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March 30, 2021

MEMORANDUM

TO: Council Members

FROM: Tina Jayaweera

SUBJECT: Portland General Electric - Smart Grid Test Bed Interim Evaluation

BACKGROUND:

Presenter: Tim Treadwell, Jason Salmi Klotz, Portland General Electric

Summary: As part of the acknowledgement of Portland General Electric's (PGE) 2016 Integrated Resource Plan, the Oregon Public Utilities Commission ordered the company to establish a test bed that would enable PGE to accelerate the development of new flexible load capability and test new strategies in engaging customers in demand response. This "smart grid test bed" was launched in July 2019 in three separate neighborhoods within PGE's territory.

An overall goal of the test bed is to gain insights into customer behavior and value propositions that PGE could then apply to its larger service territory to acquire needed flexible load capacity. Types of demand response products tested include: peak time rebates, smart thermostat load control in both residential and nonresidential buildings, water heater load control, including within multifamily buildings, and battery storage direct load control.

Integral to ensuring successful implementation of the test bed, PGE hired a third-party evaluation contractor to provide near real-time learnings. An interim evaluation report was released in January 2021, covering the first 16 months of the project (July 2019 – Oct 2020). PGE staff will share key

findings from this report and speak to ongoing work within the test bed and future plans.

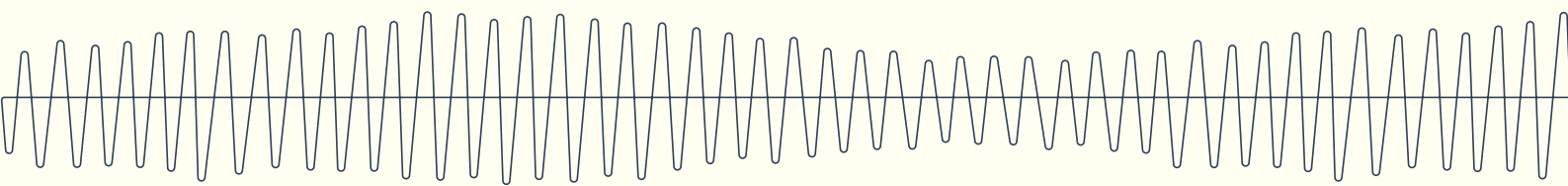
Relevance: Demand response was identified as a key component of the Seventh Power Plan preferred resource strategy. However, minimal incremental DR has been implemented in the region since the Plan's release, except for by PGE. PGE's work with the smart grid test bed is innovative in understanding both customer value propositions and impacts from a variety of demand response programs.

Background: PGE's smart grid test bed website:

<https://portlandgeneral.com/about/smart-grid/smart-grid-test-bed>

PGE presented to the Council in August 2019 on their recent IRP and the impetus for the smart grid test bed. See

