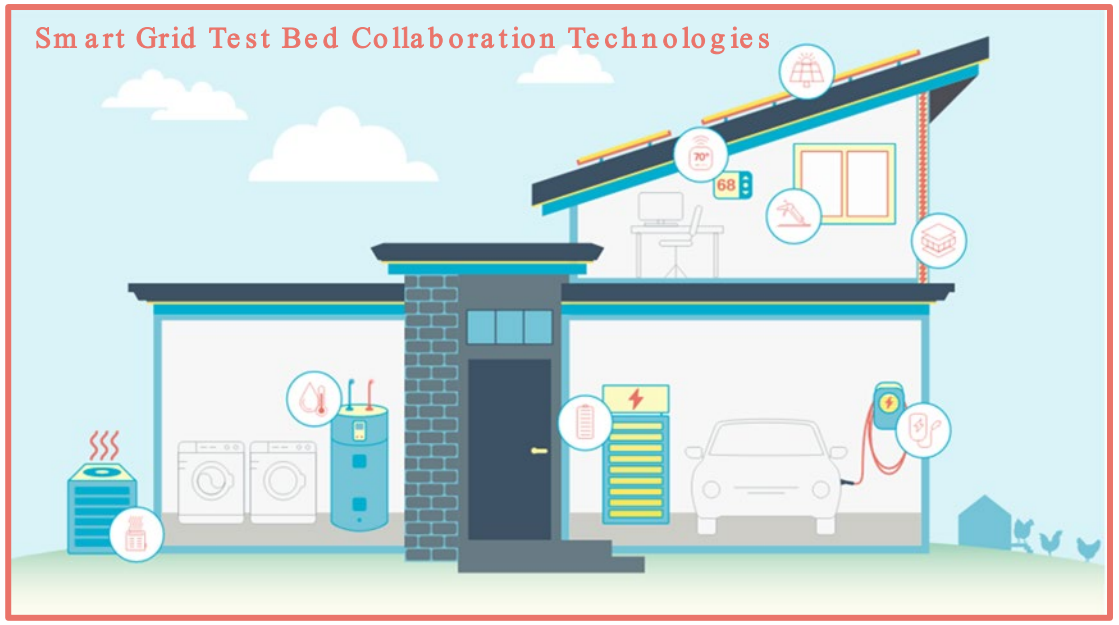
2024 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BUILDING TECHNOLOGIES OFFICE

BTO Peer Review: SALMON

SmartGrid Advanced Load Management & Optimized Neighborhood

SALMON:
SmartGrid Advanced Load Management & Optimized Neighborhood

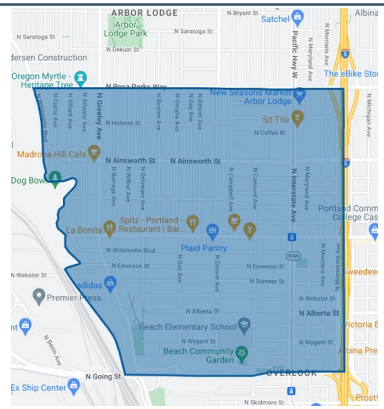


Portland General Electric
Matt Hubbard, Manager Distributed Device Strategy
matt.hubbard@pgn.com
FOA 0002206; DE-EE0009778

Project Summary

OBJECTIVE, OUTCOME, & IMPACT

Build a 1.4 MW flex load resource in the study area consisting of energy efficiency (EE), connected devices, solar, storage, and EVs. Demonstrate bulk services (energy, generation capacity and frequency response) and distribution services (congestion relief, power quality, and VVO/CVR). Improve efficiency by 10% across treated sites.



TEAM & PARTNERS

PRIME: Flexible load program design, rate design, project management, evaluation

FFRDC: Digital Twin Design and use case testing, evaluation

Sub-Recipient: EE program design and delivery, contractor training, incentive delivery, evaluation

Sub-Recipient: LMI delivery, outreach, canvassing, HES delivery, evaluation

STATS

Performance Period: **06/2022 – 08/2027**

DOE Budget: **$6.65M**, Cost Share: **$5.02M**

Milestone 1: **Complete Evaluation Plan**

Milestone 2: **Develop Community Model**

Milestone 3: **Develop and Launch Customer-facing Programs and Recruitment, Complete Modeling**

