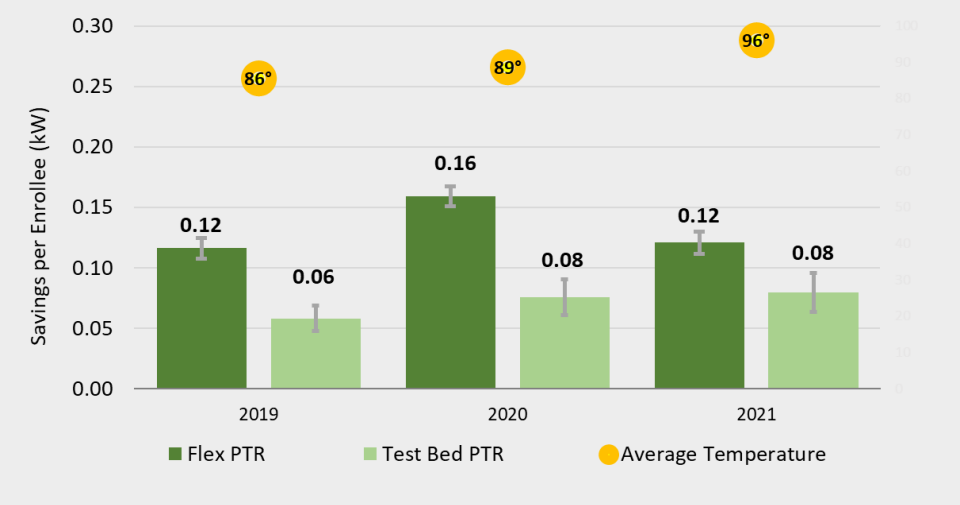


Note: Estimates based on Cadmus analysis of AMI meter data from the summer 2021 event season for Flex 2.0 PTR participants and matched comparison group. Each summer 2021 event started at 5 p.m. and lasted three hours. Error bars indicate 90% confidence intervals based on standard errors clustered on customers. Percentage savings were equal to kW savings divided by baseline demand.

Figure 17 compares the demand savings in summers 2019–2021 for SGTB PTR and Flex PTR enrolled customers. In the SGTB, average demand savings per enrolled PTR customer remained constant at 0.08 kW from 2020 to 2021. Likewise, in percentage terms, savings remained constant at 4% of demand (results not shown).[25] In summer 2021, Flex PTR participants saved 0.12 kW or 6% of baseline demand.

[25] Cadmus provided evaluated savings for SGTB customers in the Flex 2.0 PTR program to PGE in a PowerPoint presentation on December 17, 2021.

Figure 17. Average Summer Demand Savings (kW) by PTR Group and Season



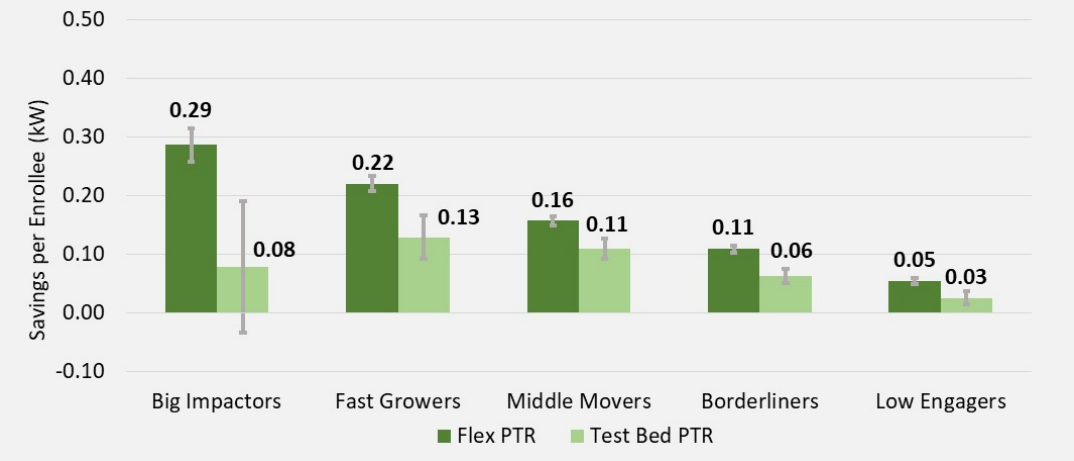
Note: Savings estimates show the average demand savings per enrolled customer across all demand response event hours. Estimates based on Cadmus analysis of AMI meter data from the summer 2021 event season for Flex 2.0 PTR participants and matched comparison group. Error bars indicate 90% confidence intervals based on standard errors clustered on customers

The comparison of Test Bed PTR and Flex PTR savings suggests the effect on savings of making participation in PTR the default option. As Figure 17 shows, in summer 2021, demand savings for Flex PTR enrollees were about one-and-a-half times as large as those for SGTB PTR enrollees. This difference is likely attributable to the opt-out PTR program design in the SGTB. By automatically enrolling customers in PTR, PGE enrolled many customers who would not have enrolled themselves, including many who had and continue to have little interest in saving or who have low savings potential. The inclusion of these customers in the program reduced the average savings per enrolled customer.

As in winter, there was substantial heterogeneity in PTR savings by residential customer demand response micro-segment.[26] Figure 18 presents the summer 2021 average demand savings per customer by micro-segment. Low Engagers and Borderliners were the largest micro-segments, accounting for 76% of PGE residential customers. However, in the Test Bed, customers in these segments saved very little. Low Engagers saved an average of only 0.03 kW and Borderliners saved 0.06 kW per enrolled customer, while outside the SGTB Low Engagers saved an average of 0.05 kW and Borderliners saved an average of 0.11 kW per customer.

[26] Before summer 2019, PGE segmented its 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. PGE has redefined the demand response micro-segment and revised the customer assignments over time. Definitions of micro-segments are provided in Table B-2 in *Appendix B*.

Figure 18. Average Demand Savings (kW) by PTR Group and Micro-Segment – Summer 2021



Note: Estimates based on Cadmus analysis of AMI meter data from the summer 2021 event season 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 (2,569 and 84), Fast Growers (10,435 and 634), Middle Movers (24,497 and 3,227), Borderliners (28,871 and 6,713) and Low Engagers (20,745 and 5,608).

In addition, because of auto-enrollment, the SGTB was more likely to enroll customers with low savings potential. In summer 2021, 76% of SGTB enrollees were Borderliners or Low Engagers compared with 57% of Flex PTR enrollees.[27] The higher enrollment of customers with low savings potential contributed to the smaller average savings per PTR customer in the Test Bed.

At the end of summer 2021, the SGTB project had completed its second full year and third summer, but a high percentage of SGTB enrollees continued to have negligible or small savings. This suggests that many customers in these groups are not highly engaged with the PTR program or have little capacity for savings. This presents PGE with an ongoing opportunity to increase these customers' engagement and savings but also a challenge for making PTR auto-enrollment cost-effective.[28]

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[27] Among Test Bed PTR and Flex PTR customers, the distributions across the micro-segments were as follows: Big impactors: 0.5% for Test Bed PTR, 2.9% for Flex PTR; Fast Growers: 3.9%, 12.0%; Middle Movers: 19.8%, 28.1%; Borderliners: 41.3%, 33.1%; and Low Engagers: 34.5%, 23.8%. 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 ($\chi^2(4)=2,377$, p-value < .001).

[28] 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 an increase in new demand response capacity.

PTR Savings Lift from CVP 5 Renewables Messaging

In summer 2020, PGE conducted a field experiment in the Test Bed to test the impacts of renewable energy–focused messaging on PTR savings.[29] Though financial incentives remain customers' greatest motivator for participating in PTR, PGE hypothesized that messages about the beneficial impacts of PTR savings on the environment and integration of more renewables could provide additional motivation and lift savings.

PGE ran two experiments with the CVP 5 messaging for Test Bed PTR customers. Experiment 1 included only customers ineligible for enrollment in the Smart Thermostat program and Experiment 2 included only eligible customers.[30] PGE then randomly assigned ineligible customers to either a PTR messaging treatment group or control group and eligible customers to a PTR messaging treatment group, migration messaging treatment group, or control group, as shown in Table 14. The two experiments involved about 14,000 Test Bed PTR customers.

Table 14. CVP 5 Messaging Experiment Sample Sizes

Experiment	Groups		
	PTR Messaging	Migration Messaging	Control
#1 (T-stat DR ineligible)	3,835	N/A	3,831
#2 (T-stat DR eligible)	2,044	2,063	2,064

Notes: Tables shows counts of Test Bed PTR enrollees assigned to treatment or control group at the beginning of the summer 2021 season.

In both experiments, the PTR savings treatment group and the control group received the same number of communications during summer 2021. (The CVP 5 communications are described in detail in the *Smart Thermostat Migration* section.) However, the PTR savings treatment group communications included taglines about supporting renewable energy and a healthier environment as well as an offer to participate in a $50 Next Adventure giveaway for customers who would receive a rebate during summer 2021.

In Experiment 2, customers in the PTR savings treatment group and the migration treatment group received the same PTR messaging treatment as the Experiment 1 treatment group; however, the migration treatment group also received two emails and one letter encouraging them to enroll in the Smart Thermostat program. Encouragement to migrate to the Smart Thermostat program did not begin until August 18, 2021, so PTR savings and migration messaging treatment groups received identical

[29] Estimates of the impacts of the renewables messaging on migration to the Smart Thermostat program are presented in the *Smart Thermostat Program Migration* section.

[30] Eligibility was predicted based on data analysis of the electricity consumption patterns of the home from a third-party contractor to infer whether the home had compatible central cooling or electric heating equipment.

treatment until the start of the messaging treatment. Only one event occurred after the migration messaging began.

The impacts of the PTR messaging were estimated in panel regressions of customer hourly electricity consumption on indicator(s) for assignment to the treatment group(s), date-hour of the sample fixed effects, and customer mean electricity demand on the hottest non-event days.[31] A separate model was estimated for each experiment. The models were estimated by ordinary least squares using electricity demand readings for only summer 2021 event hours.[32]

Figure 19 shows estimates of the CVP 5 treatment effects across all summer 2021 event hours for Experiment 1 and Experiment 2. The top panel shows CVP 5 messaging did not have a statistically significant effect on electricity demand in Experiment 1 but had statistically or near-statistically significant effects on electricity demand in Experiment 2 for the PTR messaging, migration messaging, and both (PTR and migration messaging) treatment groups.

The effect of the CVP 5 messaging was to reduce electricity demand by about 0.02 kW to 0.03 kW per treatment group customer. After combining the treatment groups in Experiment 2, CVP 5 messaging appeared to reduce demand by 0.024 kW per treatment group customer. Because of the random assignment of Test Bed PTR customers to treatment or control groups, these estimates can be interpreted as causal effects of the treatment.

Figure 20 shows estimates of the savings as a percentage of baseline electricity demand. In Experiment 2, the CVP 5 treatments saved about 1% of electricity demand. This is a substantial effect as the percentage PTR savings for all Test Bed PTR customers was 3.8%.[33]

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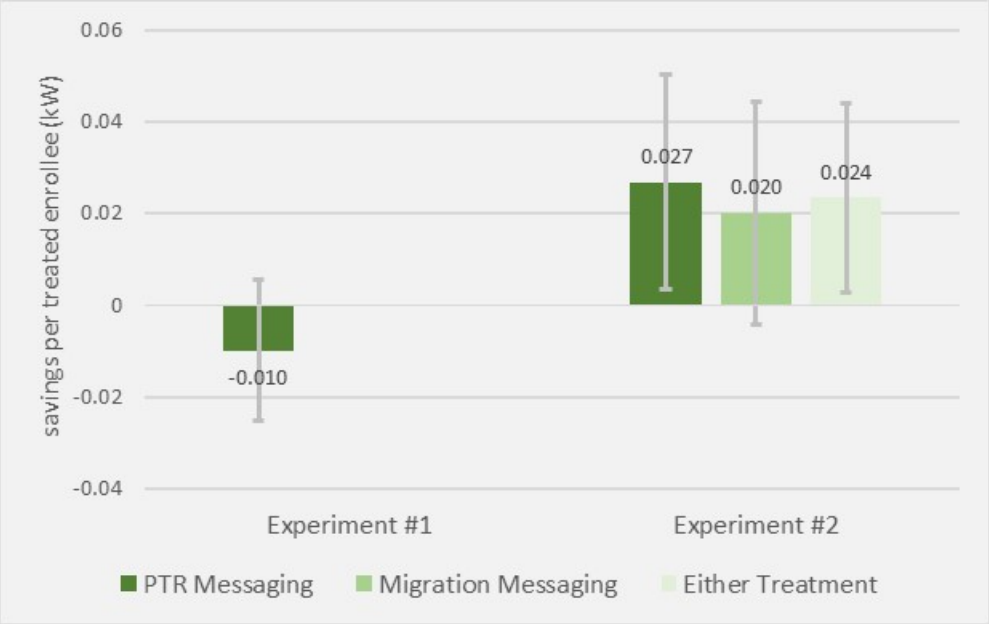
[31] The omitted category in the regressions was assignment to the control group. Control group customers were Test Bed PTR customers who did not receive treatment.

[32] Cadmus conducted balance checks by testing for statistically significant differences in mean electricity consumption between 5 p.m. and 8 p.m. on all non-holiday, non-event weekdays, the 10 hottest non-holiday, non-event weekdays, and non-event weekend days. The treatment and control groups in Experiment 1 and Experiment 2 were well balanced on their non-event day electricity demand.

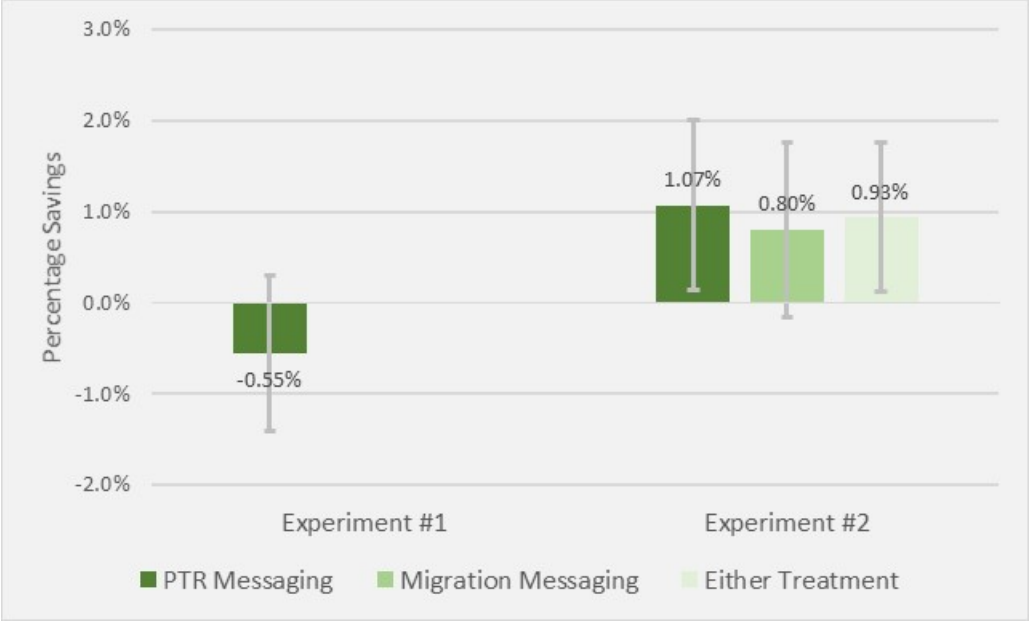
[33] Dividing 0.9% by 3.8% implies the messaging lifted savings by 24%; however, this may not be accurate because the 0.9% savings estimate pertains to treated thermostat-eligible customers while the 3.8% savings was estimated across all SGTB PTR customers, including thermostat program eligible and ineligible customers and treated and control customers. However, it is possible to conclude the CVP 5 marketing campaign lifted PTR savings for thermostat-eligible customers by at least 11% and probably significantly more. This percentage effect was obtained by dividing the estimated CVP 5 percentage treatment effect (0.93%) by the theoretical maximum savings for smart thermostat demand response–eligible customers. The theoretical maximum was calculated by assuming that all PTR savings were attributable to thermostat-eligible customers and none to thermostat-ineligible customers. The theoretical maximum equals the PTR savings divided by the percentage of PTR customers eligible for smart thermostats (3.8%/44.6%). This back-of-the envelope calculation was necessary because the evaluation did not estimate PTR savings for smart thermostat–eligible customers.

Figure 19. CVP 5 Experiment kW Savings Impact Estimates



Notes: Figure shows estimates of CVP 5 treatment effects (electricity demand savings) from an OLS panel regression of PTR enrollee hourly electricity demand on hour-of-sample fixed effects, enrollee electricity demand on non-event days in the same hour, and indicator(s) for assignment to treatment. In experiment #2, both treatment groups are receiving PTR messaging treatment. Error bars show 90% confidence intervals calculated from robust standard errors clustered on enrollees.

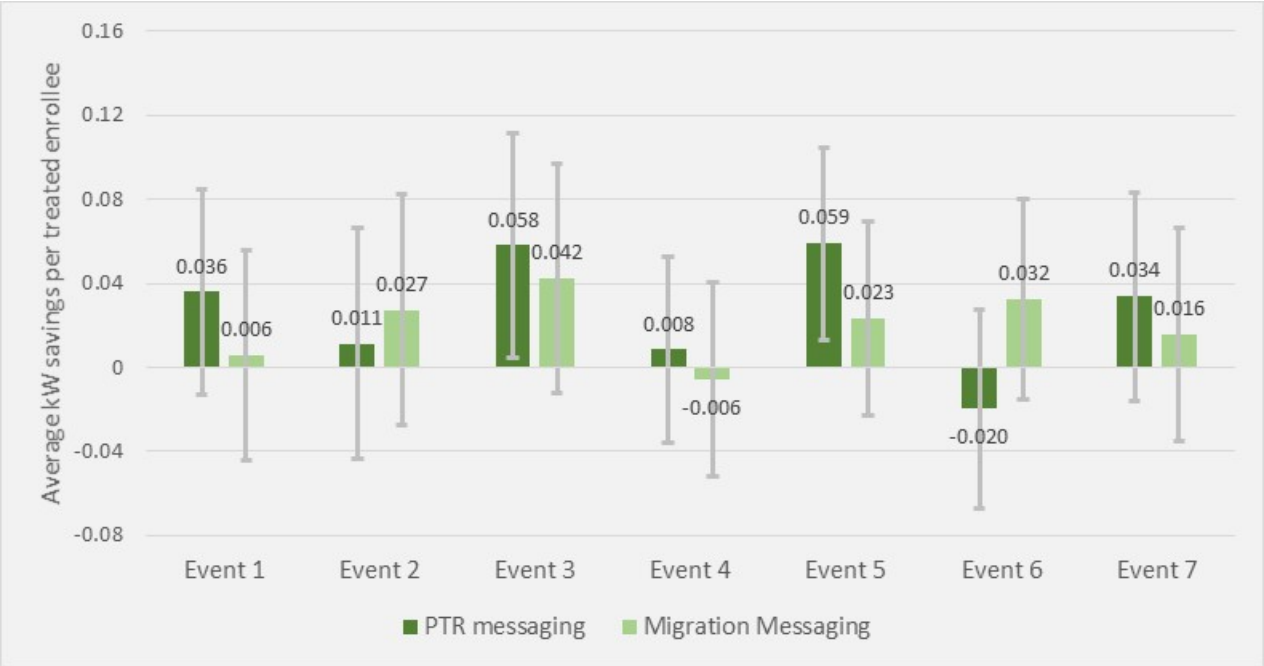
Figure 20. CVP 5 Experiment Percentage Savings Impact Estimates



Notes: Figure shows estimates of CVP 5 treatment effects (electricity demand savings) from an OLS panel regression of PTR enrollee hourly electricity demand on hour-of-sample fixed effects, enrollee electricity demand on non-event days in the same hour, and indicator(s) for assignment to treatment. Percentage savings estimated as kW savings divided by baseline electricity demand. In experiment #2, both treatment groups are receiving PTR messaging treatment. Error bars show 90% confidence intervals calculated from robust standard errors clustered on enrollees.