https://www.nwcouncil.org/sites/default/files/2019_0813_6.pdf



PGE's Flexible Load Portfolio - Northwest Power Conservation Council

April 7, 2021

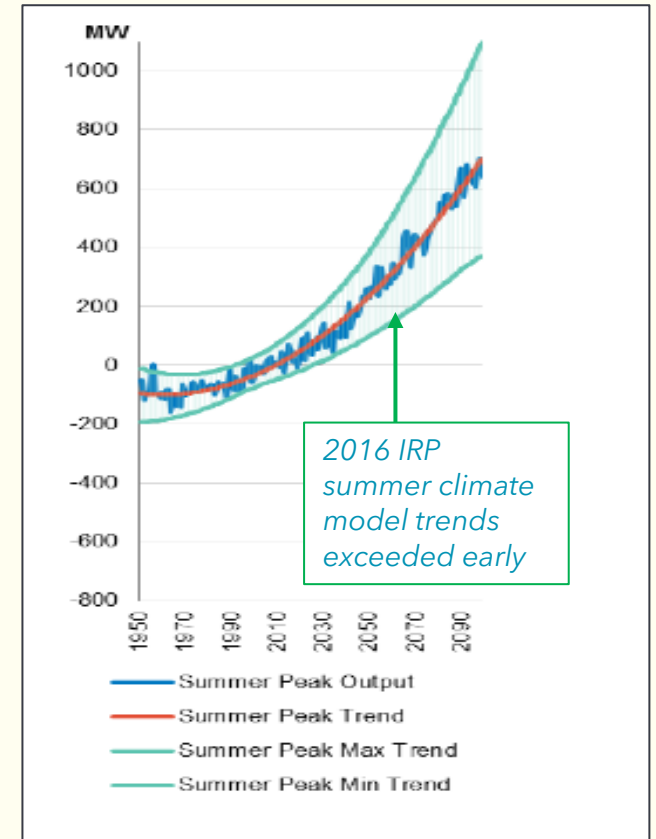


PGE Shifting to Become Summer Peaking Utility

- Nationally, most utilities focus DR development on summer peak: PGE is a rare dual season peaking utility
- PGE seasonal load is shifting to summer more rapidly than projected in the 2016 IRP climate study, this trend reverses under high-electrification scenarios

2021 Goals		
	Summer	Winter
Low	40	36
2016 IRP Adopted	69	77
High	162	191

2025 Goals		
	Summer	Winter
Low	108	73
2019 IRP Adopted	211	141
High	383	297

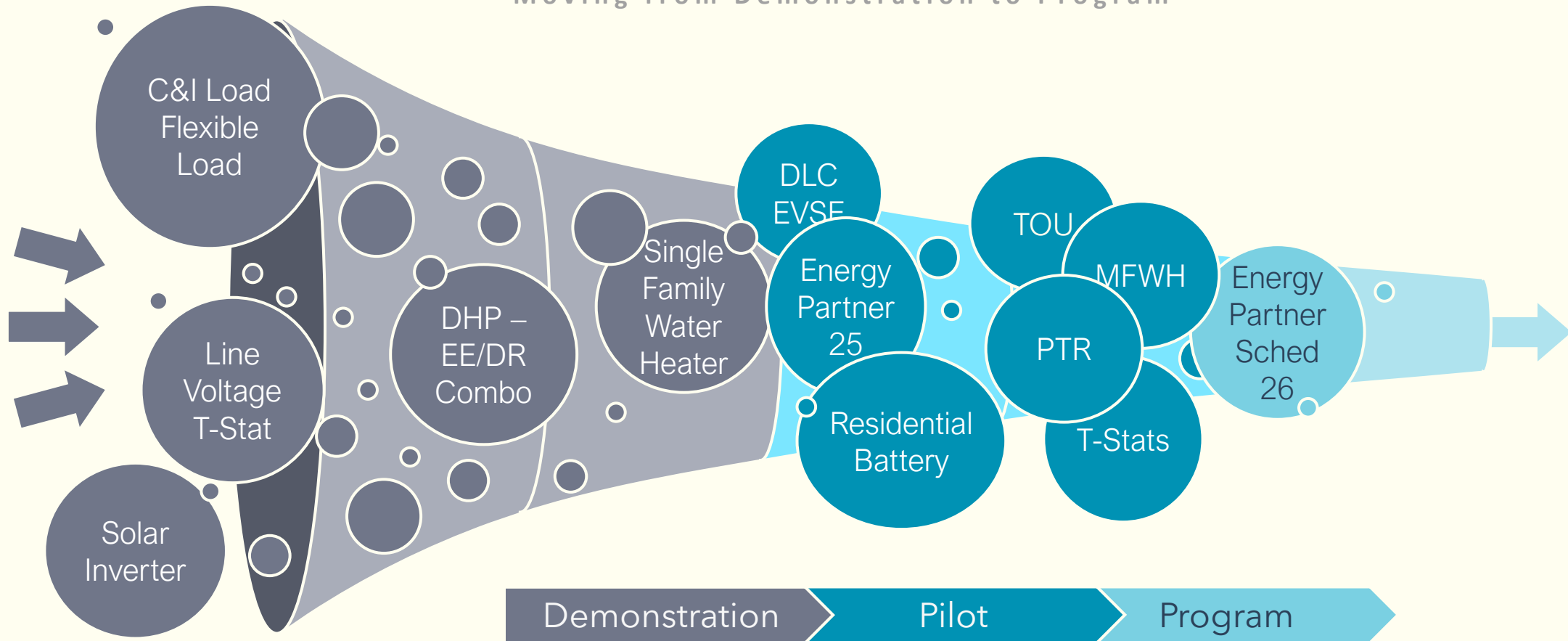


PGE 2016 IRP Chapter 5 Climate Study



Program Funnel

Moving from Demonstration to Program



PGE is building a funnel of programmatic activity moving from discovery and demonstration through to pilot scaling to firm service territory wide offering incorporated into power operations resource portfolio.