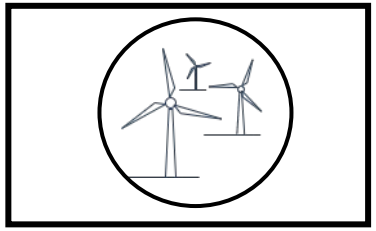
Milestone 4: **Grid Operations and Regional Sharing**

Problem: The utility operational landscape is increasingly complex

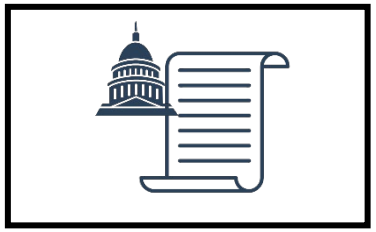
Need: Utilities must evolve and optimize flexible grid capabilities to meet customer-community needs

Grid Complexities:

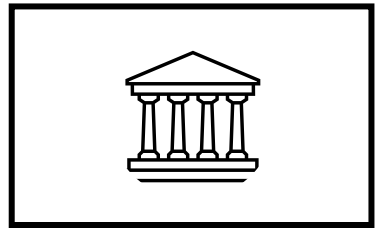
Customer Expectations



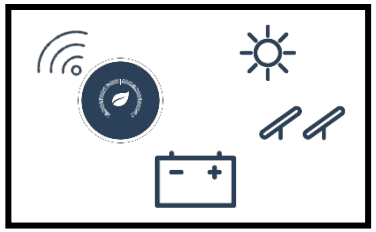
Regulatory Environment



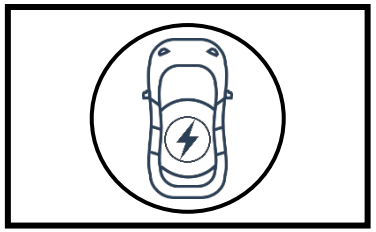
Evolving Energy Markets



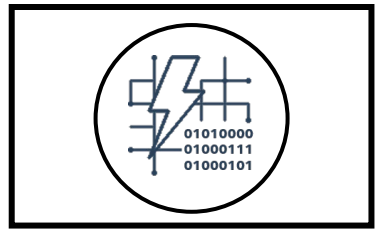
Distributed Energy Resources (DERS)



New Dynamic Loads



Increased Network Complexity



Alignment and Impact

DOE Strategy & Blueprint: Energy justice, decarbonization, and grid transformation

Energy Justice

Prioritize Equity

Prioritize Affordability

- Retrofit approximately 20% of the buildings in two historically underserved neighborhoods
- Prioritize upgrades for LMI and underserved customers

Decarbonization

Increase Building Energy Efficiency

- Build up to 1.4MW of clean, flexible load resource
- Increase efficiency by an average of 10% across all treated sites

Grid Transformation

Transform Buildings at Grid Edge

Prioritize Resilience

- Build a concentration of dispatchable assets
- Potential to fundamentally change the market for efficiency and load flexibility in the Pacific Northwest
- Transform efficiency and load flexibility use in grid operations

Alignment and Impact

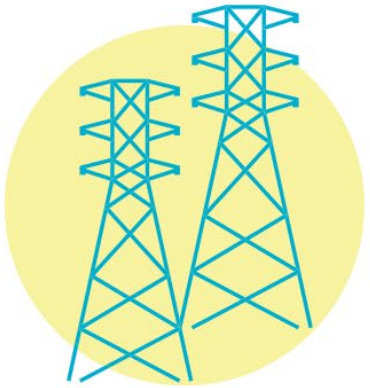
PGE Strategic Imperatives

Decarbonize

Reduce greenhouse gas emissions associated with electricity served to retail customers.

Electrify

Increase beneficial electricity use to capture the benefits of new technologies while building an increasingly clean, flexible and reliable grid.



Perform

Improve efficiency, safety and system and equipment reliability while maintaining affordable energy service.