In addition, Cadmus estimated the CVP 5 treatment effects for each of the seven summer 2021 events. These results are presented in Figure 21.

Figure 21. CVP 5 Experiment #2 kW Savings Estimates by Event



Notes: Figure shows estimates of CVP 5 treatment effects (electricity demand savings) for each event from an OLS panel regression of PTR enrollee hourly electricity demand on hour-of-sample fixed effects, enrollee electricity demand on non-event days in the same hour, and indicator(s) for assignment to treatment. Error bars show 90% confidence intervals calculated from robust standard errors clustered on enrollees. A separate model was estimated for each event.

PTR messaging and migration messaging treatment consistently produced savings across events, though the effects for many of the events were not statistically different from zero. The insignificance of the event-specific savings is due to the relatively small sample sizes and treatment effects. The individual event results are important because they suggest that the renewables and healthy environment messaging, not the Next Adventure $50 giveaway, were responsible for the savings. The first marketing of the giveaway occurred on July 6. The event results show that the PTR messaging and migration messaging treatments produced savings for the three events preceding the beginning of the marketing of the giveaway.

Overall, the CVP 5 experiment suggests that messaging about renewable energy and a healthier environment increased PTR savings for customers eligible for enrollment in the Smart Thermostat program. This result is consistent with the findings of the resonance assessment about environmentally focused messaging with many PGE customers.

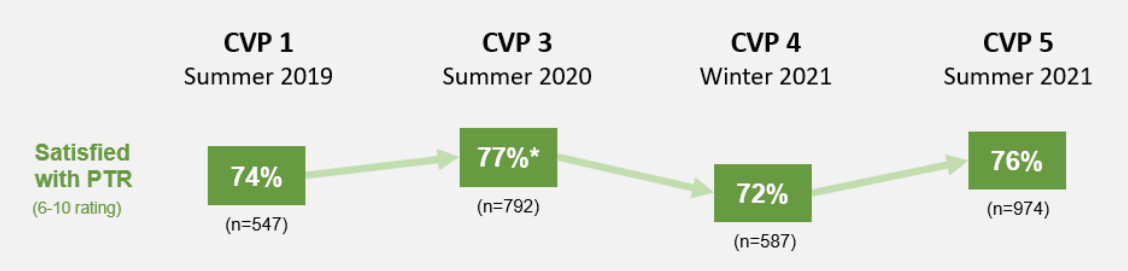
Customer Satisfaction and Resonance

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 22 shows the results for the percentage of satisfied respondents from the SGTB's CVP surveys. SGTB customer satisfaction with the PTR program ranged from 72% to 77%. Based on the CVP surveys, PGE did not meet its 80% customer satisfaction goal for PTR. At the end of the two-year period, the SGTB achieved 76% customer satisfaction with PTR.

Figure 22. SGTB Customer Satisfaction with PTR



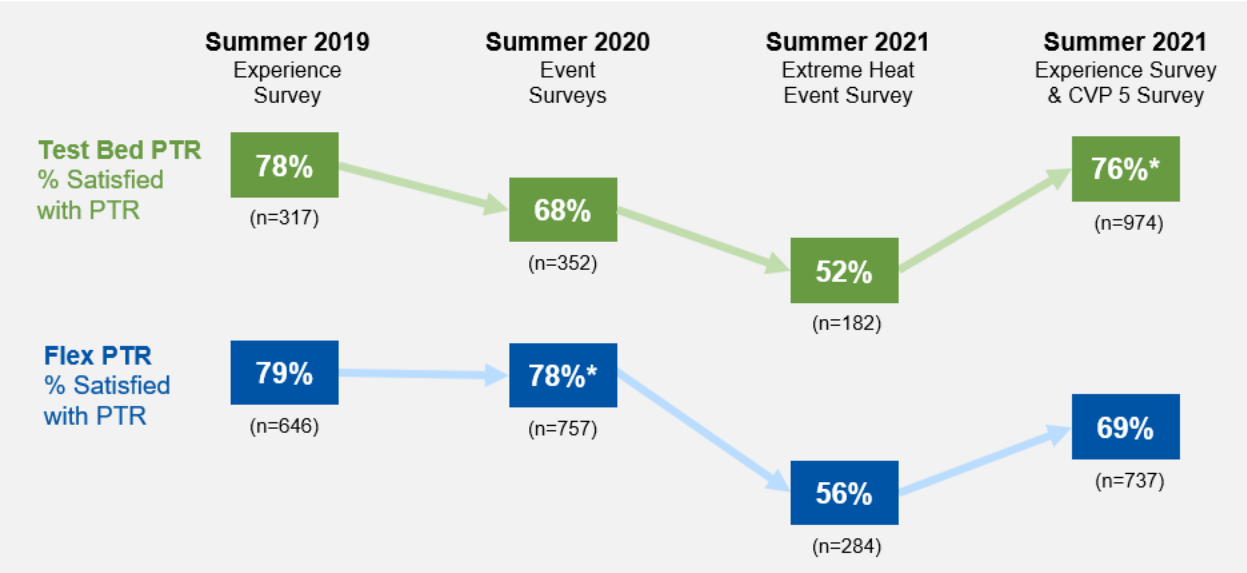
*Difference between CVP 3 and CVP 4 is significant with 90% confidence (p≤0.10).

Source: Cadmus CVP Survey Question. "Please rate your overall satisfaction with PGE's Peak Time Rebates Program."

To compare satisfaction results between SGTB customers (Test Bed PTR) and customers outside the SGTB (Flex PTR), Cadmus analyzed the Flex evaluation surveys. Figure 23 shows the results for the percentage of satisfied respondents from the Flex evaluation surveys.[34]

[34] As part of the Flex evaluation, Cadmus administered surveys to Flex PTR and Test Bed PTR customers. The only time when both PTR groups were not surveyed together was for the summer 2021 experience survey. Cadmus excluded the Test Bed customers from the summer 2021 experience survey because of the survey's close fielding proximity to the CVP 5 survey.

Figure 23. SGTB Customers vs. Flex PTR Customers: Satisfaction with PTR



* Difference between Test Bed PTR and Flex PTR is significant with 90% confidence (p≤0.10).

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

Test Bed customer satisfaction with the PTR program ranged from 52% to 78% and ranged from 56% to 79% for Flex PTR customers. Though the range in satisfaction percentages appear similar for both PTR groups, there were differences across time. At the start of the program in summer 2019, Test Bed PTR customers (78%) and Flex PTR customers (79%) showed similar satisfaction. At the end of the two-year period, significantly more Test Bed PTR customers were satisfied (76%) than Flex PTR customers (69%). In particular, both PTR groups showed a dramatic decrease in satisfaction during the summer 2021 extreme heat wave, followed by a strong satisfaction rebound at the end of summer 2021; however, the Test Bed PTR customers' satisfaction rebound was significantly stronger than Flex PTR customers. This significant rebound could be partly due to the CVP 5 campaign. Test Bed PTR customers received CVP 5 messaging during summer 2021 with its various environmental messages such as supporting renewables and a healthy outdoor environment. The Flex PTR customers did not receive any environmental messaging and received only the standard PTR communications.

The evaluation team expected to see higher customer satisfaction with Flex PTR customers consistently across time. Programs where customers self-enroll typically observe higher program satisfaction than programs where customers were auto-enrolled. However, Test Bed PTR achieved higher customer satisfaction than Flex PTR at the end of the two-year period.

Customer Resonance: All-Event and Some-Event Participants

In the interim evaluation report, the Cadmus team uncovered the two emergent groups of participants: those who participated in all events and those who participated in only some events. Both groups shared similar values, beliefs, and reasons for event participation. Where the two groups differed was in the intensity of their values, beliefs, and participation reasons as well as other notable areas. The interim evaluation report first noted these group differences. The evaluation team continued to see

these two emergent groups in the CVP 5 survey results. Table 15 summarizes the differences found between customers who participated in all versus only some events.

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

Category	CVP 5 Survey Item	All-Event Participants (n≤324)	Some-Event Participants (n≤587)
Personal Value of Saving Money	Always looking for ways to spend less on money	65%	47%
	Likes to take advantage of special offers that include gift cards	52%	37%
	Feels good when I save a few dollars	69%	56%
Personal Value of Environment	Cares about doing my part to conserve our natural resources	76%	65%
	Cares about helping to saving our planet	51%	31%
	Cares about reducing my carbon footprint	57%	34%
Personal Value of Community and Service Protection	Cares about being a responsible citizen in my community	85%	76%
	Believes if I reduce my energy user, it will keep costs down for all	54%	34%
	Likes doing business with companies that give back to the community	75%	63%
Top PTR Event Participation Reasons	Participated to reduce my energy bill	81%	64%
	Participated because it doesn't cost me anything	75%	61%
	Participated to earn rebates	77%	58%
	Participated to help the community avoid power outages	71%	54%
	Participated to support the use of clean energy	67%	55%
	Participated to help save the planet	65%	54%
PTR Satisfaction	Satisfied with PTR (6-10 rating)	87%	76%
Smart Thermostat Program	Likely to enroll in Smart Thermostat program in the next 12 months	29%	39%
Age and Income	65 and older	27%	14%
	Is low-income	29%	23%

Note: All-event vs. some-event differences listed in the table were significant with 90% confidence (p≤0.10).
Source: Cadmus CVP 5 survey questions

All-event participants are driven by saving money and express a stronger commitment to the greater good including the environment, community, and service protection compared to some-event participants. Some-event participants are also driven by saving money, but they are less concerned with the environment, community, and service protection compared with all-event participants. All-event participants continued to show more passion in their reasons for participating in PTR events and higher satisfaction than some-event participants.

The observations from the CVP 5 survey suggest an opportunity to either increase the frequency of PTR participation from some-events to all-events or migrate the some-event participants to the Smart Thermostat program. Notably a greater percentage of the some-event participants (39%, n=160) said they are likely to enroll in the Smart Thermostat program in the next 12 months than the all-event participants (29%, n=77). Given that some-event participants were less passionate about PTR participation compared with all-event participants, PGE could consider targeting the some-event participants for the Smart Thermostat program.

Customer Resonance: Customer-Benefit and Utility-Benefit Messaging

As noted earlier, saving money emerged as the top reason customers participated in PTR events. The money-saving reason also revealed that customers focused on the financial benefits to themselves—for

example, "To save on *my* energy bill," "It doesn't cost *me* anything," and "To earn rebates on *my* bill" (emphasis added). These customer-benefit money-saving reasons came out on top, and the utility-benefit reasons pertaining to "helping PGE" appeared at the bottom.

Table 16 shows the five PTR event participation reasons that ranked at the very bottom of the list of 18 reasons. Three out of the five least-popular reasons contained **utility-benefiting reasons**, captured in the phrasing "to help PGE."

Table 16. SGTB Customers' Lowest-Ranked PTR Event Participation Reasons from CVP 5 Survey

Event Participation Reason	% of Respondents Who Said "Very True" (n=909)
To **help PGE** use more renewable energy sources	52%
Because the little things I can do can make a big impact	51%
To **help PGE** include more clean and reliable energy sources into the mix	50%
To **contribute to PGE's** energy-shifting commitment	47%
For the chance to win a $50 Next Adventure gift card	30%

Source: Cadmus CVP 5 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."

Results from the CVP 4 survey also exhibited this customer dislike for utility-benefiting reasons. The CVP 4 campaign aimed to get PTR customers to donate their rebates to local nonprofits. Of 16,799 PTR customers in the SGTB, only 183 opted to donate their rebates during the CVP 4 campaign. As shown in Table 17, customers who opted not to donate their rebates most frequently said they did not because they preferred to support nonprofits through direct, personal contributions rather than through PGE.

Table 17. SGTB Customers' Top Non-Donation Reasons from CVP 4 Survey

Reason for Not Donating Rebates to Nonprofits	% of Respondents Who Said "Very True" (n≤200)
I prefer to make my donations personally rather than **through PGE** or others	45%
I prefer to donate in other ways to nonprofits	38%
I'm not interested in giving up my peak time rebates	31%
The peak time rebates I earn are not big enough to make a difference	30%
I cannot afford to give away my peak time rebates	25%

Source: Cadmus CVP 4 Survey Question. "Below are some reasons people may have decided not to enroll in the rebate donation. Please indicate how well each reason applies to you."

These CVP 4 and CVP 5 survey findings should not be misinterpreted as customers not caring about corporate social responsibility. On the contrary, the CVP 3 regression analysis (Figure 11, above) showed that customers who participated in PTR events viewed corporate social responsibility as equally important as care for the environment. To summarize, customers prefer to hear about what PGE is doing for the environment and community rather than being asked to help PGE do these things.

PTR Enrollment and Retention

At the beginning of the SGTB project, PGE auto-enrolled most residential customers in PTR and thereafter periodically auto-enrolled new residential Test Bed customers. Auto-enrollment in PTR was a defining feature of Phase I of the SGTB project.

PTR Customer Enrollment and Retention Outcomes

Table 18 shows changes in PTR enrollments for SGTB customers between July 13, 2019, the date of the first auto-enrollment, and October 31, 2021, about 28 months later. In July 2019, PGE auto-enrolled 12,897 residential SGTB customers who had yet to self-enroll in PTR, bringing the total enrollment to 13,980 customers. Since then, PGE has continued periodically to auto-enroll new residential customers, bringing the total gross number of enrolled customers to 26,009 through October 31, 2021. Over this period, the PTR program also lost enrollees who enrolled in the Smart Thermostat program (n=438), opted out of the PTR program (n=2,101), or closed their PGE accounts mostly because of moving residences (n=6,747), resulting in a net enrollment of 16,723 customers.

Through October 2021, PGE has exceeded its PTR retention goal of 80%. After excluding customers whose accounts closed since July 13, 2019 or whom PGE later determined to be ineligible for PTR, almost 87% of SGTB PTR customers remained in the program. When SGTB customers who migrated to the Smart Thermostat program are also excluded, the retention rate rises to almost 89%.[35] The high net retention rate indicates that most auto-enrolled customers whose accounts did not close remained in the PTR program. This is significant because most auto-enrolled customers would not have self-enrolled and PGE can bring these customers into the program for the long run by auto-enrolling them.

Table 18. PTR Program Enrollment and Unenrollment Breakdown

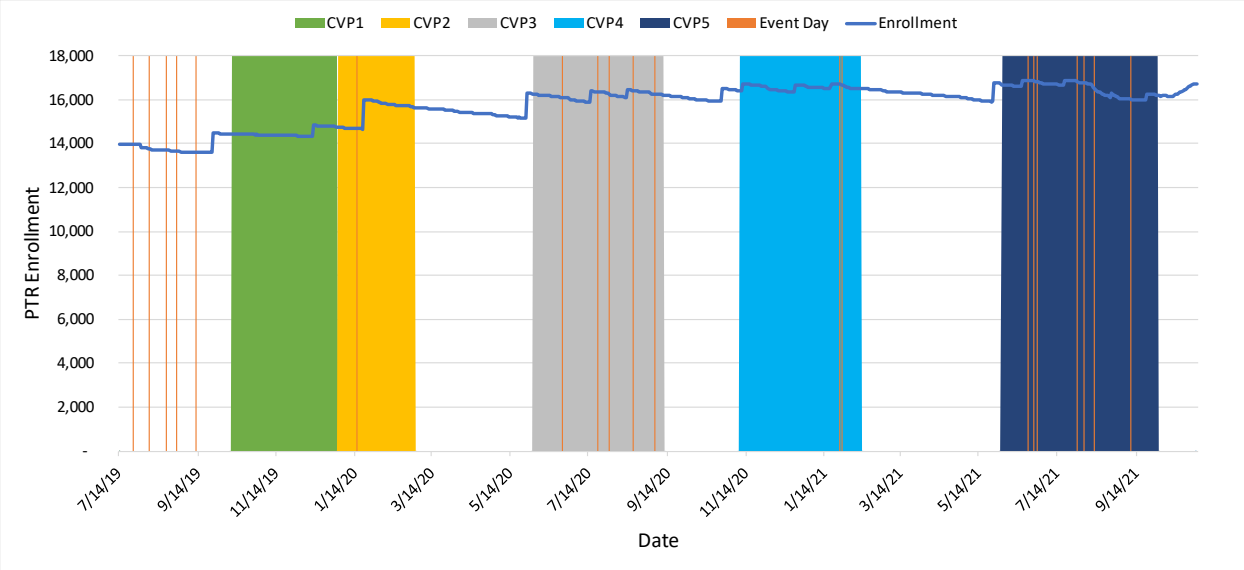
Category	Group	SGTB Customers
Enrollment	Beginning Enrollees (as of Test Bed auto-enrollment date: July 13, 2019)	13,980
	New Enrollees through October 31, 2021	12,029
	Total Enrollment (Gross) – by October 31, 2021	**26,009**
Unenrollment	Opt-Outs (total)	2,539
	Opt-Outs – migrated (to the Smart Thermostat program)	438
	Opt-Outs – non-migrated	2,101
	Account Closures	6,747
	Total Unenrollment (from July 13, 2019 to October 31, 2021)	**9,286**
Net Enrollment	**Net Enrollment (October 31, 2021)**	**16,723**
	Net Retention Rate	**86.8%**
	Net Retention Rate (adjusted for smart thermostat migration)	**88.8%**

Source: Cadmus analysis of PGE PTR and Smart Thermostat program tracking and enrollment data. The net retention rate is calculated as (total enrollment – opt outs – account closures)/(total enrollment – account closures).

[35] When customers whose accounts were closed over this period are included in the denominator, the retention rate for this time period falls to 64.3 percent.

Table 18 shows only the beginning and ending enrollments. Additional insight about PTR enrollment trends and the causes of unenrollment can be obtained by plotting enrollment over time. Figure 24 presents the cumulative Test Bed PTR enrollment from July 13, 2019, to October 31, 2021. This plot shows periods of gradual decreases in enrollment from customers opting out of PTR or closing their accounts alternating with discrete jumps in enrollment from PGE auto-enrolling new customer accounts.