Megawatt Savings by Activity

End of Year 2020 Total Resource

ACTIVITIES	Summer MW	Winter MW
Energy Partner Schedule 26	18.8	14.0
Energy Partner Schedule 25	0.9	0.7
Multi-Family Water Heater	4.0	6.0
Peak Time Rebates	14.6	10.9
Smart Thermostats	24.4	7.0
	62.7	38.6



Smart Grid Testbed - Understanding and Realizing DR Value

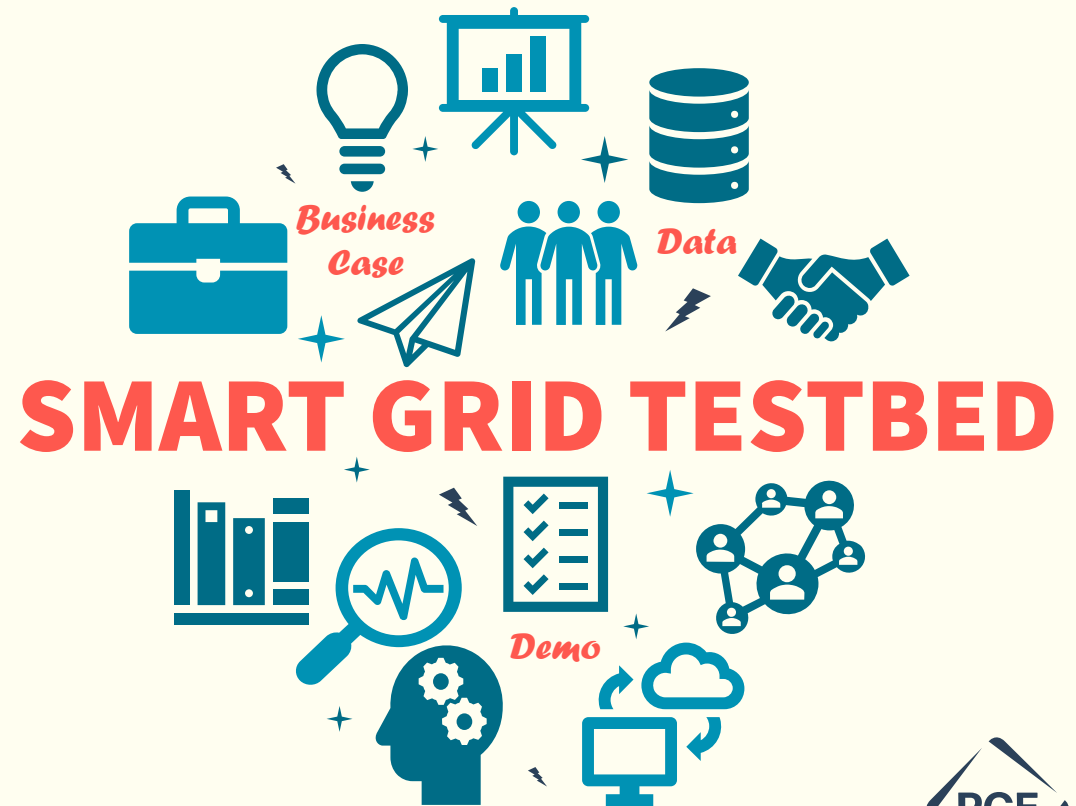
The Smart Grid Testbed (SGTB) Program is focused on demand response (DR) technology and markets; using marketing strategies to understand differential response to customer value propositions and assessing the technical potential of DR resources in the service territory.

Key Statistics

- \$5.9M
- 2.5 years
- 66% Participation

Research Objectives

- Identify sustainable customer value proposition.
- Accelerate the pilot to program cycle.
- Collect data to inform maximum technical potential.