Virtual Power Plant

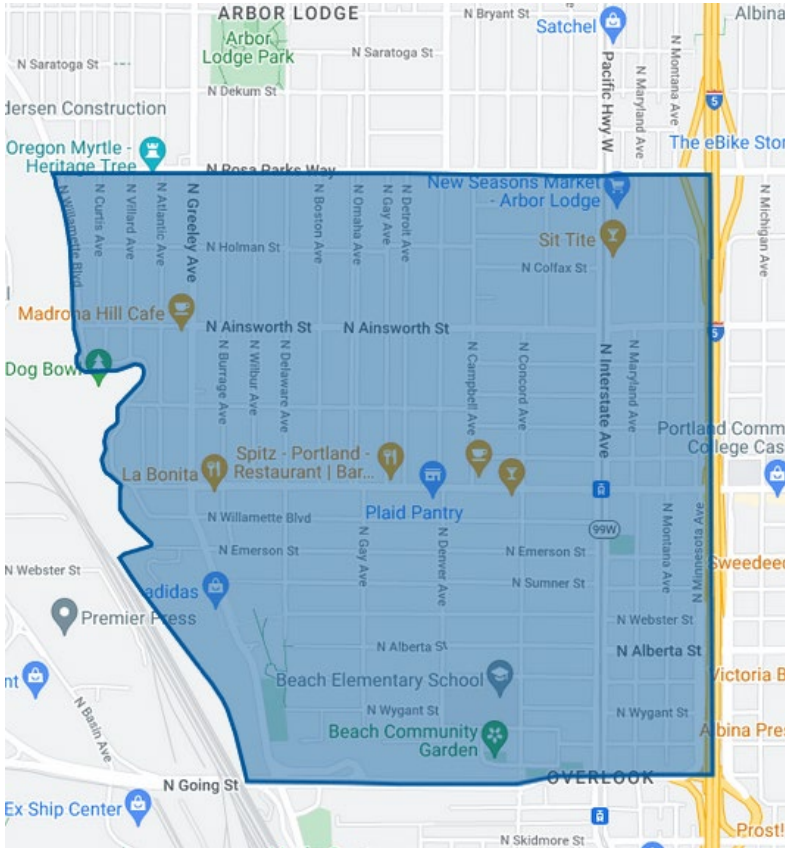
Enable and scale a fully-integrated, system that can effectively plan, manage, and optimize a network of dispatchable DERs to achieve a safe, reliable, and resilient clean energy future where all customers can participate and benefit.

Alignment and Impact

Build resiliency in the neighborhood and reduce the carbon footprint. Build new delivery models and inform market transformation activities regionwide.

Systematically test the co-benefits of efficiency and flexible load. Build an understanding of their value of as a resource for new grid operations use cases.

Build the technical capability to inform PGE's VPP strategy by conducting hardware and software in the loop testing of the utility's ADMS/ DERMs systems with the Community Model. Deploy the designed strategies in the field for confirmation of modeled benefits.



Project SALMON Neighborhood Boundary

Implementation Approach

Providing Additional Incentives for prioritized measures in the project area **to increase** participation and enable efficiency projects to be "no- or low- cost" to all customers. Free HES score as entry point.

Streamlining **the installation process** by using select contractors (trade allies) who participate in commissioning training for all grid-connected devices.

Offering free retrofits and replacements to **low-income and BIPOC households** including weatherization, maintenance and safety repairs, deep energy retrofits, and water heater **replacements**

Customers will also receive enrollment and ongoing incentives to automate their smart devices, such as thermostats, water heaters, electric vehicle chargers and batteries, to work in concert with PGE as it operates the grid.

Small to medium businesses will be served through direct outreach where a single point person shares details on eligible improvements and incentives specific to their site.

Target Audiences

Based on market intelligence of the eligible neighborhoods, the Collaboration is primarily targeting the following audiences within the Smart Grid Test Bed Collaboration boundary:

- Residential customers, including high-adopter and lagging/underserved audiences (e.g., low-income segments, communities of color)
- Small/medium-sized business owners
- Large commercial