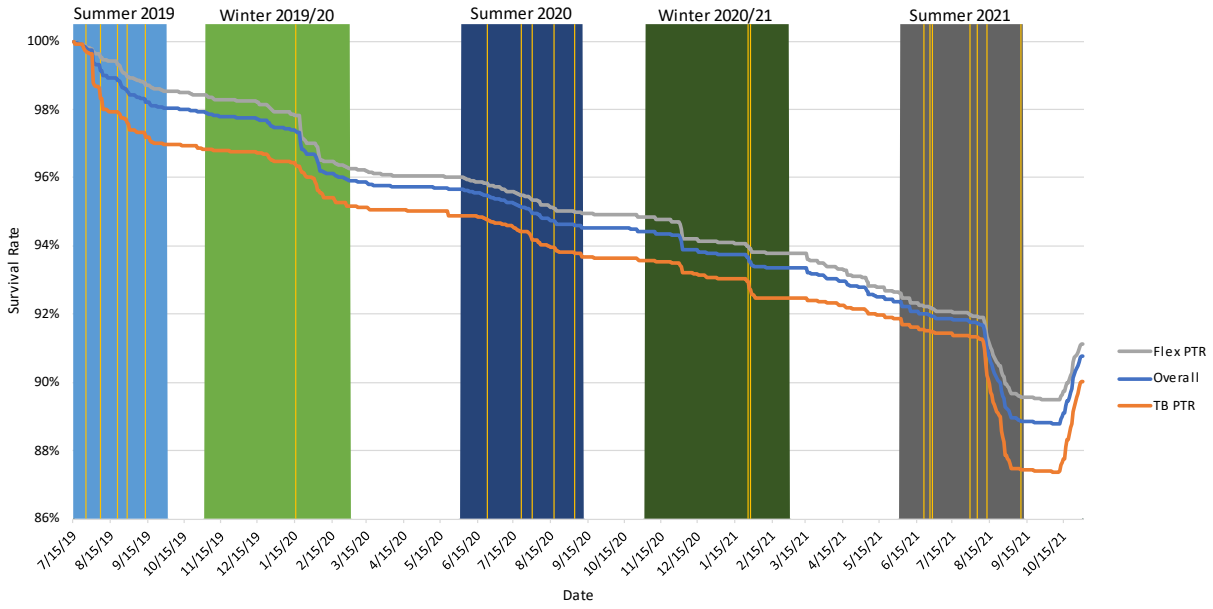
Figure 24. SGTB PTR Enrollment Over Time



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

In Figure 24, the periodic auto-enrollment of new customer accounts and steady closures of customer accounts obscure the trends in customer retention and unenrollment. To better illustrate these trends, Figure 25 shows the retention (survivorship) rate for SGTB customers who were enrolled on July 13, 2019. This analysis includes auto-enrolled customers and customers who had previously enrolled themselves before this date (because they would have been auto-enrolled if they had not already self-enrolled) and excludes customers whose accounts were closed or who were unenrolled because they were ineligible for the program during this period. Retention is calculated as the percentage of customers enrolled on July 13, 2019 who remained enrolled. Flex PTR participant retention is included as a point of comparison and is calculated for customers enrolled in PTR on July 13, 2019.

Figure 25. PTR Enrollment Survival Rates for Test Bed PTR and Flex PTR



Note: 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 entire analysis period. The survival rate was the percentage of customers enrolled on July 13, 2019 who remained enrolled.

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

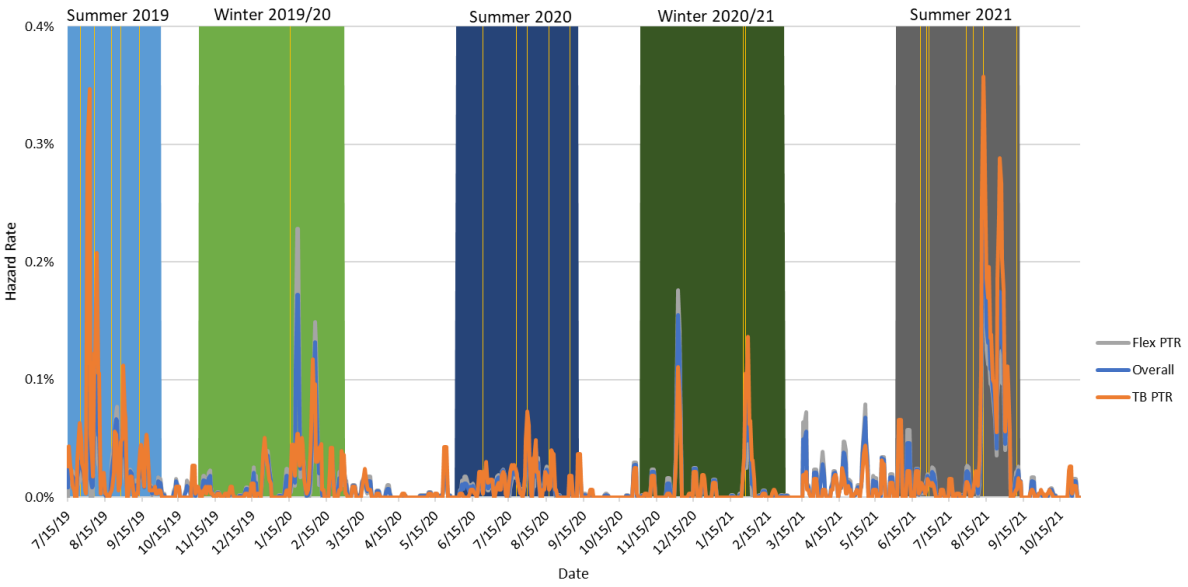
In the SGTB, most unenrollment during the first 24 months occurred in the first three months after the initial autoenrollment, a total of about 3% by September 30, 2019. There was a sharp drop of almost 1% following the first summer 2019 event day, and smaller, but still noticeable, drops after subsequent event days. Large drops in enrollment followed events in the winter 2020 and winter 2021 seasons, and smaller drops occurred following summer 2020 event days. In August 2021, due to a miscommunication with the call center, PGE unintentionally unenrolled about 3,400 PTR customers including some customers in the SGTB. Almost all accidentally unenrolled customers were re-enrolled in October 2021. Overall, retention for auto-enrolled SGTB PTR customers by the end of October 2021 was 90.0%.

Retention for Flex PTR customers followed a similar trend across most of the analysis period. The only period of significant deviation in trends occurred during the first half of the summer 2019 event season, when a larger percentage of auto-enrolled Test Bed customers than Flex PTR customers unenrolled from the PTR program. Despite having been auto-enrolled, Test Bed PTR customers had only slightly lower enrollment retention rates over the analysis period than Flex PTR customers who self-enrolled.

To better see the effects of demand response events on unenrollment from the PTR program, Figure 26 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 still 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 any administrative process-related delays in PGE's unenrolling of customers, the figure displays a three-day 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 summer 2020, winter 2020/2021, and summer 2021 events, though the magnitude of the increases in unenrollment diminish. Again, the large hazard rates after August 2021 are not significant because they were due to an administrative issue in enrollment data processing.

Figure 26. SGTB PTR Unenrollment Hazard Rate



Note: The analysis shows the three-day moving average of the hazard 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.

Savings from Auto-Enrolling Customers in PTR

Automatic enrollment in PTR was a key feature of the residential SGTB and a means toward PGE's goals of engaging customers in demand response and obtaining flexible load capability. In the interim evaluation report, Cadmus showed that auto-enrolling customers increased PTR savings in the SGTB. This section updates the analysis in the interim report about the impacts on savings of auto-enrolling residential customers in PTR through summer 2021. The interim report includes a more detailed discussion of the assumptions and modeling underlying the estimates.[36]

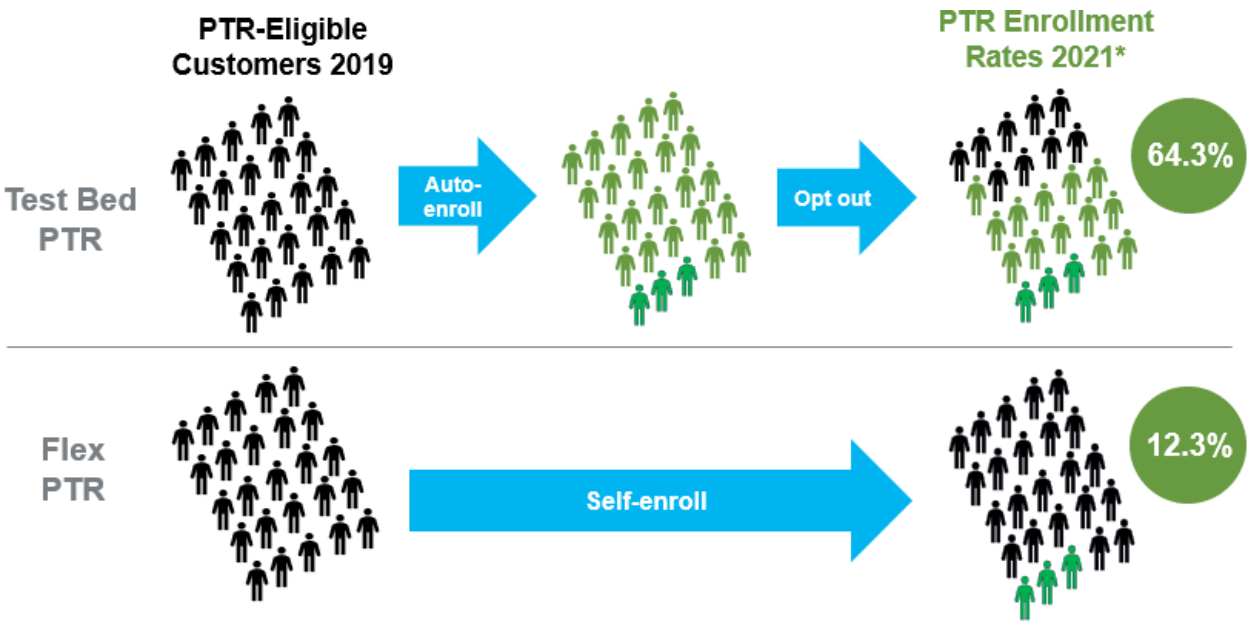
Figure 27 illustrates the impact of auto-enrolling customers on PTR enrollments by comparing enrollments when PGE auto-enrolls customers, such as in the Test Bed, and when PGE allows customers to self-enroll, such as outside the Test Bed. In the top panel, when PGE automatically enrolls residential customers in PTR, it enrolls and retains customers who would have self-enrolled if they had not been auto-enrolled ("always-takers"), shown in bright green, as well as customers who would not have self-

[36] See the 2020 Flex 2.0 Demand Response Pilot Evaluation Report (June 2020): https://edocs.puc.state.or.us/efdocs/HAQ/um1708haq124912.pdf.

enrolled but remained in the program after being auto-enrolled ("complacents"), shown in a lighter shade of green. A small percentage of auto-enrolled customers opt-out of PTR ("never-takers"). Also, PGE unenrolls customers from PTR when they change residences or become ineligible for participation. Opt-out and unenrolled customers are shown in black. Between July 2019 and October 2021, on average PGE retained 64% of the customers it had automatically enrolled in PTR.[37]

In contrast, as shown in the bottom panel, when PGE allows customers to self-enroll, it ends up with a smaller percentage of eligible customers (only the "always-takers) enrolled in the program. In October 2021, about 12% of eligible customers outside the Test Bed were enrolled in PTR. This comparison shows that auto-enrolling customers can lift PTR enrollments, complacent customers are the difference in enrollments between opt-out and opt-in programs, and the incremental savings from operating an opt-out versus an opt-in PTR program come from complacent customers.

Figure 27. Comparison of Enrollments with Customer Auto-enrollment and Self-Enrollment



Using the enrollment in PTR of residential customers outside the Test Bed, one can approximate the effect on savings of making PTR enrollment the default option. The savings and self-enrollment rate of Flex PTR customers (outside the Test Bed) can be used to estimate the population percentage and average savings of "always-takers" in the SGTB. The estimates are an approximation because the Test Bed, the three SGTB neighborhoods, while similar to the rest of PGE's service area, also differed in

[37] This was calculated as 1 minus the ratio of unenrolled residential TB customers to residential TB customers ever enrolled between July 2019 and October 2021.

several respects.[38] The percentage of "never-takers" can be estimated as the percentage of SGTB auto-enrolled customers who unenroll.

Table 19 shows the calculation of the average PTR savings per SGTB complacent customer (who did not self-enroll but remained in the program after auto-enrollment) for summer 2021. Several arguments in the calculation, 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. As noted above, the savings of always-takers s_A and percentage of always-takers in the Test Bed can be approximated by the savings and enrollment of PTR customers outside the Test Bed.

Table 19. 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 in summers 2020 and 2021	0.078 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 outside the Test Bed) in summers 2020 and 2021	0.140 kW
p_A	Percentage of TB PTR enrollees who are always-takers	PGE CIS data: percentage of residential customers outside the Test Bed who were enrolled in PTR at end of summer 2021 divided by (1-%never takers)	14.1%
p_C	Percentage of TB PTR enrollees who are complacent customers	PGE 2.0 evaluation and CIS data: (1- %Always takers - %Never takers)/(1-%never takers). %Never takers estimated as % of Test Bed customers automatically enrolled who opted out of PTR before end of summer 2021.	84.1%
s_C	**Average savings (kW) per customer who would not have self-enrolled**	**$s_C = [s - s_A * p_A/(p_A+p_C)] / p_C/(p_A+p_C)$**	**0.069 kW**

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

The average demand savings per auto-enrolled Test Bed PTR customer who would not have self-enrolled ("complacents") was 0.069 kW, which was equal to about 50% of the savings of customers who would have self-enrolled (0.14 kW).[39] Thus, PGE was able to obtain half the savings the average self-enrolled customer generated by auto-enrolling customers who would not self-enroll but who remain in the program after being auto-enrolled. The complacent customer savings are only about 0.01 kW less than the average savings per PTR Test Bed customer (0.078 kW) in summer 2020 and summer 2021 because most Test Bed PTR customers (75.4%) were 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.

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

[39] In the Interim Test Bed Evaluation Report (2021, p. 45), there was an error in calculating the complacent customer savings. The correct estimate of the complacent customer savings is 0.067 kW per customer, not 0.072 kW, as reported.

First, making participation the default option will be cost-effective for the PTR program only if the benefits from the savings of complacent customers (0.069 kW) exceeds the costs of administering the program to them. If it is not cost-effective, PGE could consider selectively auto-enrolling customers with high savings potential while allowing any customer who wanted to enroll to do so. Second, even if the savings of complacent customers are not high enough, auto-enrolling customers may still be cost-effective for PGE if it causes enough customers to later enroll in PGE's Smart Thermostat program or other direct load control programs.

The impact of the SGTB on Smart Thermostat program migration is analyzed later in this report.

Smart Thermostat Program Migration

Description of CVP 5 and Experiment

From October 2019 through December 2019, PGE ran the CVP 1 Monetary Incentives campaign to promote the Smart Thermostat program and persuade residential SGTB customers that they can earn more by switching from PTR to the Smart Thermostat program. At that time, PGE had very limited data on customers' HVAC systems and could not identify how many of its customers qualified for the Smart Thermostat program and, therefore, which to target. Consequently, PGE's CVP 1 campaign promoted the Smart Thermostat program offer to all customers who had not yet enrolled even if they were ineligible.

Following the CVP 1 campaign, PGE hired Bidgely Inc., an energy monitoring and management company, 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. With these new data on customers' HVAC systems now available, PGE opted to test another Smart Thermostat program migration campaign targeting program-eligible customers only. PGE did so in the CVP 5 Renewables campaign and followed Cadmus' recommendations to set up an experimental design.

From June 2021 through September 2021, PGE ran the CVP 5 Renewables campaign, which communicated to customers that shifting energy during peak times allows PGE to use more renewable resources. PGE ran separate experiments for customers who were and were not eligible for the Smart Thermostat program. Eligible customers had electricity consumption suggesting they had central space cooling or electric heating systems compatible with a smart thermostat.

Within the ineligible segment, PGE randomized customers in the ineligible segment into a treatment or control group. The treatment group received standard PTR messaging plus the renewables tagline and the control group received standard PTR messaging. Within the eligible segment, PGE randomly assigned customers to a control group or one of two treatment groups. The first treatment groups received PTR messaging plus the renewables tagline and the second received PTR messaging, the renewables tagline, and Smart Thermostat program migration messaging. PTR messaging began on June 1, 2021. Smart thermostat migration messaging, which included two emails and one letter, began on August 18, 2021, and concluded on September 25, 2021.

Table 20 shows details of the CVP 5 experimental design. PGE did not set a smart thermostat migration rate goal for the migration experiment component of CVP 5. Rather, it sought to understand whether the renewables messaging of CVP 5 affects migration more or less than the CVP 1 monetary incentives messaging.

Table 20. CVP 5 Experimental Design

Experimental Group		Communications (Direct Messaging Only)
Thermostat Ineligible	**Thermostat Eligible**	
Exp 1 Control	Exp 2 Control	• PTR season start and program info (1 email on 6/1) • PTR event alerts customer contact confirmation (1 email on 6/12) • PTR tips and program info (3 emails on 7/6, 8/31, 9/14) • **Portland Thorns prize giveaway (3 emails on 7/6, 8/31, 9/14)**
Exp 1 PTR Treatment	Exp 2 PTR Treatment	• PTR season start and program info (1 email on 6/1) • PTR event alerts customer contact confirmation (1 email on 6/12) • PTR tips and program info (3 emails on 7/6, 8/31, 9/14) • **Next Adventure $50 giveaway (3 emails on 7/6, 8/31, 9/14)** • **Tagline *Shifting Energy=Supporting/More Renewables=Healthier Environment* (5 emails on 6/1, 6/12, 7/6, 8/31, 9/14)**
	Exp 2 Migration Treatment	• PTR season start and program info (1 email on 6/1) • PTR event alerts customer contact confirmation (1 email on 6/12) • PTR tips and program info (3 emails on 7/6, 8/31, 9/14) • **Sign up for Smart Thermostat program (2 emails on 8/18, 9/25; 1 letter on 9/14)** • **Tagline *Shifting Energy=Supporting/More Renewables=Healthier Environment* (7 emails on 6/1, 6/12, 7/6, 8/18, 8/31, 9/14 9/25; 1 letter on 9/14)**

Note: Items **bolded in blue** indicate the communication differences between groups. All items in blue, except for the Smart Thermostat program sign-up, appeared in the PTR communications listed above in black.

CVP 5 Migration Experiment Outcomes

Awareness of Smart Thermostat Program Offering

As expected, migration communications to the migration treatment group boosted customer awareness of the Smart Thermostat program offering. Based on the CVP 5 survey, 77% of migration treatment group respondents (n=128) said they had heard about the Smart Thermostat program. This was significantly higher than the Experiment 2 PTR treatment group (56%, n=166) and the Experiment 2 control group (50%, n=155).[40] Because of the small number of respondents for the Smart Thermostat awareness and enrollment status questions, the evaluation could not determine whether awareness of the Smart Thermostat program increased customers' likelihood of enrollment.