Accelerating Customer Engagement

Demand Response Products and Programs

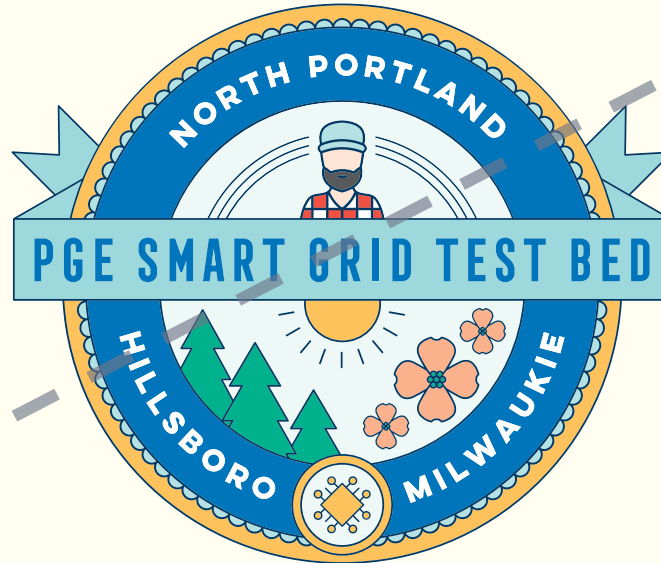
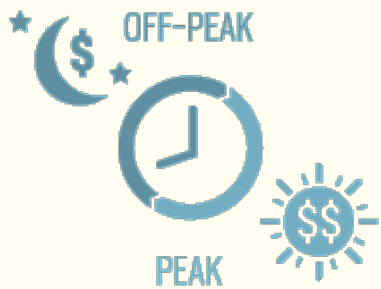
Non-Firm