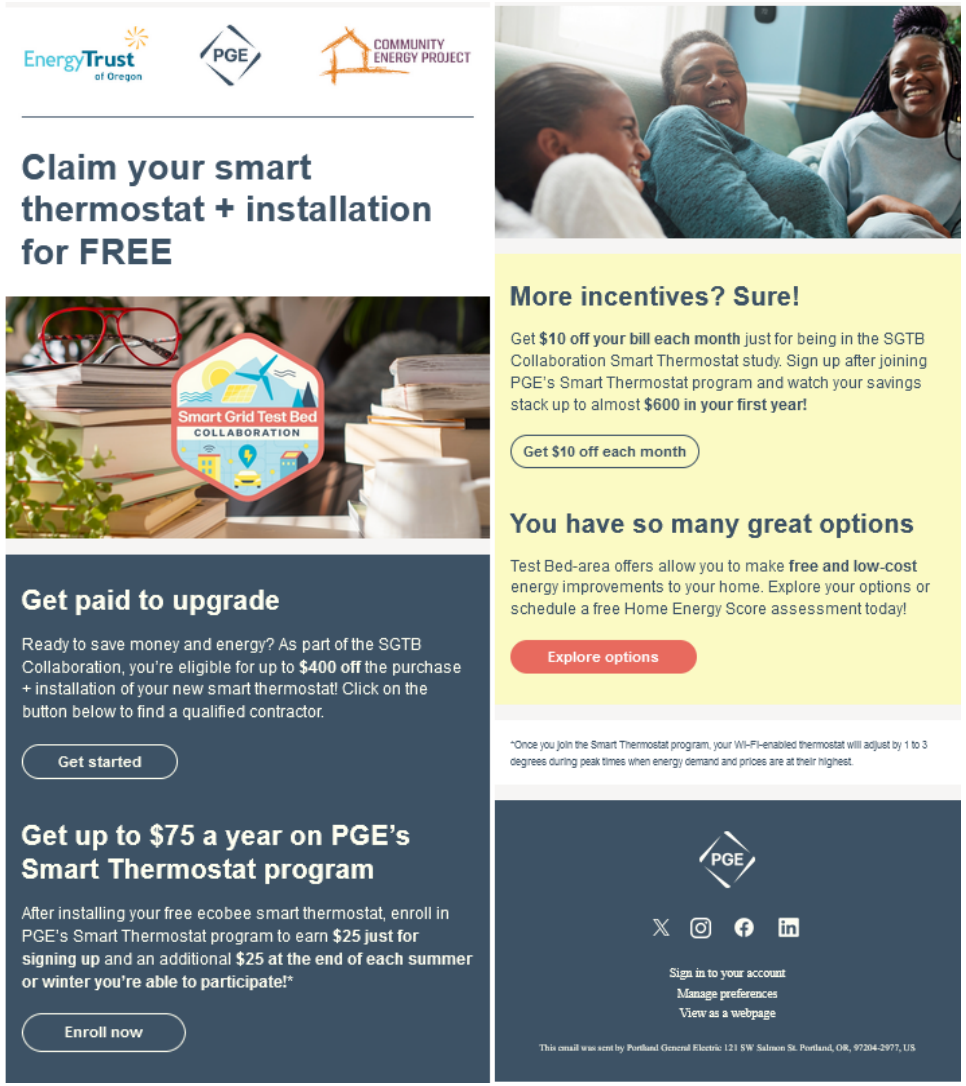
Rebates and Incentives

Residential

- **Home Energy Score:** Free to any single-family home in SGTB Collab area
- **Smart Thermostats:** Free contractor install for eligible HVAC systems; enhanced energy shifting incentives
- **Weatherization**: Low to no cost attic insulation for residents; enhanced rebates for wall & floor weatherization.
- **Solarize Campaign:** January-February; enhanced rebates for solar & storage installations
- **Smart Water Heater**: equipment rebate; enhanced energy shifting incentives
- **Electric Vehicle Charging**: Charger/panel rebates; enhanced energy shifting incentives
- **HVAC**: Heat Pump and Ductless Heat Pump rebates

Commercial

- **Free Energy Efficiency Audit**: PGE delivers through inhouse advisors
- **Smart Thermostats**: Free contractor installed Honeywell Thermostat
- **Large Commercial Customers**: Additional project cost buy down