CVP 5 Treatment Effects on Migration

The evaluation team estimated the impacts of the PTR messaging by comparing the migration rates from August 18, 2021, to November 30, 2021, of customers in the randomized migration messaging treatment group with the migration rates of customers in the randomized control group (simple difference of migration rates) and the migration rates of customers in the randomized PTR messaging

[40] Difference between groups is significant with 90% confidence (p≤0.10).

treatment group (difference-in-differences).[41] The differences-in-differences comparison uses Smart Thermostat program migration rates before the migration messaging treatment started between June 1 and August 18 to control for pre-existing differences between groups in migration propensities and to isolate the incremental effect of the migration messaging for customers who received the PTR messaging. The analysis period end date was about two months after customers received the last encouragement to migrate to smart thermostats.

Table 21 shows the migration rates during the pre-treatment and treatment periods for the control group and the two treatment groups. During the pre-treatment period, there were no statistically significant differences in migration rates between the treatment groups and the control group. The migration rates for all three groups were about six per 1,000 PTR customers, or 0.6%. Because the treatment groups received the renewables messaging encouraging them to save during PTR events during the pre-treatment period, it is likely that such messaging alone does not increase migration to the Smart Thermostat program.

During the treatment period, the migration rate for customers receiving the migration messaging was about 1%, which is three times the rate for both the control group and the PTR messaging group.

Table 21. PTR to Smart Thermostat Program Migration Rates

	Control Group	PTR Messaging	PTR & Migration Messaging
Pre-treatment Period	0.56%	0.67%	0.62%
Treatment Period	0.36%	0.31%	0.93%

Notes: Pre-treatment period was from June 1, 2021 to August 17, 2021. Treatment period was from August 18, 2021 to November 30, 2021. Analysis sample only includes customers randomly assigned to one of three groups with active accounts on first day of migration treatment (August 18, 2021). Migration rates calculated by Cadmus based on customer counts provided by PGE.

Table 22 reports estimates of the CVP 5 messaging treatment effects on migration. Based on a comparison of migration rates during the treatment period, the effect of migration messaging was to increase the probability of migration by 0.57 percentage points or 160% relative to the baseline rate of 0.36 percent. The treatment effect of PTR messaging (-0.05% percentage points) was not statistically different from zero. When estimating migration messaging impact as a difference-in-differences and accounting for differences in the baseline rate of migration during the pre-treatment period, the estimate of the treatment effect is 0.67 percentage points or 217% of the baseline migration rate (control group during the treatment period). Overall, the causal effect of the migration messaging approximately tripled the migration rate.

[41] The results are similar if the analysis uses October 31, 2021 as an end date.

Table 22. CVP 5 Smart Thermostat Migration Experiments Treatment Effects

Treatment Group	Simple Difference	Difference-in-Differences
PTR Messaging	-0.05% (0.19%)	N/A
PTR & Migration Messaging	0.57%* (0.26%)	0.67%* (0.36%)

Notes: The treatment effects are percentage point changes in enrollment in PGE's Smart Thermostat program and were estimated based on Cadmus calculations using data on customer enrollment counts provided by PGE. Treatment period was from August 18, 2021 to November 30, 2021. Analysis sample only includes customers randomly assigned to one of three groups with active accounts on the first day of migration treatment (August 18, 2021).
* indicates estimate is statistically different from zero at the 5% significance level.

The CVP 5 experiment shows that sending only renewables messaging to PTR customers with eligible HVAC systems did not increase the migration rate to the Smart Thermostat program. However, the renewables messaging paired with encouragement to migrate significantly lifted enrollment in the Smart Thermostat program. Thus, PGE can raise Smart Thermostat program enrollment by encouraging its PTR customers with eligible HVAC systems to migrate. A limitation of the experiment is that it does not indicate the marginal contribution of the environmental messaging, that is, whether migration encouragement without environmentally focused messaging would have yielded similar impacts.

Overall Effect of SGTB on Migration to Smart Thermostats

Residential SGTB customers continued to enroll in PGE's Smart Thermostat program since the interim evaluation report. Table 23 tracks the Smart Thermostat program enrollment of PTR customers in relation to the CVP 4 and CVP 5 campaign periods and the 12 months ending October 31, 2021. As of October 31, 2020, PGE participant tracking data showed that 2.25% of all residential Test Bed PTR customers were enrolled in the Smart Thermostat program. During the subsequent year from November 1, 2020, to October 31, 2021, 1.55% of all residential Test Bed PTR customers enrolled in the Smart Thermostat program. If the analysis is restricted to customers eligible for the Smart Thermostat program (i.e., they have compatible central cooling and/or electric heating system), 2.59% of SGTB PTR customers have enrolled.

Table 23. SGTB PTR Migration to Smart Thermostat Program

Location	All PTR Customers		Smart Thermostat-Eligible PTR Customers		
	Enrollment Baseline (Enrolled on 10/31/20)	11/1/20–10/31/21	During CVP 4 (11/9/20–2/11/21)	During CVP 5 (6/1/21–9/30/21)	11/1/20–10/31/21
All	2.25%	1.55%	0.78%	1.01%	2.59%
North Portland	1.97%	1.16%	0.79%	0.77%	2.32%
Milwaukie	1.35%	0.77%	0.43%	0.49%	1.36%
Hillsboro	4.66%	3.72%	1.20%	1.93%	4.49%

Notes: Smart thermostat eligible customers have central electric space heating or cooling systems compatible with a smart thermostat.

To measure the SGTB's effect on enrollment in the Smart Thermostat program, enrollment rates inside and outside the SGTB were compared. The analysis involves comparison of the enrollments of SGTB PTR customers and the matched comparison group of PTR nonparticipants from the summer 2020 evaluation of the Flex 2.0 PTR program. As shown in the Flex 2.0 evaluation report, Test Bed PTR customers and the matched comparison group are well balanced on electricity demand and other observable characteristics.[42] This migration analysis includes only SGTB PTR customers and matched controls from summer 2020 who were not enrolled in the Smart Thermostat program as of November 1, 2020. Any effect of the SGTB on enrollment reflects the combined influences of auto-enrollment in PTR, encouragement to enroll in the Smart Thermostat program (CVP 1), and other SGTB messaging through September 2021.

Table 24 compares the Smart Thermostat program enrollment rates during the CVP 4 campaign (November 9, 2020, to February 11, 2021), the CVP 5 campaign (June 1, 2021, to September 30, 2021), and the 12 months from November 1, 2020, to October 31, 2021. During CVP 4, 0.27% of Test Bed PTR customers migrated to Smart Thermostat, which was higher than the 0.29% enrollment rate for the control group. During CVP 5, 0.34% of Test Bed PTR customers migrated to Smart Thermostat compared to 0.30% enrollment for the matched control group. Over the 12 months from November 1, 2020, to October 31, 2021, 1.08% of Test Bed PTR customers migrated compared with 0.84% enrollment for the control group.

Across all periods, the results show that Test Bed PTR customers were more likely to enroll in PGE's Smart Thermostat program than were the matched comparison group. The percentage difference in enrollment rates between the Test Bed PTR group and the matched control group was higher during the CVP 4 marketing campaign than the CVP 5 campaign. Over the full year, SGTB customers were about 30% more likely to enroll in the Smart Thermostat program. However, the baseline rate of enrollment was very low (0.84%), so the absolute effect of the SGTB on the Smart Thermostat program enrollment was also small.

In addition, the percentage lift from the SGTB in the Smart Thermostat program enrollment decreased since the interim evaluation. During the first 16 months of the SGTB, the enrollment rate in the Smart Thermostat program was two to three times higher for SGTB PTR customers than the matched comparison group. This drop likely reflects the enrollment of SGTB customers with the highest enrollment propensities in the first year of the Test Bed project. Further enrollments in subsequent years may have been increasingly difficult to obtain.

[42] Cadmus. 2020. *Flex 2.0* evaluation report: https://edocs.puc.state.or.us/efdocs/HAQ/um1708haq124912.pdf

Table 24. SGTB Smart Thermostat Program Enrollment Lift

Group	Customer Count	Metric	Period		
			CVP 4 (11/9/2020–2/11/2021)	CVP 5 (6/1/2021–9/30/2021)	November 1, 2020–October 31, 2021
Test Bed PTR	n = 11,428	Enrollment rate	0.27%	0.34%	1.08%
		Enrollment count	31	39	123
Matched Non-Participants	n = 9,539	Enrollment rate	0.19%	0.30%	0.84%
		Enrollment count	18	29	80
Absolute difference in migration rate between TB PTR and matched control customers			**0.08%**	**0.04%**	**0.24%***
Percentage difference in migration rate			**42%**	**13%**	**29%**

* Denotes statistical significance at the 5% level. 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 program prior to November 1, 2020. Analysis period was from November 1, 2020 to October 31, 2021. Test Bed PTR customers were enrolled in PTR in summer 2020.The comparison group was customers from outside of the SGTB not enrolled in PTR and matched to Test Bed PTR customers based on consumption and other demographic characteristics for the S20 Flex 2.0 impact evaluation. See Cadmus' Flex 2.0 impact evaluation study (2020) for details.

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

How did migration from PTR to the Smart Thermostat program depend on the customer's PTR savings potential? Table 25 compares migration rates from November 1, 2020, to October 31, 2021, of SGTB PTR customers by demand response micro-segment. This comparison is of interest because of the low savings potential and low realized PTR savings of the Low Engager and Borderliner customer segments, as shown in Figure 15 and Figure 18 earlier in this report. Enrollment in the Smart Thermostat program might provide an alternative way for these customers to contribute demand response capacity to PGE. If PGE can induce enough Low Engagers and Borderliners to migrate to the Smart Thermostat program, it may still be a sound and cost-effective strategy to auto-enroll them in PTR.

Table 25. Smart Thermostat Migration Lift by Demand Response Micro-segment

Micro-segment	Customers	Smart Thermostat Program Enrollment	Enrollment Rate November 1, 2020–October 31, 2021
Big Impactors	101	9	8.91%
Fast Growers	590	25	4.24%
Middle Movers	2,428	36	1.48%
Borderliners	4,800	41	0.85%
Low Engagers	3,490	12	0.34%

Notes: The Test Bed PTR and matched nonparticipant populations were customers in each group who were *not* enrolled in PGE's Smart Thermostat program prior to November 1, 2020. Analysis period was from November 1, 2020 to October 31, 2021. Test Bed PTR customers were enrolled in PTR in summer 2020.The comparison group was customers from outside of the SGTB not enrolled in PTR and matched to Test Bed PTR customers based on consumption and other demographic characteristics for the S20 Flex 2.0 impact evaluation.

However, the customers with the lowest PTR savings potential also had the smallest likelihood of enrolling in the Smart Thermostat program. Less than 1% of Borderliners and Low Engagers, who constituted almost 75% of SGTB PTR customers, enrolled in the Smart Thermostat program over the year. In contrast, almost 10% of Big Impactors enrolled, but they constituted less than 1% of Test Bed PTR customers.

Barriers to Smart Thermostat Migration

In the interim evaluation, customers' perceived program ineligibility and reluctance to cede control of their thermostat emerged as the top barriers to customer enrollment in the Smart Thermostat program. These two barriers, respectively, defined two customer audience groups: self-disqualifiers and control keepers. In the CVP 5 survey, the barriers pertaining to **self-disqualifiers** and **control keepers** appeared at the top again, as shown in Table 26. In particular, the evaluation found additional barriers surrounding the control keepers (data security and complacency with current thermostat) that make this group very challenging to move to the Smart Thermostat program.

Table 26. Reasons for Not Enrolling in Smart Thermostat Program

Reasons (ranked from highest to lowest overall % of *very true* and *somewhat true* combined)	**Overall** (n≤422)	**PTR Treatment** (n≤157)	**Migration Treatment** (n≤117)	**Control** (n≤148)
Not sure if the smart thermostat would work with my heating or cooling system	62%	60%	59%	66%
I am concerned about the security and sharing of my data on smart devices	60%	60%	62%	59%
I am concerned about giving PGE control of my thermostat	59%	65%	57%	53%
The incentives are not big enough to make it worthwhile	44%	46%	44%	44%
I am concerned the program would make my home feel uncomfortable	34%	34%	36%	32%
My home is not eligible for the program	33%	33%	32%	34%
It's too messy to install a new thermostat	31%	31%	30%	33%
I already have a smart thermostat but I prefer to control it myself (Note: This statement was only shown to respondents who already had a smart thermostat.)	90% (n=60)	100% (n=21)	90% (n=19)	80% (n=20)
I am happy with my programmable or manual thermostat (Note: This statement was only shown to respondents who did not have a smart thermostat.)	70% (n=341)	67% (n=128)	71% (n=90)	71% (n=123)

Note: Blue = statement associated with self-disqualifiers. Green = statement associated with control keepers. The CVP 5 survey displayed this question to customers eligible for the Smart Thermostat program.
Source: Cadmus CVP 5 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."

Self-Disqualifiers

Self-disqualifiers represent a group of customers who indicated in the survey that they were not sure if a smart thermostat was compatible with their HVAC system or that their home was eligible for the program. Only homes with central cooling or electric heating equipment are eligible. The CVP 5 survey showed a notable drop in those who said their home was not eligible, suggesting that the availability of HVAC data and targeted marketing helped clarify this issue. The percentage of respondents indicating

that their home was not eligible for the program significantly decreased from 46% in the CVP 1 survey (n=508) to 33% in the CVP 5 survey (n=422).[43]

However, the percentage of respondents indicating that they were not sure if a smart thermostat was compatible with their HVAC system did not change between the CVP 1 survey (63%, n=508) and CVP 5 survey (62%, n=422). Currently PGE's Smart Thermostat program checks customers' HVAC system compatibility during the direct install scheduling process or the sign-up process, which comes *after* the customer has decided to sign up. Offering a reference tool during the marketing phase would help customers determine their system compatibility.

Control Keepers

Control keepers represent a group of customers who indicated in the survey that they had concerns about giving PGE control of their thermostat. Control keepers made up 59% of program-eligible respondents in the CVP 5 survey (n=422). The percentage of respondents indicating that they had concerns ceding control significantly increased from 47% in the CVP 1 survey (n=508) to 59% in the CVP 5 survey (n=422). [44] The percentage of control keepers increased because the targeted marketing was able to eliminate customers who were not eligible for the program.

The evaluation investigated the control keepers further in the CVP 5 survey by adding three new non-enrollment reasons to ask respondents about:

- I am concerned about the security and sharing of my data on smart devices
- I already have a smart thermostat but I prefer to control it myself
- I am happy with my programmable or manual thermostat.

These new statements were added to address customer concerns discovered by the residential focus groups that the evaluation team conducted during the interim evaluation.

As shown in Table 26 above, the percentage of respondents who indicated having concerns about data security (60%) was the same as that of respondents who indicated having concerns about ceding control (59%). The evaluation team ran crosstabs on these two non-enrollment reasons and the reason "I am happy with my programmable or manual thermostat." Figure 28 shows how these three non-enrollment reasons overlap. Among respondents reporting concerns about data security, 45% said they were happy with their existing thermostat and 68% said they had control concerns. Among respondents with control concerns, 49% said they were happy with their thermostats and 67% said they had data security concerns. The similar percentages observed for these non-enrollment reasons show that data security

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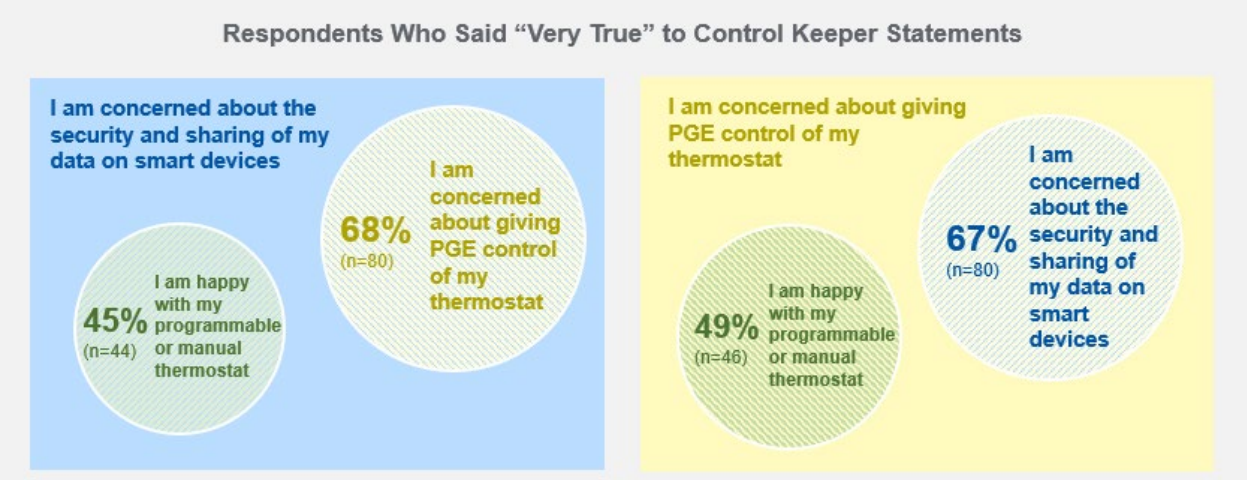
[43] Difference between CVP 1 and CVP 5 is significant with 90% confidence (p≤0.10). The CVP 5 survey asked this question to customers eligible for the Smart Thermostat program. The CVP 1 survey asked this question to all customers.

[44] Difference between CVP 1 and CVP 5 is significant with 90% confidence (p≤0.10). The CVP 5 survey asked this question to customers eligible for the Smart Thermostat program. The CVP 1 survey asked this question to all customers.

and control are the two biggest concerns for control keepers. In addition, control keepers will be harder than other groups to move to the Smart Thermostat program because many are complacent about their current thermostat.

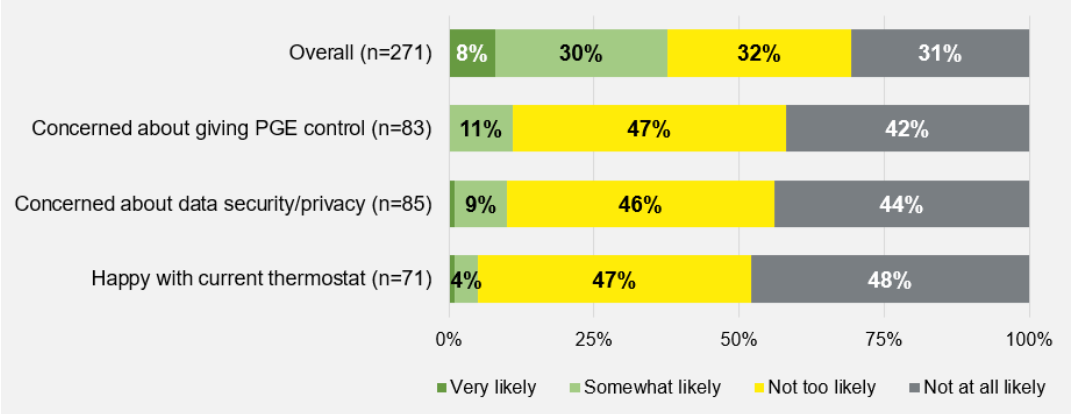
Figure 28. Control Keepers' Overlapping Non-Enrollment Reasons



Source: Cadmus CVP 5 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."