Customer Journey

Firm

Peak-Time Rebate

Time-of-Use



Smart Thermostats



Multifamily Water Heaters

SF Heat pump water heaters



EV Chargers



Distributed Energy Storage

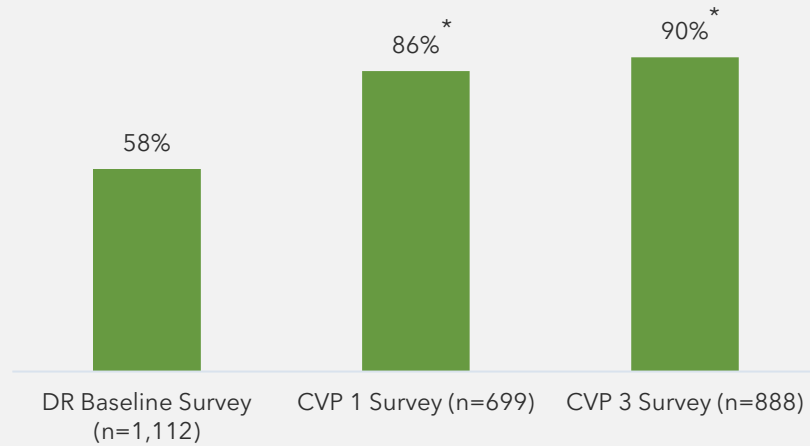


Interim Report - Key Findings to Date

Increasing Knowledge, Awareness and Participation

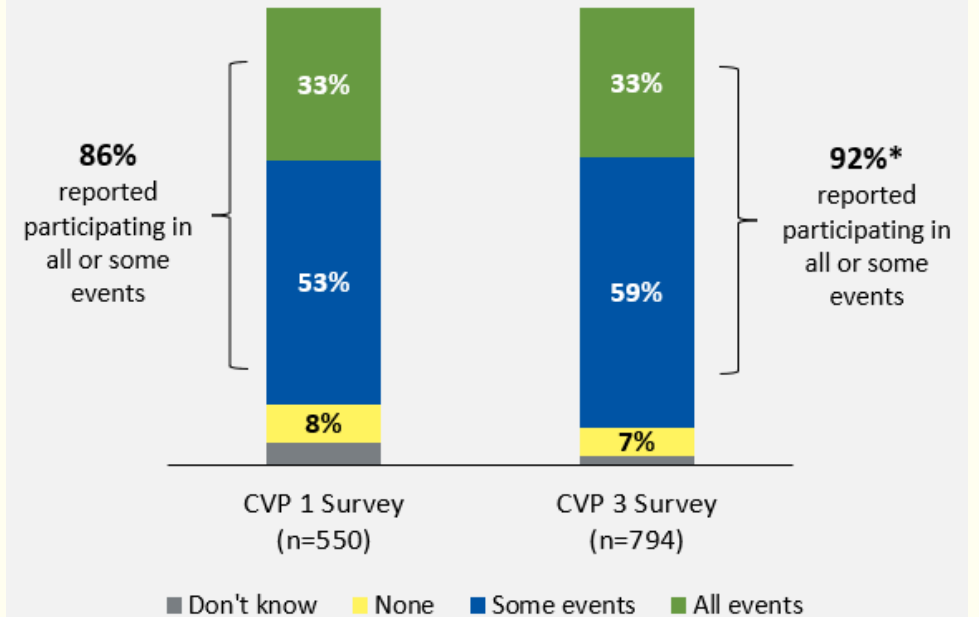
DR Awareness Relative to Baseline

Percentage of Respondents Aware of Demand Response Concept



* Difference from baseline is significant with 90% confidence

Self-Reported Event Participation



Interim Report - Key Findings to Date

Increasing Knowledge, Awareness and Participation

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

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%)

Motivation Typology Key

Money

Community

Environment / Carbon

Social Responsibility

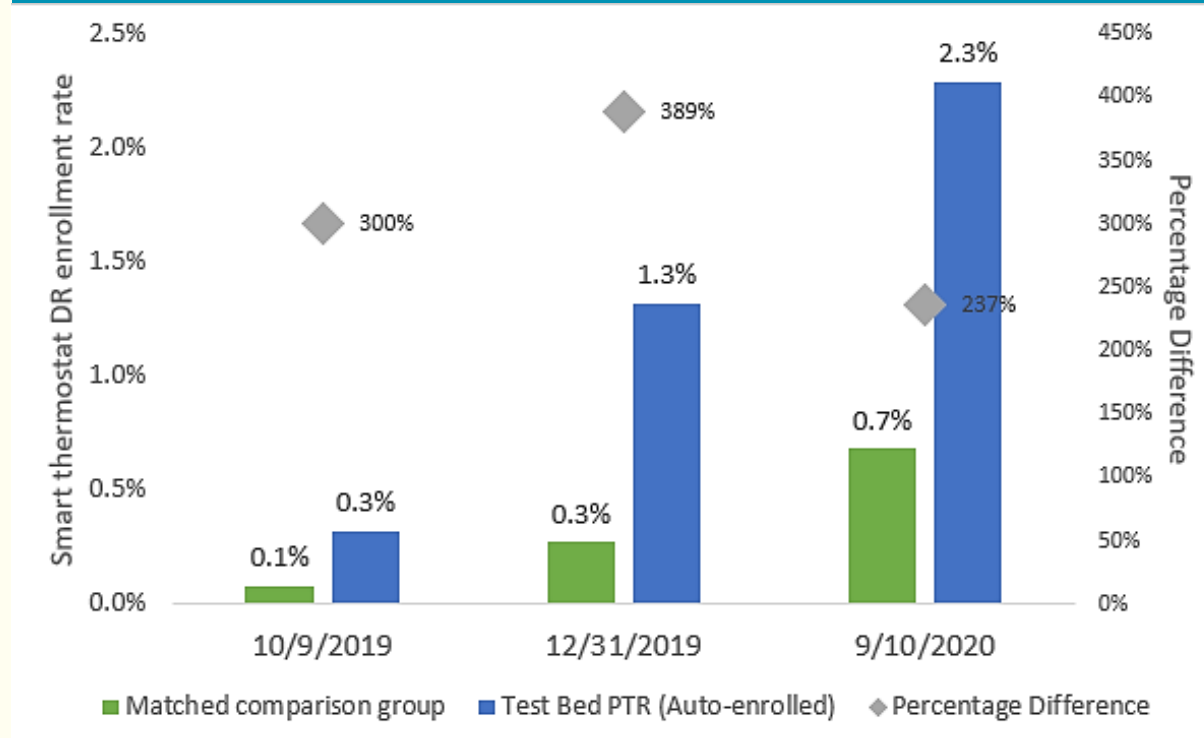
Other



Interim Report - Key Findings to Date

Increasing Knowledge, Awareness and Participation

Auto-enrollment in PTR then encouraging migration tripled smart thermostat DR enrollments rates.



The Test Bed PTR and matched comparison group were customers who were not enrolled in PGE's smart thermostat demand response program prior to July 13, 2019, when SGTB customers were automatically enrolled in the PTR program.



