Appendix G. Smart grid test bed phase II project descriptions

G.1 Flexible feeder

As PGE's flexible load portfolio expands and its DERMS capabilities mature, there is a growing need to understand how DERs can be integrated into distribution operations and the value they provide. In this research area, projects will be developed to explore the values of DERs as an operational asset, by driving high levels of dispatchable load on a single feeder, using targeted incentives for new equipment, controls, storage, distributed solar and EE. This work will involve close collaboration between PGE and Energy Trust of Oregon, as the two organizations learn about co-deployment of DER solutions and the capabilities of a virtual power plant by investing in significant DER deployment in a traditionally under-served North Portland community historically subjected to redlining and gentrification.[87]

The purpose of the project is to create a concentration of resources dense enough to create or approach the capabilities of a virtual power plant.

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

The effort will target a mix of 750 single family, multifamily, and commercial customers.

G.2 Managed charging/V2X

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

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

The effort will target 300-500 vehicles.

87. Mapping inequality, available at: https://dsl.richmond.edu/panorama/redlining/#loc=12/45.564/-122.758&city=portland-or, 2018 Gentrification and displacement neighborhood typology assessment, available at: https://www.portland.gov/sites/default/files/202001/gentrification_displacement_typology_analysis_2018_10222018.pdf

G.3 Distributed PV/smart inverters

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

Projects in this area will assess the value of inverter-based controls to deliver distribution operations value (e.g., Volt/VAR support); address hosting capacity issues, including as an alternative to PGE's two-meter solution; and support orchestration of DERs together with distributed solar and storage to minimize grid export. Work in this area may also include rate design (e.g., fixed price) and transactive energy strategies that incentivize self-consumption and/or distribution level load balancing. The effort will target participation from 200-400 customers.

G.4 Commercial & industrial, municipal flexible load and resiliency

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

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

The effort targets five large C&I sites, five municipal sites, and a hundred small-medium business sites. The technologies to be evaluated may include:

- Building management systems
- Self-generation
- Energy storage
- EE and DR strategies and measure installation

G.5 Multifamily bundle

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

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

The effort will target three-to-five buildings, representing approximately 500 multifamily units.

G.6 Single family new construction bundle

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

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

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

The effort targets up to three residential developer partners, and a goal of 200-300 participating homes. The technologies evaluated may include:

- Smart thermostat/DHP controls
- Heat pump water heater
- Solar PV with smart inverter
- Battery storage
- Home energy management system (HEMS)