When asked about the likelihood of enrolling in the Smart Thermostat program in the next 12 months, 38% of program-eligible respondents said they are very likely or somewhat likely to enroll (Figure 29). Control keepers in the program-eligible group were even less likely to enroll. All three statements associated with control keepers showed that 11% or less are likely to enroll. This indicates that around 90% of control keepers currently do not intend to enroll. Control keepers will be a difficult customer segment for PGE to migrate to the Smart Thermostat program as these customers have additional barriers around data security and thermostat complacency for PGE to overcome.

Figure 29. Likelihood to Enroll in Smart Thermostat Program



Source: Cadmus CVP 5 Survey Question. "How likely are you to enroll in PGE's Smart Thermostat Program in the next 12 months?"

Smart Thermostat Program Event Notifications

Description of Event Notification Experiment

In the interim evaluation report, Cadmus suggested as future research to investigate whether maintaining consistency between PTR and Smart Thermostat program delivery could improve the customer experience or have other benefits for PGE. One major delivery inconsistency between the two programs was with pre-event notifications: PTR customers received email and/or text notifications from PGE while Smart Thermostat program customers did not.

Like many utilities operating residential smart thermostat demand response programs, PGE does not directly notify participants of upcoming events; thermostat manufacturers may notify participants a few minutes before an event via the thermostat app or thermostat display, depending on the participants' notification settings. Participants may also learn about the events from observing changes to their thermostat settings or noticing changes in their home's temperature. The residential focus groups conducted during the interim evaluation revealed that customers who migrate from PTR to the Smart Thermostat program may expect or want pre-event notifications. Thus, PGE selected pre-event notifications as an area of research and ran an experiment during summer 2021 to test the impact of sending event notification emails to customers in the Smart Thermostat program.

PGE ran the experiment on a subset of Smart Thermostat program enrollees. The experiment was implemented as a randomized controlled trial; customers assigned to the control group did not receive pre-event notifications, which provided a baseline for measuring their impacts. Table 27 describes the pre-event notification experimental design, including the number of enrollees (unique customer-premise combinations) assigned to each group. Because of the small number of residential SGTB participants in the Smart Thermostat program, PGE included participants outside the SGTB for this experiment.

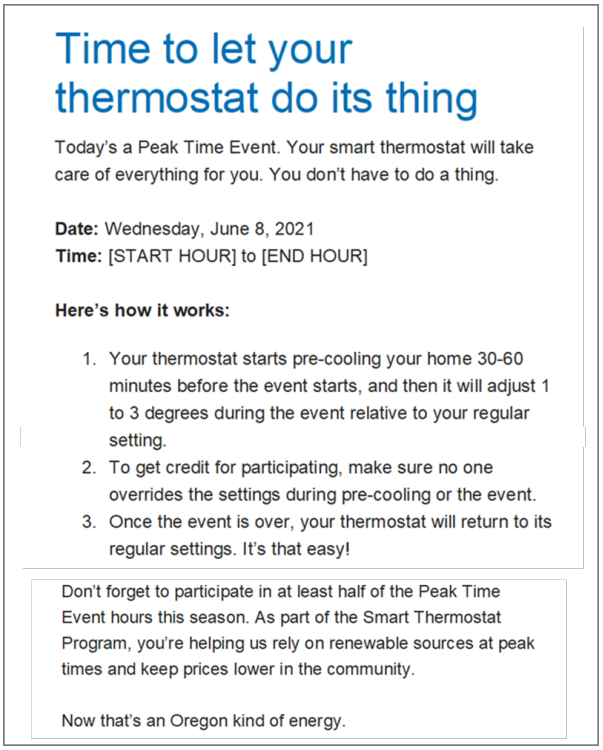
Table 27. Experimental Design of Residential Smart Thermostat Pre-Event Notifications

Group	Sample Size (Smart Thermostat Enrollees)	Received Event Notification Emails from PGE?
Event Notification Treatment Group	3,552	Yes
Control Group	3,554	No

Notes: Sample sizes calculated based on summary table of random assignments provided to Cadmus (July 14, 2021).

PGE called eight events during summer 2021 and tested the pre-event notification emails from Event 3 through Event 8. Customers in the treatment group received the event notification email on the morning of the event. Figure 30 shows a copy of the pre-event notification email that PGE sent to treatment group customers.

Figure 30. PGE Event Notification Email from Summer 2021



Time to let your thermostat do its thing

Today's a Peak Time Event. Your smart thermostat will take care of everything for you. You don't have to do a thing.

Date: Wednesday, June 8, 2021
Time: [START HOUR] to [END HOUR]

Here's how it works:

1. Your thermostat starts pre-cooling your home 30-60 minutes before the event starts, and then it will adjust 1 to 3 degrees during the event relative to your regular setting.
2. To get credit for participating, make sure no one overrides the settings during pre-cooling or the event.
3. Once the event is over, your thermostat will return to its regular settings. It's that easy!

Don't forget to participate in at least half of the Peak Time Event hours this season. As part of the Smart Thermostat Program, you're helping us rely on renewable sources at peak times and keep prices lower in the community.

Now that's an Oregon kind of energy.

Customer Experience Impacts

Cadmus conducted a survey with participants in the Smart Thermostat program after the end of the summer 2021 season. From that survey, 72% of treatment group respondents (n=266) remembered receiving the pre-event notification emails. Of those who remembered receiving the notification emails, 99% of them (n=181) said they understood what PGE was asking them to do in the email. As expected, a significantly higher proportion of treatment group respondents (86%, n=266) reported noticing the events compared with the control group (60%, n=160).[45]

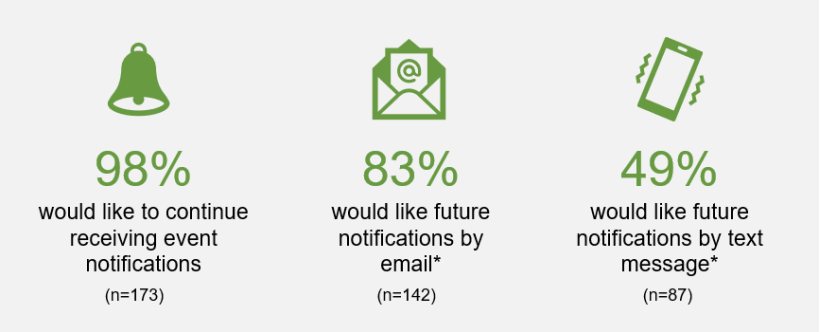
Nearly all treatment group respondents (98%, n=177) found the pre-event notification emails useful. Specifically, 71% said the emails were *very useful* and 27% *somewhat useful*. As to what made the pre-event notification emails useful, customer open-end responses showed the following (n=112):

- 58% said being made aware or told of the event
- 17% said it helps prevent overriding
- 16% said details about the event, such as the starting and ending times
- 8% said it allowed them to prepare for the event
- 7% said it made clear that the thermostat was not malfunctioning

[45] Difference between treatment and control group is significant with 90% confidence (p≤0.10).

Nearly all treatment group respondents (98%) said they would like to continue receiving the pre-event notifications. As shown in Figure 31, most respondents want to receive the notifications via email and around half want a text message.

Figure 31. Future Event Notification Preferences



*The percentage of respondents who want email may be high and the percentage of respondents who want text may be low due to the survey distribution method. This survey was distributed to participants via email. Therefore, these results may be biased in favor of email notifications and should be interpreted with caution.

Source: Cadmus Residential Smart Thermostat Summer 2021 Survey Questions. "Would you like to continue receiving these event notifications?" and "How would you like to receive these event notifications? Select all that apply."

Although respondents who received the pre-event notification emails liked receiving these emails, this did not make a difference in their satisfaction. Program satisfaction was similar between the treatment group (79% satisfied, n=266) and control group (80% satisfied, n=160). Satisfaction with PGE was also similar between the treatment group (91%, n=266) and control group (91%, n=159).

PGE is considering testing pre-event notification emails again in future seasons to confirm these survey findings.

Event Overriding Impacts

Using thermostat telemetry data from Resideo, the Smart Thermostat program Demand Response Management Service provider, Cadmus estimated the impacts of the pre-event notifications on the probability that a Smart Thermostat program enrollee would override a demand response event. The impacts were estimated as a difference-in-differences between the randomized treatment and control groups using the first two events in summer 2021, when pre-event notifications were not delivered, to establish baseline overriding behavior. The dependent variable of the panel regression model was a 0/1 indicator for whether the customer overrode the event and the model included event-date fixed effects (indicators for each of Events 1 through 8), an indicator for whether the customer was assigned to treatment, and event-date indicators for Events 3 through 8 interacted with assignment to treatment. The coefficients on the interaction variables indicate the treatment effects.

A priori, the effects of the pre-event notifications on overriding rates are uncertain. The pre-event notifications could increase overriding by alerting customers to the events when they otherwise would

have been unaware or decrease overriding by preparing customers for the events that they would have otherwise overridden.

Table 28 reports the number of thermostats in the treatment and control groups in the analysis sample and the overriding rates for the summer 2021 events. Due to a dispatch issue, the thermostats of customers with space heat pumps did not receive the event control commands during Event 1, and data for these thermostats and this event were dropped from the analysis sample. A customer could override the thermostat control settings during either the pre-conditioning or the event periods.

Table 28. Overriding Rates for Smart Thermostat Pre-Event Notification Experiment

Event	Treatment		Control		Pre-Event Notification	Pre-Event Notification Email Open Rate
	Number of Customers	Override Rate	Number of Customers	Override Rate		
1	2187	26.3%	2249	24.9%	No	n/a
2	2941	24.9%	3030	25.3%	No	n/a
3	2958	15.1%	3055	16.2%	Yes	46.8%
4	2948	13.4%	3009	16.0%	Yes	45.7%
5	2947	15.9%	3044	20.4%	Yes	45.4%
6	2942	19.9%	3006	25.2%	Yes	46.0%
7	2921	15.7%	2970	18.2%	Yes	44.6%
8	2921	11.5%	2975	14.4%	Yes	45.2%

Notes: Cadmus analysis of thermostat telemetry data for summer 2021 provided by Resideo. Email pre-event notification rates provided by PGE.

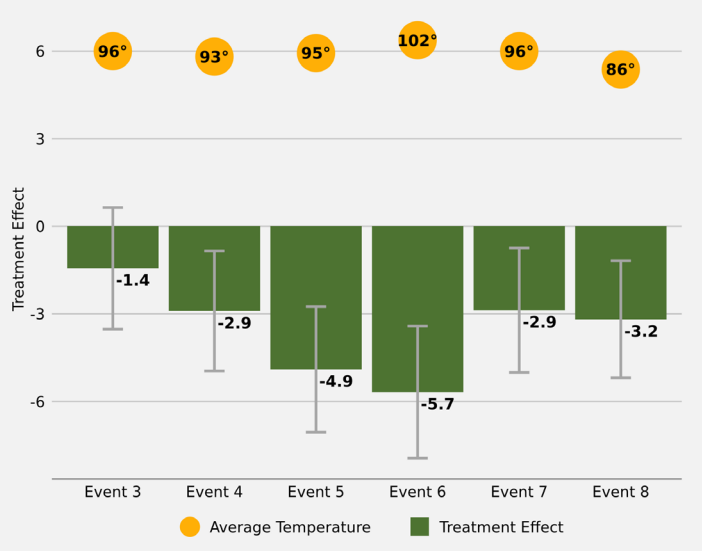
For the control group, event overriding rates ranged from about 15% (Events 3, 4, and 8) to 25% (Event 6). There were no statistically significant differences between the randomized treatment and control groups in the probability of overriding for Events 1 and 2 before PGE started delivering pre-event notifications. However, starting with the delivery of the pre-event notifications before Event 3, the treatment group consistently overrode less frequently than the control group, with the largest difference (-5.3 percentage points) occurring for Event 6.

Figure 32 shows estimates of the pre-event notification treatment effects from the regression analysis. The pre-event notifications reduced overriding during Event 3 by 1.5 percentage points, but the estimate was not statistically significant (because the confidence interval includes zero). The treatment effects for Event 4 through Event 8 were statistically significant and ranged from -2.9 percentage points (Event 4 and Event 7) to -5.7 percentage points (Event 6).

These average treatment effects are estimated across treatment group customers who opened the pre-event notification emails and those who did not. The percentage of treatment group customers who opened the notifications for each event ranged from 45.2% to 46.8%, as shown in Table 28. If it is assumed that customers who did not open their pre-event notifications did not become aware of the events ahead of time and the pre-event notifications therefore had zero effect on the probability of overriding, it is possible to estimate the local average treatment effect (LATE) of the notifications for

customers who opened them by dividing the average treatment effect in Figure 32 by the email notification open rate in Table 28.[46] Doing this yields a LATE of approximately twice the size of the treatment effects in Figure 32. For example, the effect of the pre-event notification email for event 5 on customers who opened the email would be to reduce the probability of overriding by about 11 percentage points (=4.9/0.454).

Figure 32. Pre-Event Notifications Treatment Effects



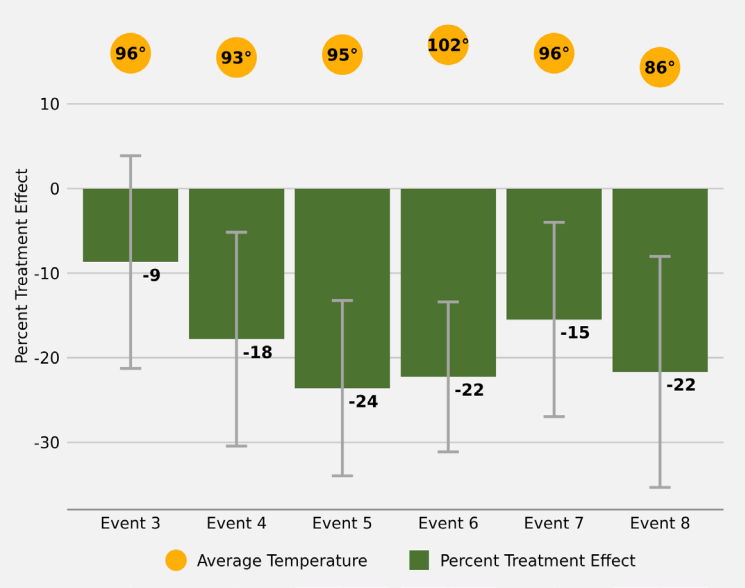
Notes: Treatment effects estimated in a two-way fixed effects (enrollee and event) difference-in-differences regression of Smart Thermostat program enrollees overriding the demand response event controls. PGE sent pre-event notifications to treatment group customers for events 3–8. Error bars show 90% confidence intervals based on standard errors clustered on Smart Thermostat program enrollees.

Figure 33 reports the estimates of the percentage treatment effects, calculated as the percentage point treatment effect divided by the baseline overriding rate for treatment group customers.[47] Sending pre-event notifications reduced overriding between 16% (Event 7) and 24% (Event 5) relative to the baseline rate.

[46] If customers who received but did not open the pre-event notification email became aware of the event ahead of time, the treatment effect for these customers may not be zero and the calculation of the local average treatment effect for customers who opened the notification email will not be valid.

[47] The baseline rate of overriding for treatment group customers was estimated using the results of the panel regression model as the sum of the overriding rate of the control group (the coefficient on the event day fixed effect) and the coefficient on the standalone assignment to treatment indicator variable.

Figure 33. Pre-Event Notification Percentage Treatment Effects



Notes: Treatment effects estimated in a two-way fixed effects (enrollee and event) difference-in-differences regression of Smart Thermostat program enrollees overriding the demand response event. Percentage treatment effect estimated by dividing the event estimated treatment effects by the event baseline rate of overriding. PGE sent pre-event notifications to treatment group customers for events 3–8. Error bars show 90% confidence intervals based on standard errors clustered on Smart Thermostat program enrollees.

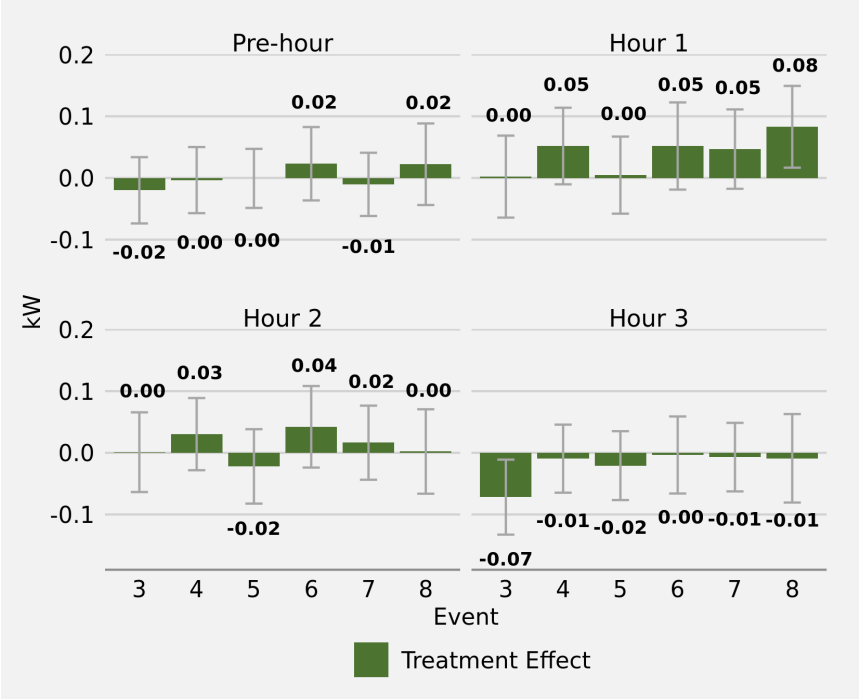
The impact of the reduction in overriding on kW demand savings will depend on when during the pre-cooling or event period overrides tend to occur and when delivery of pre-event notifications affect overriding behavior. For example, if pre-event notifications reduce overriding for customers who tend to override late in events and not for customers who override during the pre-conditioning or early event phases, the pre-event notifications will have little effect on demand savings. The pre-event notifications effect will also depend on which customers tend to override. If Smart Thermostat program customers who override provide little demand response capacity to PGE, reducing overriding will have little impact on savings. The next section examines the savings impacts of the pre-event notifications.

Pre-event Notifications Savings Impacts

The kW impacts of the pre-event notifications were estimated in difference-in-difference regressions of customer hour electricity consumption (kWh) on hour-of-the-day fixed effects, cooling degree hours, indicators for assignment to the treatment group, event-day indicators, and interactions between these variables. The regressions were estimated with interval consumption data for treatment and control group customers on event days 3-8 and the 10 hottest non-event, non-holiday weekdays during summer 2021. Cadmus tested for differences in energy use on non-event days and found the randomized treatment and control groups had statistically equivalent consumption. A forthcoming impact evaluation report for PGE's Smart Thermostat program will describe the sample selection, data preparation, and regression modeling of the pre-event notifications impacts in more detail and report additional analyses and robustness checks.

Figure 34 shows estimates of the kW impacts of the pre-event notifications for events 3–8. As the notifications reduced the frequency of overriding, it was hypothesized that they also reduced electricity demand and increased savings. Estimates for individual event hours are presented because the effects of the pre-event notifications may have differed depending on when during the events overriding was reduced. A negative treatment effect indicates a reduction in electricity demand and an increase in savings. In almost all event hours, the pre-event notifications did not lead to statistically significant load reductions relative to the control group. There were not statistically significant differences between treatment and control group, as indicated by the 90% confidence intervals including zero.