Interim Report - Key Findings to Date

Increasing Knowledge, Awareness and Participation

Two key barriers to migration to the Smart Thermostat DLC program are customers' perceived eligibility and concern about ceding control

Not sure if the smart thermostat would work with my heating or cooling system

63% said true (n=508)
33% very true for me
30% somewhat true for me

My home was not eligible for the program

46% said true (n=495)
29% very true for me
17% somewhat true for me

I am concerned about giving PGE control of my thermostat

47% said true (n=504)
19% very true for me
28% somewhat true for me

I am concerned the program would make my home feel uncomfortable

28% said true (n=502)
6% very true for me
22% somewhat true for me

HVAC Eligibility
concerns often coupled together (33%)

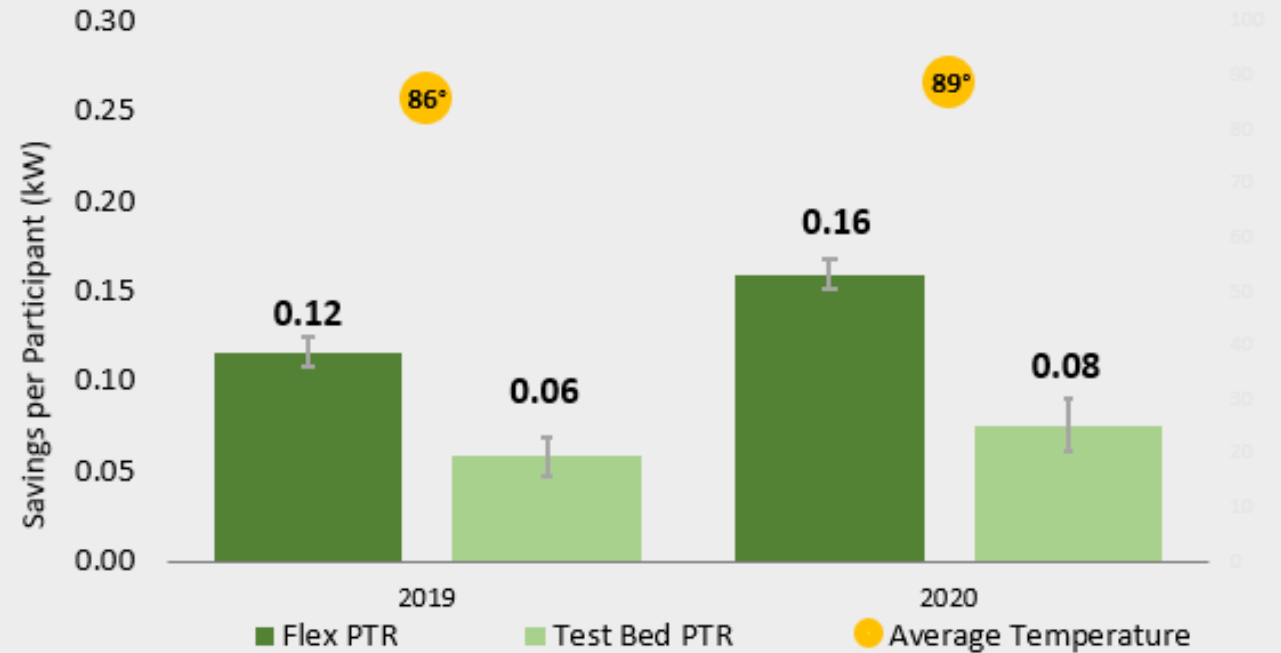
Control Keepers
concerns often coupled together (23%)