Customer Participation Progress: Sept. 2024

100+ DERs in SALMON project area

Customer Communications

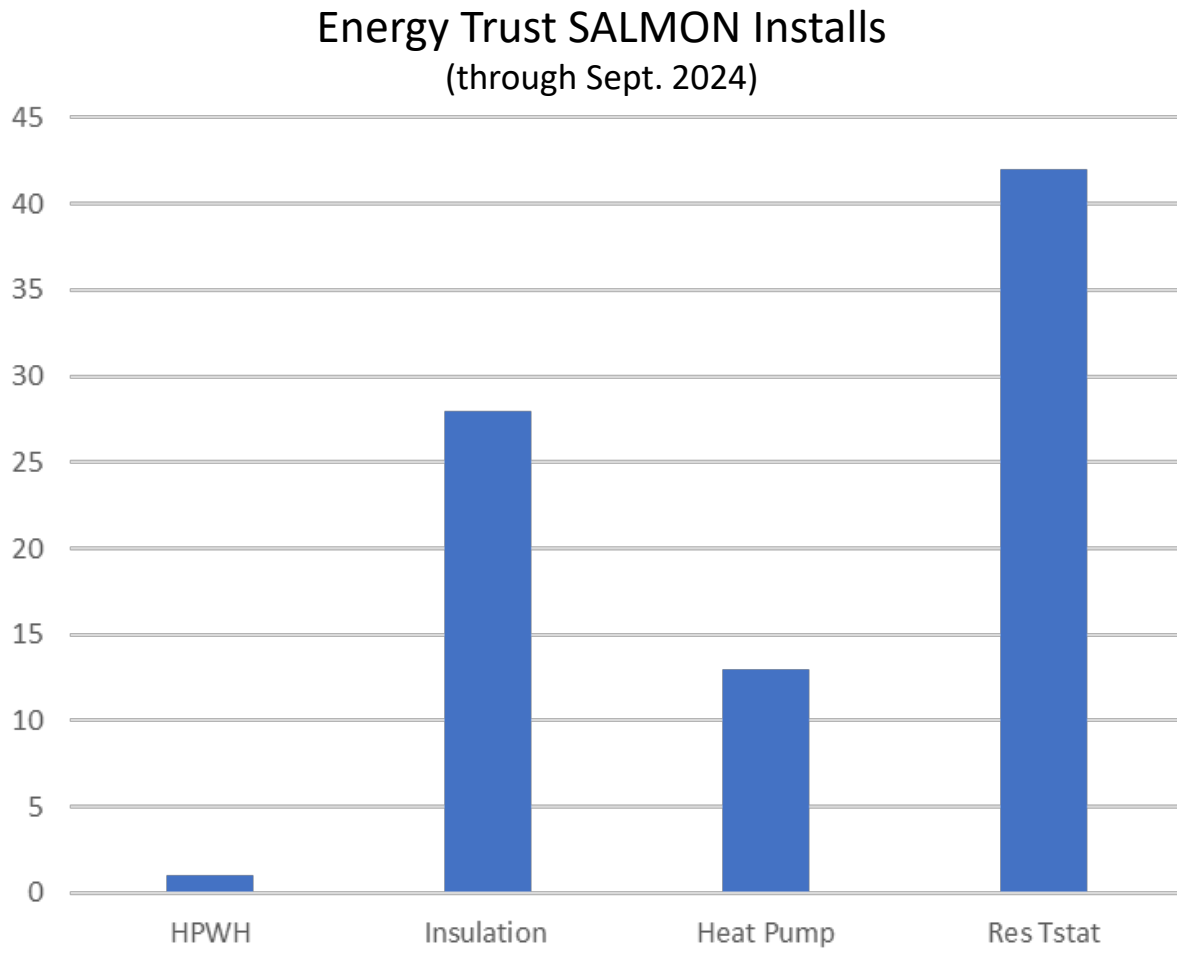
- Smart Grid Test Bed Collaboration Webpage
- 1,750+ customer emails sent with 60%+ open rate
- 3,000+ unique webpage visits
- 180+ contractor page visits

Portland General Electric

- Secured UCMs for connected water heater program
- Delivered targeted emails

Community Energy Project

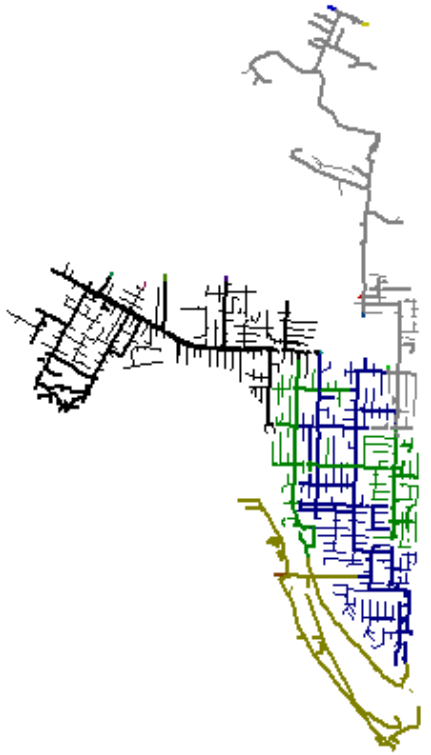
- Delivered 50+ total Home Energy Scores (10 for LMI customers)
- Conducted canvassing in project area
- Scoped 5 low-income whole home projects