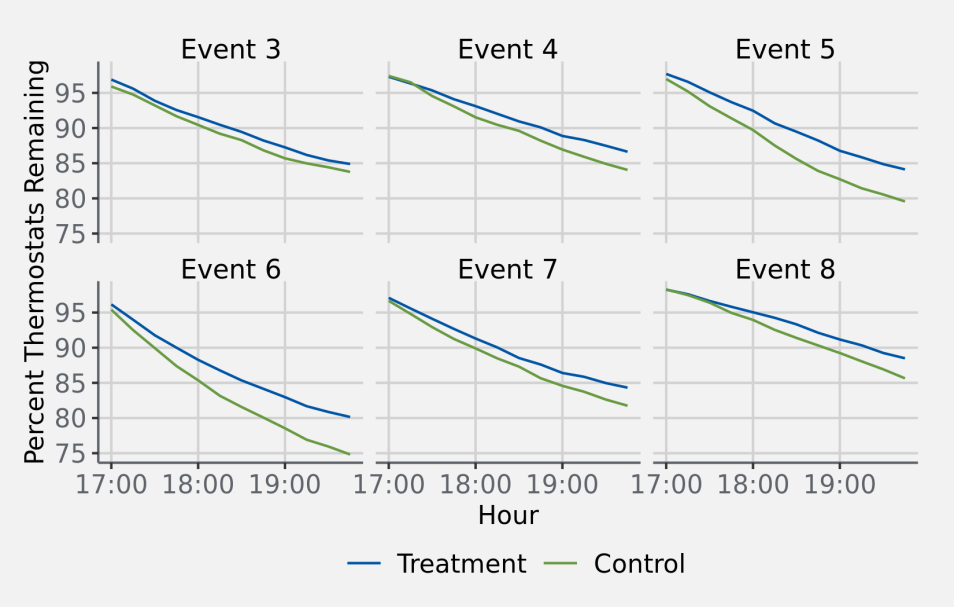
Figure 34. Treatment Effects of Smart Thermostat Pre-event Notifications



Notes: kW impacts of event notifications were estimated in a difference-in-differences regression of customer hour electricity demand using hour interval electricity consumption data for randomized treatment and control group customers. Error bars show 90% confidence intervals based on robust standard errors clustered on customers.

Although the pre-event notifications reduced overriding, Figure 34 shows they did not increase demand savings. As Figure 35 shows, this was because of when during events overriding was avoided. Figure 35 displays the percentage of thermostats remaining (those that did not override in a previous interval during the event) in each 15-minute event interval for events 3-8. In events 4-8 (the events leading to statistically significant reductions in overrides), the difference between the treatment and control groups in the percentage of thermostats remaining (not overriding) is small at the beginning of the event but increases as the event progresses. This suggests pre-event notifications reduced overriding in the second half of events when demand savings were smaller and did not affect demand savings in the first half of the events when the savings were higher.

Figure 35. Percentage of Thermostats Remaining by Event Interval

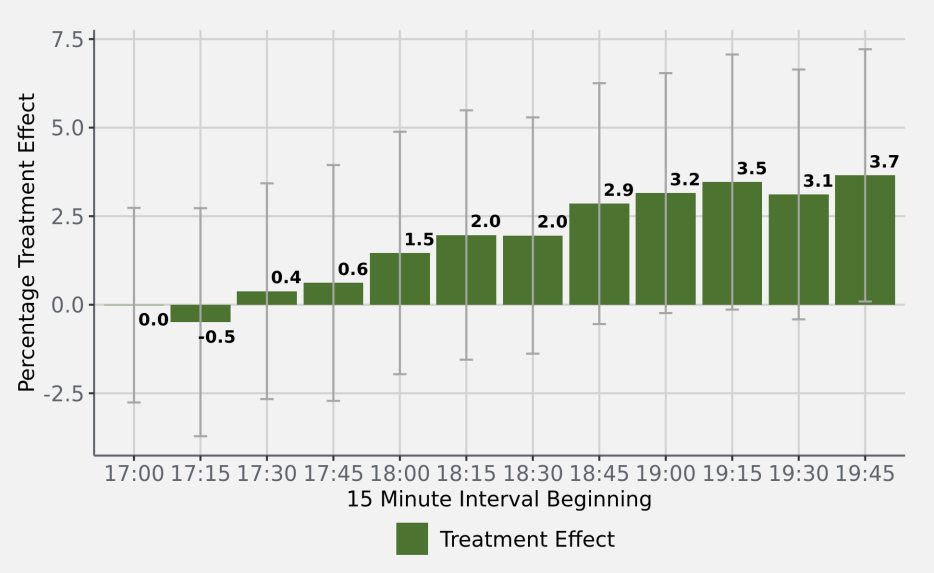


Notes: Cadmus analysis of Resideo 15 minute interval telemetry data for thermostats participating in the pre-event notification experiment.

Using thermostat telemetry data, Cadmus estimated the impacts of the pre-event notifications on the probability that a Smart Thermostat program enrollee would remain in the event in each 15-minute event interval. The impacts were estimated as a difference-in-differences between the randomized treatment and control groups using the first two events before pre-event notification treatment began to establish baseline overriding behavior. The dependent variable of the panel regression model was the percentage of thermostats remaining in the event in a given 15-minute interval. The model included interval fixed effects (indicators for each 15-minute interval between 5 p.m. and 8 p.m.), a 0-1 indicator for whether the customer was assigned to treatment, a 0-1 indicator for events 3-8, and interactions between these variables.

Figure 36 displays the estimated average treatment effects for the event intervals. A reduction in overriding presents as an increase in the percentage of customers remaining in the event. As Figure 36 shows, the estimated treatment effects were small, averaging less than two cumulative percentage points, and statistically insignificant for intervals in the first 90 minutes of events. The estimated treatment effects increased and became statistically detectable during the second half of events. In the last event hour, the cumulative treatment effects were larger than 3 percentage points and statistically significant or nearly so. This analysis indicates that the cumulative impacts of the pre-event notifications on overriding were small at the beginning of events when they would have had their largest impacts on electricity demand and did not become larger until the end of events when demand savings were lower. The tendency for pre-event notifications to avoid overriding late rather than early in events likely explains the absence of statistically detectable kW savings impacts.

Figure 36. Treatment Effect of Pre-Event Notifications on Percentage Remaining in Event



Notes: Pre-event notifications impacts on percentage of thermostats remaining in the events were estimated in a difference-in-differences regression using 15-minute interval telemetry data for randomized treatment and control group customers.
Error bars show 90% confidence intervals based on robust standard errors clustered on customers.

Community Engagement and DEI

Since PGE designed the SGTB and received approval from the OPUC to implement Phase I, there has been growing awareness of inequities in the delivery of electric service and demand-side management programs to utility customers. Customer groups such as the elderly, BIPOC,[48] low-income customers, non-English speakers, and renters have traditionally participated in such programs at lower rates than other customer groups. Though PGE designed Phase I of the SGTB to be representative of its residential customer population and to include disadvantaged customer groups, addressing inequities in service and program delivery was not an explicit goal.[49]

During Phase I, PGE took steps to improve its delivery of service and programs to make them more equitable for disadvantaged customer groups inside and outside the SGTB. PGE has developed and implemented many of these steps as part of the SGTB implementation.

Outcomes of Community Engagement Practice

In the first year of the SGTB, PGE's DEI Community Outreach Consultants forged a new dedicated community engagement practice at the company, identified potential community partners, established

[48] BIPOC stands for Black, Indigenous, and People of Color.

[49] PGE Test Bed Proposal (2018) to the OPUC: https://edocs.puc.state.or.us/efdocs/HAS/um1976has12165.pdf.

an equity lens framework for projects, and crafted a Community Engagement Strategic Plan. Momentum continued in the second year with the DEI Community Outreach Consultants achieving the following:

- Applied the equity lens framework to several projects
- Researched EJC customer groups
- Identified a clear list of community partners and developed relationships with most of them
- Established a SGTB Community Workgroup

Application of Equity Lens Framework

PGE's equity lens framework is a reflective framework that intentionally works to uncover potential and/or real bias in PGE's decision-making and actions and aims to help PGE uphold its commitment to DEI. The framework is a tool to ensure PGE scrutinizes assumptions underlying its program delivery and helps ensure PGE is not creating unintentional barriers as PGE evaluates new products, pilots, or programs.

At the end of the first year, the DEI Community Outreach Consultants began developing an equity lens framework and applied an equity lens to SGTB customer engagement activities, such as the ductless heat pump controls demonstration project and the CVP 3 Carbon campaign. The DEI Community Outreach Consultants completed the development of the framework in early 2021 and applied an equity lens to the residential electric vehicle (EV) charging demonstration project inside the SGTB and outside the SGTB through the roundtables and public process for PGE's 2021 Integrated Resource Planning. All applications of the equity lens were done either retrospectively or to projects in-flight.

Research into EJC Customer Groups

PGE identified the types of customers who are part of the underrepresented, underserved, and/or relevant communities—collectively referred to as environmental justice communities (EJC)—by aligning with the Oregon House Bill 2475 relating to public utilities.[50] EJC include low-income customers, people of color, renters, seniors, and non-English speakers.

As part of the SGTB, the DEI Community Outreach Consultants set a goal to identify disparities and participation barriers experienced by the EJC and presented recommendations for overcoming these disparities and barriers. The DEI Community Outreach Consultants gathered EJC feedback through public events, an online community forum, one-on-one conversations with interested parties, and shared data from partners. Though the data they collected was rich with qualitative insights, the DEI Community Outreach Consultants lacked important quantitative, demographic data with statistical rigor.

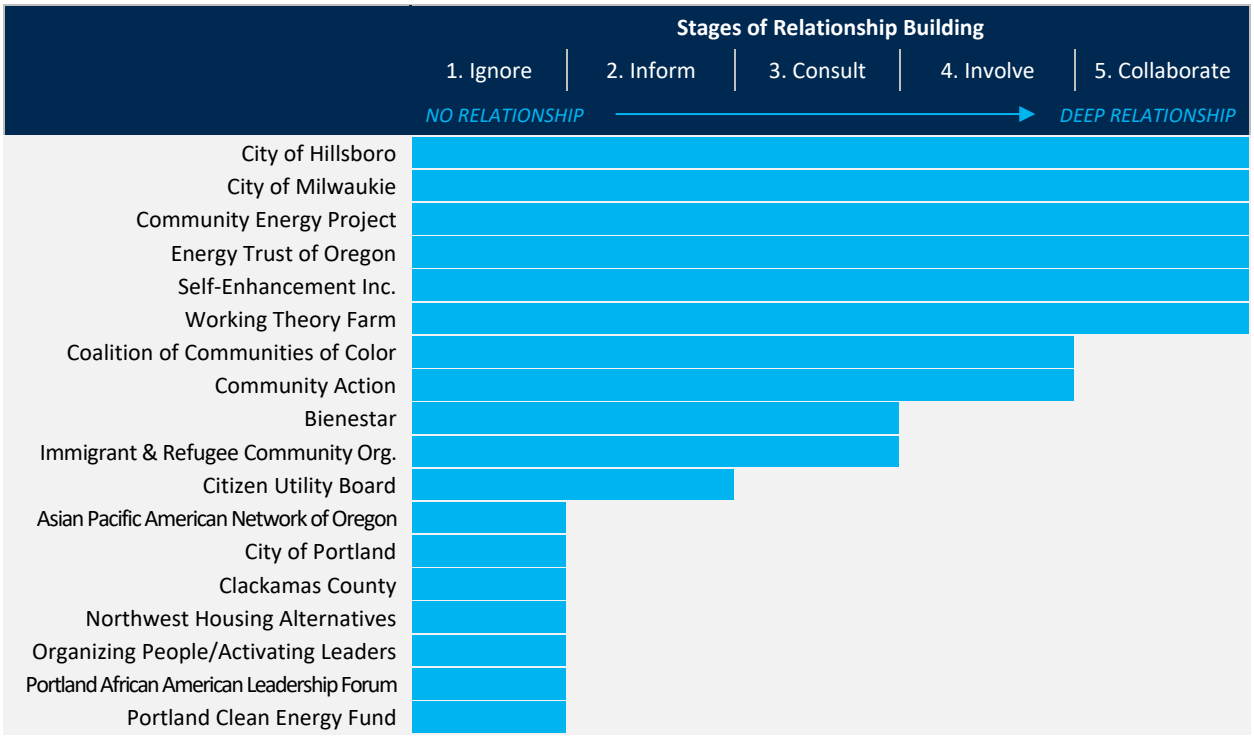
[50] Environmental justice communities include communities of color, communities experiencing lower incomes, tribal communities, rural communities, frontier communities, coastal communities and other communities traditionally underrepresented in public processes and adversely harmed by environmental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

The evaluation team was able to collect enough EJC customer responses from the CVP 5 survey to run statistical comparisons that would help identify distinct barriers and disparities of the EJC customer groups. The next section summarizes the key survey findings on the EJC customer groups.

Identification of Community Partners and Relationship Building

The DEI Community Outreach Consultants narrowed the list of community partners for the SGTB, from 100 potential partners in the first year to a short list of 18 partners by the end of second year. Figure 37 shows the progress toward relationship building with the 18 identified community partners. The DEI Community Outreach Consultants established deep relationships with six of these community partners and was in the relationship development stages with five of them by the end of 2021.

Figure 37. Community Partner Relationship Status



Source: PGE DEI Report (2021)

Understandably, some of the community partners who were initially on board with the SGTB opted to focus their attention and resources on serving their communities during the COVID-19 pandemic and placed the SGTB as low priority.

Notably, the DEI Community Outreach Consultants contracted with Energy Trust of Oregon and Community Energy Project to deliver weatherization workshops to low-income renters and homeowners in the SGTB. The shelter-in-place ordinances and restrictions on public meetings due to the COVID-19 pandemic forced these workshops to move to a virtual format and opened them up to low-income customers outside the SGTB. The weatherization workshops generated 469 household participants. Through the workshop effort, new energy-shifting content was created first for the SGTB and then integrated into all future weatherization and cooling workshops that occurred outside the SGTB.

The DEI Community Outreach Consultants also involved the Community Energy Project and Working Theory Farm in the CVP 4 Giving Back with Learnings campaign, through which SGTB customers in PTR were able to donate their rebate earnings to a nonprofit.

Establishment of SGTB Community Workgroup

At the end of 2020, PGE formed the SGTB Community Workgroup comprising 11 members from the EJC and the short list of community partners.[51] Because of the low number of BIPOC groups in the SGTB, this workgroup filled in the representation gap and provided a way for BIPOC voices to be heard. The workgroup met every month over a 12-month period and focused on building relationships with community partners, increasing knowledge of energy shifting concepts among its members, and gaining insights about the SGTB and the customers.

Effect of PTR Auto-Enrollment on EJC Customers

A strategy for raising participation of EJC customer groups in utility programs is to make enrollment in the program the default option. When PGE auto-enrolled residential SGTB customers in PTR, it greatly increased the participation of EJC customers.

To establish this, Cadmus compared the enrollments of EJC customer groups inside and outside the SGTB. Outside the SGTB, customers must self-enroll in PTR, so outside PTR enrollment rates indicate the participation of EJC customers when customers must self-enroll.

Table 29 shows the results of the comparison for low-income customers, renters, seniors, and non-English speakers. (BIPOC customers cannot be identified in PGE's Customer Information System, so enrollment rates for this customer group are not reported.) The first two columns show EJC customers constituted a very similar percentage of the residential customer population inside and outside the SGTB. This is by design, as SGTB neighborhoods were selected to be representative of PGE's residential customer population.

Table 29. SGTB Impact on PTR Enrollment Rates of EJC Customer Groups

Customer Segment	% of Residential Customer Population		Enrollment Rate		Ratio of Enrollment Rates (SGTB PTR to Flex PTR)
	Inside the SGTB	Outside the SGTB	SGTB PTR (%)	Flex PTR (%)	
Low-Income	16.3%	16.4%	87.8%	12.0%	7.32
Renter	50.1%	50.2%	90.0%	13.6%	6.62
Senior	30.6%	31.8%	87.6%	8.8%	9.95
Non-English Speaker	1.9%	3.4%	87.7%	6.0%	14.62

Notes: Enrollment rates are calculated for PGE residential customers with active service accounts on October 31, 2021 using PGE CIS data.

Due to auto-enrollment in the SGTB, EJC customers have much higher PTR enrollment rates inside than outside the SGTB. Low-income customers, renters, and seniors inside the SGTB are seven to 10 times as

[51] Each member was provided a stipend that compensated for their time including meetings, pre/post work and any access issues, e.g., technology, internet, software, etc.

likely to be enrolled as their counterparts outside. For example, the enrollment rate for low-income customers is 88% inside the SGTB but only 12% outside. The effect of auto-enrollment is even greater for non-English speakers, raising enrollment by a factor of 15. Thus, auto-enrolling customers is an effective way for PGE to pull EJC customer groups into the program.

Nonetheless, enrolling EJC customers in PTR does not imply they are engaged with and benefiting from the program. To assess their engagement, Cadmus analyzed PTR customer survey data.

EJC Residential Customer Survey Findings

The following presents the CVP 5 survey findings on low-income customers, people of color, renters, seniors, and non-English speakers in the context of demand response.

Low-Income Customers

Low-income customers are those with an annual household income at 250% or less of the federal poverty level. Table 30 shows the federal poverty levels that the evaluation used in the CVP surveys to determine whether the respondent met the low-income criteria. The evaluation sourced survey responses to the household-size and income-threshold questions.

Table 30. Federal Poverty Levels

Persons in Household	≤ 250% of Federal Poverty Level
1	$31,900
2	$43,100
3	$54,300
4	$65,500
5	$76,700
6	$87,900
7	$99,100
8	$110,300
Add $4,480 for each person over 8	

Source: https://www.payingforseniorcare.com/federal-poverty-level

The CVP 5 survey revealed several key differences between low-income and middle- and high-income customers, as shown in Table 31. A high percentage of low-income customers were aware of the concept of demand response (82%) and PTR (97%), though this was significantly lower than awareness of the non-low-income customers (94% demand response; 99% PTR). The lower awareness among low--income customers did not result in lower PTR participation. Low-income customers were just as likely to participate in all or some events. However, low-income customers earned average rebate amounts for summer 2021 ($9.11) that were significantly lower than that of middle- and high-income customers ($10.68).

This difference in earned rebates may be indicative of low-income customers having a lower capacity for energy savings. The lower capacity could be partly due to low-income customers not having the equipment or information that would enable higher energy savings. For instance, the survey found that

significantly fewer low-income customers (6%) own a smart thermostat than non-low-income customers (23%), and significantly fewer low-income customers (57%) have air conditioning than non-low-income customers (69%).

Not surprisingly, low-income customers were significantly more likely to be motivated by money to participate in PTR. Offering smart thermostats and/or providing information on optimizing air conditioning usage could be ways to help low-income customers achieve higher rebate earnings.