Interim Report - Key Findings to Date

Increasing Knowledge, Awareness and Participation

SGTB Auto-enrollees saved, but less so than Flex Participants



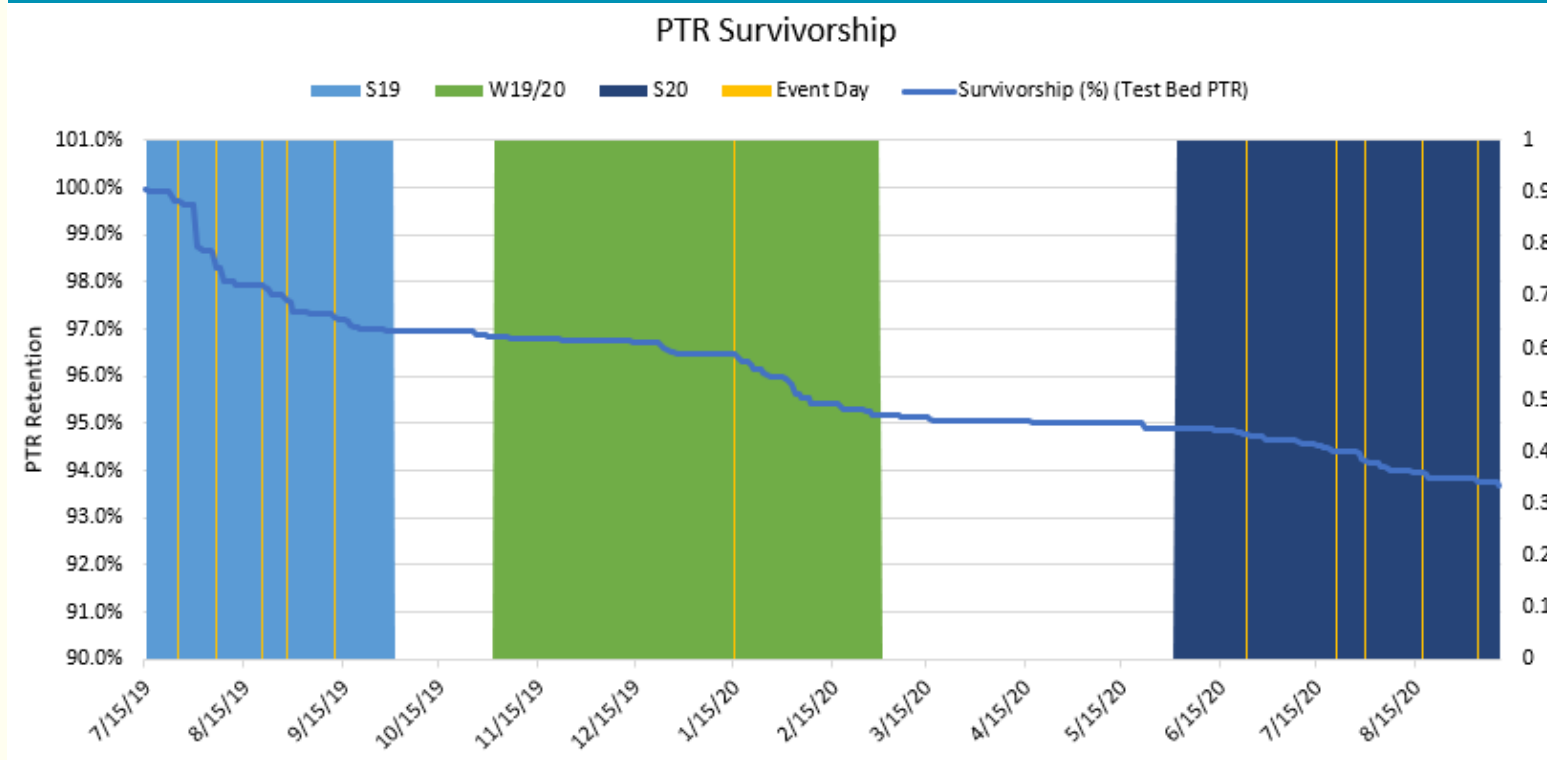
Note: Error bars indicate 90% confidence intervals calculated from standard errors clustered on customers.



Interim Report - Key Findings to Date

Increasing Knowledge, Awareness and Participation

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



Interim Report - Key Findings to Date

Increasing Knowledge, Awareness and Participation

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

For **low-income customers**, **structural barriers** to participating in demand response programs exist (living in older homes that lack quality weatherization) and contribute to logistical challenges with shifting energy use

Driving participation in Smart Thermostat DLC among **renters** is challenging, given the need for **landlord approval** before installing new appliances and devices

DR educational materials have been largely limited to **English**, though PGE offered PTR and Smart Thermostat DLC information in Spanish (and Russian for PTR) but not in **other languages**