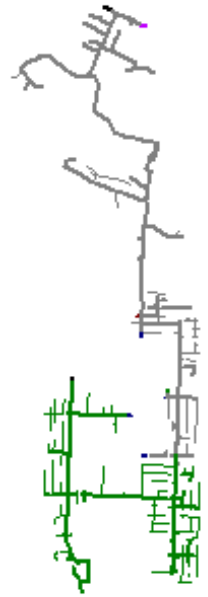
Community Model

PGE provided NREL with system data to use in developing a Community Model of the project area, develop a DER adoption model, and a DER benefits framework

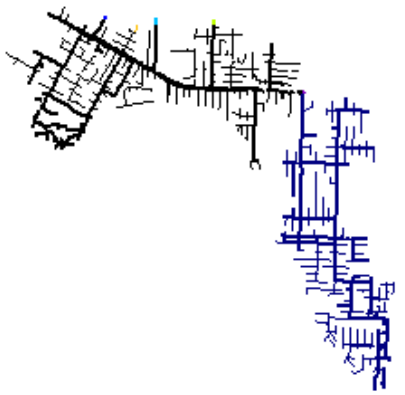
- Two feeders that serve the community are modeled:
  - Delaware-Denver
  - Peninsula Park-Ockley Green
- Feeder modeling:
  - Original models were in CYME
  - Converted to OpenDSS and validated by comparing OpenDSS power flow results with that of CYME
  - Used advanced metering infrastructure (AMI) data to create load profiles