Table 31. CVP 5 Survey Results by Income Status

Survey Item	Low-Income Respondents (n≤278)	Non-Low-Income Respondents (n≤742)
Awareness of Demand Response Concept	82% aware	94% aware*
Awareness of PTR	97% aware	99% aware*
Summer 2021 Self-Reported Event Participation	39% all events	32% all events
	56% some events	63% some events
Summer 2021 Average Total Rebate Earned	$9.11	$10.68*
Personal Value: *I would like to do more to improve the comfort of my home*	56% said very true*	47% said very true
Personal Value: *I like trying out new technologies and innovative programs*	34% said very true	37% said very true
Personal Value: *I like to take advantage of special offers that include gift cards as rewards*	55% said very true*	38% said very true
Personal Value: *It's fun to participate in activities that help my community*	37% said very true	27% said very true
PTR Motivator: *To earn rebates on my bill*	75% said very true*	62% said very true
PTR Motivator: *To save on my energy bill*	82% said very true*	66% said very true
PTR Motivator: *To help save the planet*	61% said very true	56% said very true
PTR Motivator: *To reduce my carbon footprint*	55% said very true	57% said very true
Satisfaction with PTR	73% satisfied	78% satisfied
	36% delighted	33% delighted
Satisfaction with PGE	90% satisfied	93% satisfied
	49% delighted	41% delighted
Smart Thermostat Program Awareness	56% aware	62% aware
Smart Thermostat Ownership	6% have it	23% have it*
Have Air Conditioning	57% have it	69% have it*

* Difference between groups is significant with 90% confidence (p≤0.10).
Source: Cadmus CVP 5 Survey Questions.

Black, Indigenous, and People of Color

BIPOC stands for Black, Indigenous, and People of Color. This acronym is used in this report to represent individuals who self-identify as African American, Black, American Indian, Native American, Aleut Eskimo, Asian, Asian American, Pacific Islander, Middle Eastern, Hispanic, Latino, multi-racial, or multi-ethnic. The evaluation sourced from survey responses to the race/ethnicity question.

The CVP 5 survey revealed several key differences as well as similarities between BIPOC customers and white customers, as shown in Table 32. A high proportion of BIPOC customers were aware of the concept of demand response (85%) and PTR (96%), but this is significantly lower than the proportion of white customers (93% demand response; 99% PTR). Additionally, though the proportion of BIPOC customers (53%) who participated in some events is significantly lower than the proportion of white customers (63%), a greater proportion of BIPOC customers (38%) participated in all events compared with white customers (33%), though this difference is not statistically significant. Overall, total PTR event participation was very similarly high between the two groups: 91% for BIPOC customers and 96% for white customers.

Similar to the low-income/non-low-income findings, BIPOC customers also averaged a lower earned rebate amount ($8.49) compared with white customers ($10.94) despite comparable event participation. This may again be indicative of a lower capacity for energy savings among BIPOC customers, due at least in part to existing wealth gaps, which result in BIPOC customers not having the equipment that would enable higher energy savings. The survey results showed that significantly fewer BIPOC customers (56%) have air conditioning than white customers (68.5%). However, the results also revealed stronger personal values among BIPOC customers who indicate opportunities for greater savings: a higher percentage of BIPOC customers responded *very true* to "I would like to do more to improve the comfort of my home" (63%) and "I like trying out new technologies and innovative programs" (45%) than white customers (45% and 34%, respectively).

This greater openness to new technologies and programs and greater desire to increase home comfort among BIPOC customers highlights an opportunity for greater savings, should these customers be given access to the necessary equipment and more education about the PTR program.

Table 32. CVP 5 Survey Results by Ethnic Group

Survey Item	BIPOC Respondents (n≤188)	White Respondents (n≤803)
Awareness of Demand Response Concept	85% aware	93% aware*
Awareness of PTR	96% aware	99% aware*
Summer 2021 Self-Reported Event Participation	38% all events	33% all events
	53% some events	63% some events*
Summer 2021 Average Total Rebate Earned	$8.49	$10.94*
Personal Value: *I would like to do more to improve the comfort of my home*	63% said very true*	45% said very true
Personal Value: *I like trying out new technologies and innovative programs*	45% said very true*	34% said very true
Personal Value: *I like to take advantage of special offers that include gift cards as rewards*	57% said very true*	38% said very true
Personal Value: *It's fun to participate in activities that help my community*	39% said very true*	27% said very true
PTR Motivator: *To earn rebates on my bill*	69% said very true	64% said very true
PTR Motivator: *To save on my energy bill*	77% said very true	68% said very true
PTR Motivator: *To help save the planet*	57% said very true	58% said very true
PTR Motivator: *To reduce my carbon footprint*	55% said very true	56% said very true
Satisfaction with PTR	73% satisfied	78% satisfied
	38% delighted	35% delighted
Satisfaction with PGE	89% satisfied	93% satisfied
	47% delighted	43% delighted
Smart Thermostat Program Awareness	56% aware	62% aware
Smart Thermostat Ownership	21% have it	18% have it
Have Air Conditioning	56% have it	68.5% have it*

* Difference between groups is significant with 90% confidence (p≤0.10).
Source: Cadmus CVP 5 Survey Questions.

Renters

Renters are those who do not own the residential property (e.g., house, apartment) where they reside. The evaluation sourced from survey responses to the home ownership question.

Similar to the low-income and BIPOC results, Table 33 shows a great majority of customers who are renters were aware of the demand response concept (86%), but this was still significantly lower than homeowner customers (94%). PTR awareness was practically 100% for both groups, with no statistical difference. There was also no significant difference between participation in some or all events for renter customers (60% some; 34% all) and owner customers (61% some; 34% all).

Table 33. CVP 5 Survey Results by Home Ownership Status

Survey Item	Renter Respondents (n≤357)	Owner Respondents (n≤701)
Awareness of Demand Response Concept	86% aware*	94% aware*
Awareness of PTR	98% aware	99% aware
Summer 2021 Self-Reported Event Participation	34% all events	34% all events
	60% some events	61% some events
Summer 2021 Average Total Rebate Earned	$7.22	$11.81*
Personal Value: *I would like to do more to improve the comfort of my home*	50% said very true	48% said very true
Personal Value: *I like trying out new technologies and innovative programs*	42% said very true*	32% said very true
Personal Value: *I like to take advantage of special offers that include gift cards as rewards*	53% said very true*	37% said very true
Personal Value: *It's fun to participate in activities that help my community*	37% said very true*	25% said very true
PTR Motivator: *To earn rebates on my bill*	74% said very true*	60% said very true
PTR Motivator: *To save on my energy bill*	78% said very true*	66% said very true
PTR Motivator: *To help save the planet*	58% said very true	58% said very true
PTR Motivator: *To reduce my carbon footprint*	54% said very true	57% said very true
Satisfaction with PTR	75% satisfied	77% satisfied
	34% delighted	35% delighted
Satisfaction with PGE	89% satisfied	93% satisfied*
	51% delighted*	40% delighted
Smart Thermostat Program Awareness	48% aware	64% aware*
Smart Thermostat Ownership	7% have it	23% have it*
Have Air Conditioning	55% have it	71% have it*

* Difference between groups is significant with 90% confidence (p≤0.10).
Source: Cadmus CVP 5 Survey Questions.

Despite virtually identical PTR participation, renter customers' average earned rebate amount ($7.22) was significantly lower than homeowners' ($11.81). This may, again, be due at least partially to a lower capacity to reduce energy usage, as renter customers were significantly less likely to have a smart thermostat (7%) or air conditioning (55%) compared with owner customers (23% and 71%, respectively). Renter customers were also significantly less likely to be aware of the Smart Thermostat program (48%) compared with owner customers (64%).

Like low-income customers, renter customers are more motivated by monetary incentives than homeowner customers. A significantly greater proportion of renter customers said *very true* to the statements to "earn rebates on my bill" (74%) and "to save on my energy bill" (78%) compared with owner customers (60% and 66%, respectively). Additionally, a significantly higher proportion of renter customers said *very true* to the statement "I like trying out new technologies and innovative programs" (42%) compared with owner customers (32%), indicating that if given access to energy-saving equipment and education about these programs, renter customers would likely be eager to participate and generate higher savings.

Seniors

Seniors are individuals who are age 65 or older. The evaluation sourced survey responses to the age group question.

The CVP 5 survey results show that senior customers appear to be better equipped to reap the benefits of PTR than other EJC customer groups. Table 34 shows a significantly higher proportion of senior customers (80%) had air conditioning compared with non-senior customers (63%). Compared with non-senior customers, senior customers also tend to be more comfortable in their homes already. Significantly fewer senior customers (37%) said *very true* to the statement "I would like to do more to improve the comfort of my home" compared with non-seniors (51%).

Of the EJC groups, senior customers appear to be the most engaged with PTR. They have the highest all-event participation, earned rebates, and PTR satisfaction of any group. Almost all senior customers reported participating in events—about half (47%) reported participating in only some events, and slightly more (51%) reported participating in all events. Again, this is the highest all-event participation of any customer group. The proportion of senior customers participating in all events (51%) was significantly higher than non-senior customers (30%). Senior customers also averaged a significantly higher earned rebate ($13.40) than non-seniors ($9.65), an average several dollars higher than that of any other EJC group. Furthermore, the senior customers group is the only one for which PGE is meeting its PTR customer satisfaction goal of 80%. A significantly higher proportion of senior customers reported being satisfied (84%) and delighted (49%) than non-seniors (75% satisfied; 31% delighted).

In contrast to the stereotype that seniors are behind on technology, senior customers were no less likely to own a smart thermostat than non-senior customers. In fact, the ownership rate was identical (19%) between the two groups. Additionally, a significantly greater proportion of senior customers (71%) was aware of the Smart Thermostat program compared with non-seniors (58%), reflecting an opportunity to target these customers for the Smart Thermostat program. The significantly lower proportion of senior customers (23%) who responded *very true* to the statement "I like trying out new technologies and innovative programs" compared to non-senior customers (39%) may be helpful to consider when designing marketing strategies toward this group.

One final note is that the high percentage of air conditioning ownership among senior customers could be a reflection of the heat sensitivity of this group. Older adults are more susceptible to heat stroke and other heat-related illnesses.[52] With the extreme heat events of summer 2021 in the Northwest in mind, PGE may want to emphasize safety over rebates for this customer group.

[52] National Institute on Aging. 2018. "Heat-related health dangers for older adults soar during the summer." https://www.nih.gov/news-events/news-releases/heat-related-health-dangers-older-adults-soar-during-summer

Table 34. CVP 5 Survey Results by Age Group

Survey Item	Senior Respondents (n≤185)	Non-Senior Respondents (n≤857)
Awareness of Demand Response Concept	95% aware*	90% aware
Awareness of PTR	98% aware	98% aware
Summer 2021 Self-Reported Event Participation	51% all events*	30% all events
	47% some events	64% some events*
Summer 2021 Average Total Rebate Earned	$13.40*	$9.65
Personal Value: *I would like to do more to improve the comfort of my home*	37% said very true	51% said very true*
Personal Value: *I like trying out new technologies and innovative programs*	23% said very true	39% said very true*
Personal Value: *I like to take advantage of special offers that include gift cards as rewards*	30% said very true	46% said very true*
Personal Value: *It's fun to participate in activities that help my community*	25% said very true	31% said very true
PTR Motivator: *To earn rebates on my bill*	61% said very true	66% said very true
PTR Motivator: *To save on my energy bill*	69% said very true	70% said very true
PTR Motivator: *To help save the planet*	62% said very true	57% said very true
PTR Motivator: *To reduce my carbon footprint*	52% said very true	57% said very true
Satisfaction with PTR	84% satisfied*	75% satisfied
	49% delighted*	31% delighted
Satisfaction with PGE	93% satisfied	92% satisfied
	47% delighted	43% delighted
Smart Thermostat Program Awareness	71% aware*	58% aware
Smart Thermostat Ownership	19% have it	19% have it
Have Air Conditioning	80% have it*	63% have it

* Difference between groups is significant with 90% confidence (p≤0.10).
Source: Cadmus CVP 5 Survey Questions.

Non-English Speakers

Non-English speakers are individuals whose preferred or dominant spoken language is not English. The evaluation sourced from the language in which the respondent completed the surveys—either English or Spanish.

Language was the one category where the evaluation did not achieve a high enough number of responses to provide meaningful statistical comparisons on the various CVP 5 survey items. This was due to the relatively small number and below-average response rate of non-English speakers in PGE's service area.

PGE developed customer-facing PTR and Smart Thermostat program materials in English and Spanish for the SGTB. Cadmus mirrored this and conducted the CVP surveys in English and Spanish. Table 35 shows the response rate by English and Spanish across the CVP surveys with the number of surveys completed out of the number of customers contacted in parentheses. (The response rate is defined as the number of surveys completed divided by the number of customers contacted.)

Table 35. CVP Survey Response Rates by Language

	CVP 1	CVP 2	CVP 3	CVP 4	CVP 5
English Language Survey Completes	**10%** (694/6,905)	--	**12%** (880/7,371)	**9%** (675/7,350)	**10%** (1,067/10,295)
Spanish Language Survey Completes	**4%** (5/133)	--	**9%** (11/121)	**7%** (10/142)	**7%** (11/151)

Overall, the surveys achieved a lower response rate with Spanish speakers than English speakers, though the differences in response rates were not statistically significant. The Spanish response rates nearly doubled since the first CVP survey. However, the population size of Spanish speakers in the SGTB is small, and the number of Spanish-speaking respondents is too few to draw definitive conclusions about differences in response rate by language.

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).

Schedule 25 Energy Partner Smart Thermostat Program

The evaluation team based the findings for Schedule 25 EPST Program from PGE staff notes, program enrollment data, and focus groups with business customers.

Overall Outcomes

Schedule 25 EPST program was offered to business customers inside and outside the SGTB. The program offering did not differ between the two groups, but PGE used the SGTB to try out different customer outreach methods, such as door-to-door marketing. PGE initially set a goal of enrolling 25% of eligible SGTB businesses (about 460 of 1,848 businesses) in EPST by the end of 2021. However, the goal was later adjusted to 300 due to slow enrollment and unexpected marketing pauses. As noted in the interim evaluation report, the COVID-19 pandemic slowed the progress of EPST enrollment during the first year of the SGTB. Then in the second year, PGE encountered two unexpected marketing pauses (stemming from ice storm outages and internal program restructuring), which put it farther behind on enrollment. PGE ended up enrolling 106 businesses into the EPST program by the end of 2021.

EPST Nonparticipant Focus Group Findings

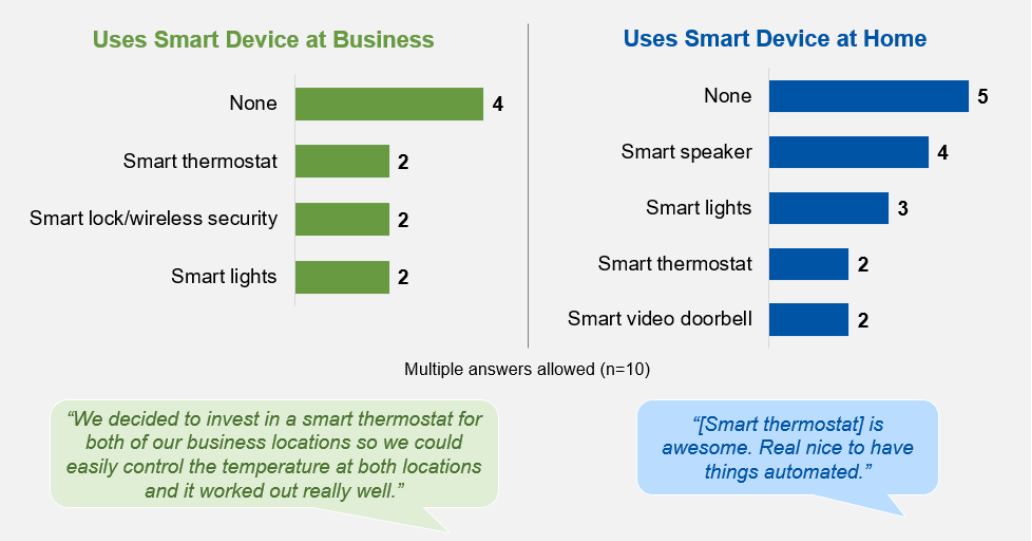
After the first year of slow enrollment, PGE sought to understand the barriers to program enrollment and uncover ways to increase enrollment. To address these issues, the evaluation team conducted two online focus groups with 10 business customers located in the SGTB that had not enrolled in the EPST program. The focus groups were intended to assess business customers' demand response awareness and attitudes, values and motivations, reactions to the EPST program design, and willingness to participate along with barriers to enrollment.

Demand Response Awareness and Attitudes

Business focus group respondents exhibited strong familiarity with demand response. Seven of 10 respondents were familiar with various aspects of demand response such as peak demand, load reduction, grid resiliency, generation, shifting energy use, and connection to smart technology. Interestingly, some respondents viewed Oregon as not having an issue with energy demand. In particular, four respondents mentioned that Oregon does not have an issue with demand or the grid system because of the region's mild weather.

During the interim evaluation, Cadmus conducted focus groups with residential customers in the SGTB who had not enrolled in the Smart Thermostat program; these focus groups showed that residential customers were hesitant about and less receptive to smart devices. Business customers on the other hand appear to embrace smart devices. Half of the business respondents said they already use a smart device at their business or home and have positive experiences with them (Figure 38).

Figure 38. Business Customers' Experience with Smart Devices



Source: Cadmus EPST Nonparticipant Focus Groups

Business respondents had very low awareness of the EPST program. When asked if they had heard of it, only one business respondent initially confirmed knowing about the EPST program. After showing the program concept stimuli, though, two more respondents recalled the program, for a total of three respondents who had heard of the EPST program.

Program Concept Testing

Business respondents in the focus groups were presented with a short program document that was compiled using actual EPST marketing materials and messaging. Respondents also read about how the program works.

> *"You have to have reliable energy or you can't have an oven, a stove, the electricity for your customers. The air conditioning, the freezers, the food that's in the freezers. You'd lose all that if you don't have reliable electricity."*

All 10 business respondents liked the EPST program offer and expressed interest in enrolling. As shown in Table 36, none of the 10 respondents had any concerns about or reported disliking any aspect of the program.

Table 36. Summary of EPST Program Concept Testing Results

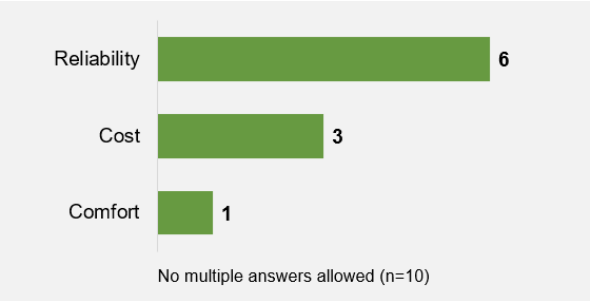
Program Aspect	Customer Response
Free Device	All 10 respondents liked this aspect. Some found it hard to be true.
Free Professional Installation	All 10 respondents liked this aspect. Adds to program's "credibility."
Event Participation Incentive	All 10 respondents liked this aspect. A bonus on top of free aspect.
Ability to Override	All 10 respondents liked having this ability
Temperature Adjustment	No one had concerns as long as they could override

Source: Cadmus EPST Nonparticipant Focus Groups

Values, Motivations, and Communications

The most important factor for businesses' energy use was reliability because energy is necessary for operations and productivity. Figure 39 shows that six of 10 respondents cited reliability, followed by cost, as the second most important factor.