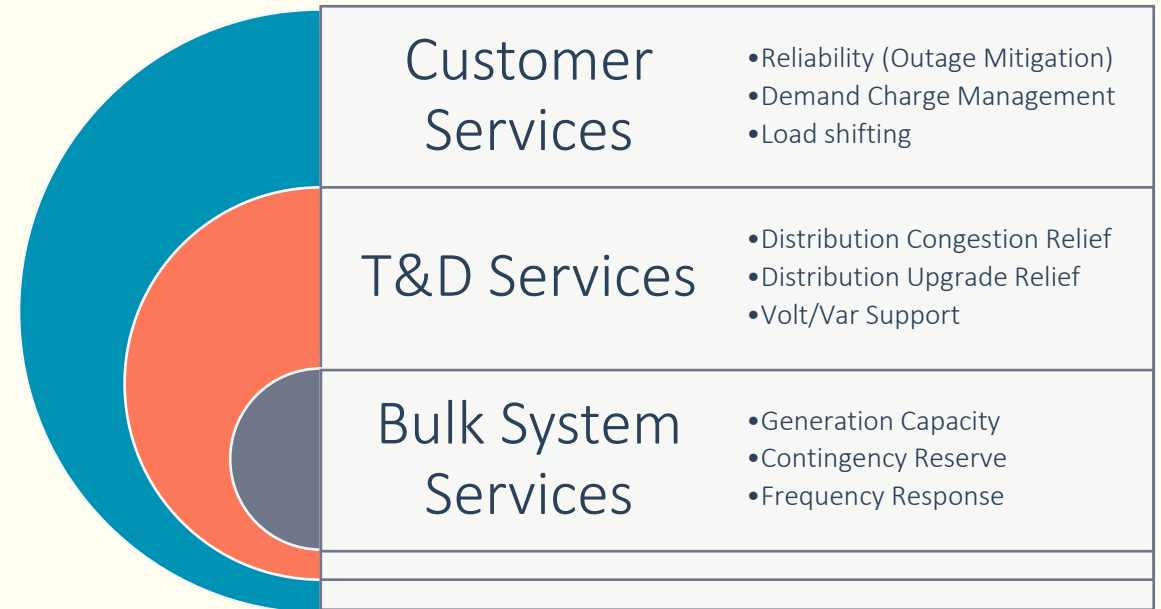
Note: Underserved customers include the following groups: low-income customers, non-English speakers, people of color, and renters.



SGTB Phase II

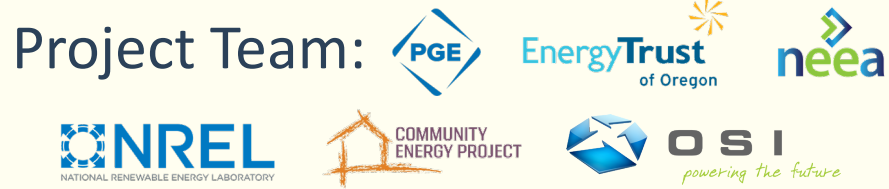
Operationalizing Flexibility as a Grid Resource

- Budget and Timeline
 - \$11M, 5-year Plan (2022 – 2026)
- Program Research Areas
 - New Construction Bundle
 - C&I, Municipal Flexible Load & Resiliency
 - Distributed PV/Smart Inverters
 - Multifamily Bundle
 - Managed Charging/V2X
 - Flexible Feeder
 - Non-Wires Alternatives



DOE Connected Communities

Demonstrating DERs as a Utility Operational Asset



Project Goal:

- Quantify the potential of DERs as an operational asset;
- Demonstrate the value of efficiency and flexibility to deliver grid services, while improving comfort and satisfaction;
- Develop and deploy grid controls focused on scalability, resilience, and grid services;
- Quantify the financial and experience benefits of DERs for historically underserved customers, and;
- Drive market transformation within the region's planning processes, contractor networks and supply chains.



SALMON
SmartGrid Asset Load Management
& Optimized Neighborhood

Host Utility, Principal Investigator, Load Flexibility: PGE

Technical Lead, System Modeling & Integrated Grid: NREL

Underserved Community Engagement Lead: COMMUNITY ENERGY PROJECT

Advise + Scale Solutions: neea, OREGON ENERGY, Northwest Power and Conservation Council

Energy Efficiency and Solar: EnergyTrust of Oregon

Overlook/ Arbor Lodge

OUTCOME:
Accelerate the growth and utilization of efficiency, flexible load, distributed generation, and electric vehicles as a resource in grid operations across the Pacific Northwest.



Thank you

Jason Salmi-Klotz

Manager of Regulatory and Policy Strategy for Integrated Grid and Customer Programs

Timothy Treadwell

Manager, Customer Technology Development and Smart Grid Testbed Program Manager