Figure 39. Most Important Factor for Business' Energy Use



Source: Cadmus EPST Nonparticipant Focus Groups

When presented with a list of motivational statements and asked to choose one that would most motivate them to enroll in EPST, "saving money" came out on top but was not a majority (four of 10 respondents). Six other respondents each picked one of the other motivational statements, such as doing a little adds up to a big difference, helping shape Oregon's clean energy future, and helping PGE bring more renewable energy into the mix. Many respondents agreed that all of these were good motivational statements.

> *"If the program doesn't justify itself, these promotional items make me feel like I'm being tricked into something that doesn't justify it. Every single one of these would make me less likely to enter that program."*

All 10 respondents agreed the EPST program was great on its own and needed no additional incentives or rewards to entice enrollment. These respondents said the program already has good selling features and that promotional offerings (e.g., free Square card reader, monthly bakery/coffee delivery, $25 gift card) would make the program less appealing to them.

Barriers to Enrollment

The main barriers to program enrollment appear to stem from internal data tracking issues rather than from the business customers themselves. Data not being tracked or updated could have led to communication gaps and ineligible customers making it into the EPST-eligible list.

PGE's tracking data showed that four of the 10 focus group respondents had been marketed to with an in-person visit at their business by Green Mountain Energy. Yet none of these four respondents recalled the program or the canvassing. This suggests a gap in reaching the right decision-maker. The focus group recruitment process used a screener to identify the decision-maker at the business, and the decision-maker participating in the focus group may not have been the same person the canvasser identified as the decision-maker. Furthermore, one respondent did not remember ever receiving any emails about

EPST despite being the business owner. This points to program information possibly not reaching the decision-makers because PGE did not have correct contact information.

> *"Somebody came by our office last year and to sign us up for it, and I said yes. Then the pandemic happened, and I never heard from them again."*

The focus groups also uncovered instances of missed opportunities for enrollment and ineligible businesses making it onto the EPST-eligible list. One respondent in particular had been enrolled in the EPST program, and when the business re-located, no actions were taken to enroll the new business location into the program. This respondent also mentioned not receiving follow-up communications after having signed up for EPST through a canvasser, though this was when the pandemic was emerging and lockdowns were taking hold.

Two respondents in the focus groups were found to be ineligible for the program, yet they appeared in the EPST-eligible list that Cadmus used to recruit focus group participants. The EPST-eligible list also contained several multifamily sites, which are not eligible for the EPST program.

Customer-side barriers, such as concerns about comfort and obtaining buy-in from building tenants/occupants, came up in the discussion among a small number of respondents. However, these are less-pressing barriers that could easily be overcome with messaging and education.

Schedule 26 Energy Partner Program

The evaluation based the findings for Schedule 26 from PGE staff notes and PGE presentation decks. As a result, the evaluation lacks information from the customers' perspective.[53]

Overall Outcomes

Schedule 26 Energy Partner program was offered to large business customers inside and outside the SGTB. PGE kept the Schedule 26 offering and customer engagement activities the same for these two groups.

PGE aimed to enroll five of 13 SGTB businesses (approximately 40%) by the end of 2021 and ended up enrolling three businesses: Oak Lodge, University of Portland, and Tri-Cities Wastewater Treatment Plant's Kellogg Creek facility. Oak Lodge began participating in peak time events in winter 2021. University of Portland and the Kellogg Creek facility have signed an agreement to participate and plan to begin participating in events sometime in 2022.

During recruitment of Schedule 26 customers in the Test Bed, PGE found that the existing participation incentives were not a key enrollment barrier (i.e., the incentives did not need to be increased). Rather, the primary recruitment barriers were identifying the right decision makers and maintaining their attention and consideration during the COVID-19 pandemic. PGE also found that the existing Schedule

[53] Cadmus had in-depth interviews planned with Schedule 26 candidates in the SGTB. Due to the small number of available candidates in the SGTB and the lack of any new/unique offerings that PGE could test and potentially apply outside the SGTB, PGE requested Cadmus to cancel the interviews.

26 program offering did not adequately address emerging technologies, such as energy storage batteries, which some customers were interested in.

In Q1 2021 PGE and OPUC discussed the possibility of adding storage batteries to Energy Partner to test their acceptance; however, the short remaining time in Phase 1 would have posed challenges to project planning, development, and operations at customer sites. PGE is currently revising the Energy Partner program and Design Services Group offerings to incorporate batteries. PGE's goal is to make batteries available starting in Q2 2022, pending OPUC approval. PGE has also added a commercial and industrial resiliency study area into Phase II of the SGTB to further explore this potential area of flexible load.

The funds originally allocated to incentives, materials, and equipment for Schedule 26 projects were largely unspent.

Appendix A. Residential SGTB Logic Model

PGE developed an initial logic model in 2019 outlining outputs and outcomes associated with the Smart Grid Test Bed (SGTB) projects' residential sector activities. For the interim evaluation report, the Cadmus evaluation team reviewed the initial logic model and associated key performance indicators (KPIs) for completeness and evaluability. The review uncovered gaps, which PGE addressed in its revised logic model. PGE made final revisions to its logic model toward the end of 2021.

Table A-1 shows the latest version of PGE's residential SGTB logic model as of October 2021. The evaluation team conducted a review of the final logic model and assessed whether PGE had met its intended outcomes and KPI goals. The logic model review and findings are reported in the *SGTB Key Performance Indicator (KPI) Goals* section in the main report.

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 EJC 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, organizations, and other stakeholder groups representing EJC 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.

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 the material and communicate to PGE and implementers 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 noting at what stage of the customer journey the content was received. Table B-1 shows the steps the evaluation team took to systematically review SGTB marketing content, including marketing reviews for the last two customer value proposition (CVP) messaging campaigns (CVP 4 and CVP 5). Key information (Step 2 in Table B-1) was tracked in an Excel spreadsheet, which was shared with PGE following the completion of each CVP campaign.

Table B-1. Systematic Marketing Reviews

Step	Description
Step 1	Gather customer-facing marketing collateral (print, digital, and broadcast media) for each Customer Value Proposition (CVP) campaign
Step 2	Document key information: • Channel and medium • Customer journey point • Target audience • Marketing analytics results from PGE Key words and phrases • Call to action • Images used
Step 3	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 the main report) to calculate key impacts metrics.

The team identified and tracked a set of key metrics 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 and by SGTB neighborhood (North Portland, Milwaukie, and Hillsboro); micro-segment; and several key demographic categories including age (if senior), language (English vs. non-English), and income (low vs. non-low). 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-2 provides a description of these micro-segments.

Table B-2. 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 engagement with technology. Most likely to make online purchases.
Middle Movers	Will track with Fast Growers, proportionally lower values on housing sizes and 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 to view 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, tend to live in smaller housing, lower household income, and comparatively older demographic with fewer children living at home

Source: PGE

Residential CVP Surveys

The Cadmus evaluation team administered surveys for CVP 4 and CVP 5 with residential customers in the SGTB:

- CVP 4 survey (fielded March 31, 2021 through April 15, 2021)
- CVP 5 survey (fielded October 21, 2021 through November 5, 2021)

Survey Design

The CVP survey questions were designed to collect information on the following topics:

- **Awareness and knowledge.** Customer understanding of demand response and grid concepts and awareness of demand response programs
- **Messaging and channels.** Resonance of CVPs, specific content from PGE communications, and channels through which messages are delivered
- **Values and attitudes.** What matters to customers in general, and where energy/PGE/SGTB fits 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 4 survey launched soon after the CVP 4 campaign ended and the CVP 5 survey launched soon after the CVP 5 campaign ended. Both surveys took around 15 minutes for customers to complete. Customers were offered a chance to enter in a prize drawing for completing the survey.

Survey Sampling and Response Rates

For the CVP 4 survey, the evaluation team sampled customers based on the following criteria:

- All customers who enrolled in the CVP 4 Giving Back donation
- Customers who did not enroll in the CVP 4 Giving Back donation
- Customers who have an email address and were not on any do-not-contact list

A sample of 7,507 records were selected for the CVP 4 survey. The sample was stratified by ethnicity and micro-segment. Table B-3 shows the number of customers contacted and the response rates for the CVP 4 survey. The survey gathered a total of 685 completes and achieved an overall response rate of 9%.

Table B-3. Residential SGTB CVP 4 Survey Sample

	Population	Sample Frame	Number of Completes	Response Rate
Overall	**11,704**	**7,507**	**685**	**9%**
By SGTB Neighborhood				
North Portland	4,888	2,984	283	9%
Milwaukie	4,261	2,765	246	9%
Hillsboro	2,555	1,758	156	9%
By CVP 4 Enrollment Status				
Enrollee	150	99	30	30%
Non-Enrollee	11,554	7,408	655	9%
By Race/Ethnicity				
White	7,332	3,688	490*	13%
BIPOC**	1,215	1,215	161*	13%
Unknown	3,157	2,604	34*	1%
By Micro-Segment				
Big Impactors	95	95	10	11%
Borderliners	4,795	2,676	238	9%
Fast Growers	546	546	51	9%
Low Engagers	3,798	2,402	217	9%
Middle Movers	2,449	1,767	165	9%
Null	21	21	4	19%

*Cadmus used survey responses instead of the SGTB tracking data to populate the number of completes for Race/Ethnicity.

**BIPOC 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.

The evaluation team sampled customers for the CVP 5 survey based on the following criteria:

- Test Bed customers who were enrolled in PTR before the start of the CVP 5 campaign
- Customers with an email address who were not on any do-not-contact list

A sample of 10,446 records were selected for the CVP 5 survey. The sample was stratified by experimental group. Table B-4 shows the number of customers contacted and the response rates for the CVP 5 survey. The survey gathered a total of 1,078 completes and achieved an overall response rate of 10%.

Table B-4. Residential SGTB CVP 5 Survey Sample

	Population	Sample Frame	Number of Completes	Response Rate
Overall	**10,483**	**10,446**	**1,078**	**10%**
By SGTB Neighborhood				
North Portland	4,307	4,296	462	11%
Milwaukie	3,835	3,814	392	10%
Hillsboro	2,341	2,336	224	10%
By Race/Ethnicity				
White	6,558	6,535	799*	12%
BIPOC**	1,012	1,009	186*	18%
Unknown	2,913	2,902	93*	3%
By Smart Thermostat Program Eligibility				
Eligible	4,790	4,781	451	9%
Ineligible	5,693	5,665	627	11%
By Experiment 1 (Thermostat Ineligible)				
PTR Control	2,828	2,816	305	11%
PTR Treatment	2,865	2,849	322	11%
By Experiment 2 (Thermostat Eligible)				
Control	1,602	1,596	155	10%
Migration Treatment	1,588	1,586	130	8%
PTR Treatment	1,600	1,599	166	10%
By Micro-Segment				
Big Impactors	65	65	8	12%
Borderliners	4,422	4,411	422	10%
Fast Growers	471	471	57	12%
Low Engagers	3,241	3,226	340	11%
Middle Movers	2,284	2,273	249	11%

* Cadmus used survey responses instead of the SGTB tracking data to populate the number of completes for Race/Ethnicity.

** BIPOC 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 overall survey results.

CVP 3 Resonance Assessment

The resonance assessment was a multivariate regression analysis to determine which customer values strongly correlated with PTR event participation and whether customer values differed between all-event and some-event participants. Cadmus used linear probability models to assess the relationships

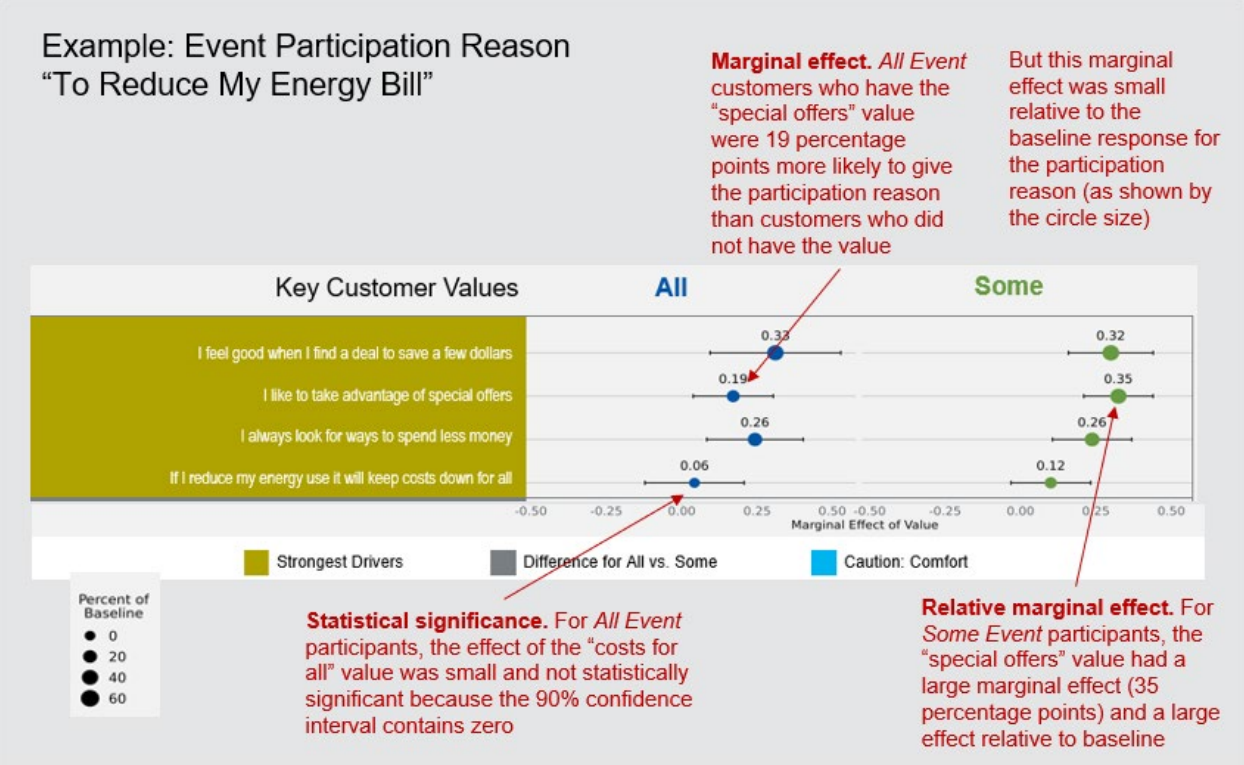
between customer values and their event participation reasons or their level of event participation as reported by respondents in the CVP 3 survey.

To establish which values correlated most strongly with reasons for participation, the evaluation team assessed:

- The significance of the correlations by the absolute size of the regression coefficient (the percentage point effect, e.g., 30 percentage points)
- The statistical significance of the coefficient (whether the 95% confidence interval excludes a zero effect)
- The size of the regression coefficient relative to the baseline response rate (the percentage effect, e.g., a 75% lift relative to customers who did not report Very True)

The effect of having each value, shown in the gold box in Figure B-1, on the probability of giving the participation reason ("Reduce My Energy Bill") was estimated in a separate OLS regression. The regressions had the form: **I**(Participation Reason is "Very True") = $\beta_0 + \beta_1$**I**(*All Events*) + β_2**I**(Value is "Very True") + β_3**I**(Value is "Very True") x **I**(*All Events*) + ε, where **I** is a 0-1 indicator variable that equals one if the statement in the parentheses is true and that equals zero otherwise. β_2 is the marginal effect and β_2/β_0 is the relative marginal effect for *Some Event* customers; and $\beta_2 + \beta_3$ is the marginal effect and $(\beta_2 + \beta_3)/(\beta_0 + \beta_1)$ is the relative marginal effect for *All Event* customers. The baseline for *All Event* customers is the percentage of *All Event* customers for whom **I**(Participation Reason is "Very True") =1 and **I**(Value is "Very True")=0. The baseline for *Some Event* customers is defined analogously.

Figure B-1. CVP 3 Resonance Assessment Regression Primer



Energy Partner Smart Thermostat Focus Groups

The evaluation team conducted online focus groups with small and medium-size business customers located in the SGTB who have not enrolled in the EPST program. The focus groups sought to address these four research objectives:

- Assess customers' awareness of and attitudes toward demand response, load control events, and the SGTB
- Identify value statements, incentives, and program features that drive customers to enroll in the EPST program
- Explore customer motivations, barriers, and willingness to participate in the EPST program
- Understand customer decision-making for program enrollment, including most-effective communication channels for program information

Sampling and Recruitment

The evaluation team recruited focus group participants over the telephone from PGE's EPST program-eligible customer list of non-enrollees. Customers were offered a gift card incentive for their participation in the focus group.

Customers had to pass the following screening criteria before they were eligible to participate in a focus group:

- Be a commercial PGE customer in the SGTB
- Be responsible for making business decisions related to energy use and operations (i.e., owner or manager)
- Not be a PGE employee or affiliated with a PGE employee
- Occupy an owned commercial space, or for tenants, be able to get permission from their property owner or manager to replace their current thermostat
- Have an HVAC system eligible for the EPST program (i.e., ducted central AC, heat pump, or electric furnace)
- Have a permanently installed Wi-Fi network at the commercial space
- Have a computer and internet access that meets virtual focus group technology requirements
- Be able to articulate clearly in English
- Not be a business that manages residential real estate properties (added after Group 1)

Table B-5 shows details of the focus groups, including date, time, and number of participants. The firmographics of the customers who were recruited and attended are shown in Table B-6.

Table B-5. Focus Group Information

Group	Date and Time	Participants Recruited	Participants Attended
Group 1 (All pitched)*	4/6, 7:30-9:00pm	5	4
Group 2 (Unknown)*	5/6, 7:00-8:30pm	7	6
Total		**12**	**10**

*All 4 participants who attended Group 1 session received the EPST marketing pitch from Green Mountain Energy or CLEAResult. For Group 2 recruitment, marketing pitch data were not provided, therefore status is unknown.

Table B-6. Firmographics of Business Customers Who Attended the Focus Groups

Category	Group 1 7:30-9:00pm	Group 2 7:00-8:30pm
SGTB Neighborhood		
North Portland	1	3
Milwaukie	2	2
Hillsboro	1	1
Business Segment		
Healthcare	1	2
Restaurant	0	2
Office	1	0
Education	0	1
Church	0	1
Construction	1	0
Multifamily Real Estate	1	0

Category	Group 1 7:30-9:00pm	Group 2 7:00-8:30pm
Business Certification		
Minority Business Enterprise	2	0
Women Business Enterprise	0	2
Standard (Male/Caucasian)	2	4
HVAC System (Multiple Answers Allowed)		
Ducted Central AC	3	4
Ducted Heat Pump	1	2
Ducted Electric Furnace	2	2

Focus Group Discussion

To frame the focus group discussion, the evaluation team developed a guide to answer the four research objectives. Each focus group lasted 90 minutes and involved a pre-group polling activity, introductions, a discussion on demand response awareness, a discussion on smart technology barriers and opportunities, concept testing of the EPST program, and a discussion on motivations and values.

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 all focus groups and questions were analyzed in a consistent manner. The team then systematically identified trends and differences among respondent groups and segments and drew out key findings and quotes that exemplified respondent thoughts.