Substation service area



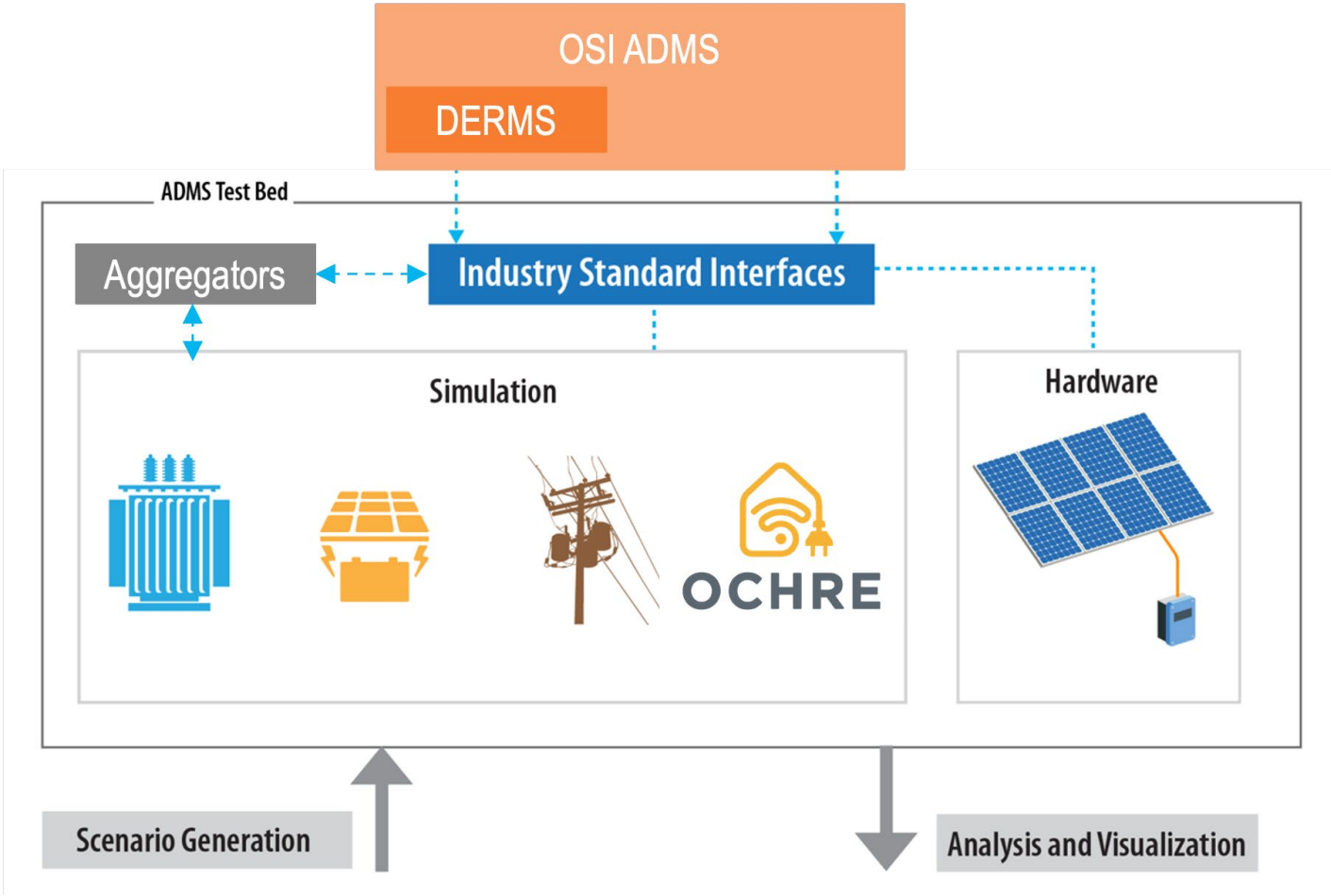
Peninsula Park-Ockley Green



Delaware-Denver

NREL Community Model Architecture

Goal: Evaluate impact of grid controls prior to field deployment in a realistic laboratory environment



Technical Progress: Sept. 2024

Developed the Community Model

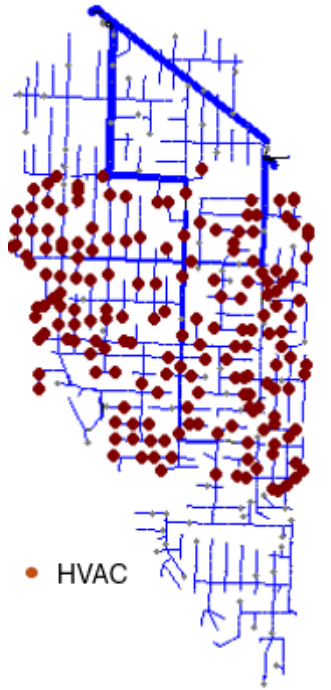
- Performs within 5% error rate

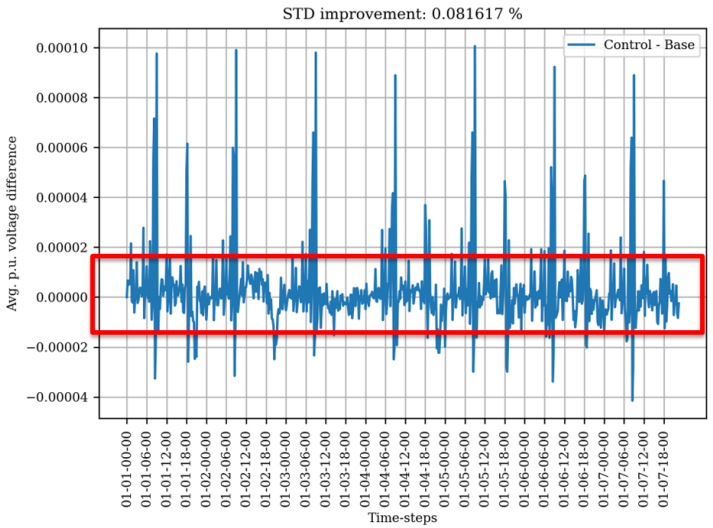
Preliminary Results:

- NREL demonstrated use of DER for voltage support use case using advanced controls and quantified impact
- Small positive impact using BESS and EV, and very small using HPWH
- Results show very little impact on primary voltage, due to very small resource
- Other use cases could show more impact, e.g., congestion relief may require only small percentage reduction in load
- Able to demonstrate that these DERs are being controlled in a way that supports voltage, so at higher DER levels, more impact can be expected
- Small negative impact with thermostat aggregator because effectiveness of EdgeFlex approach depends on accuracy of reduced order model of HVAC (and EWHs)

Aim to simulate selection of the following grid use cases with full DERMS:

1. Voltage Support
2. Congestion Relief
3. Solar PV Generation Optimization
4. Regulation and Sub-Hourly Dispatch
5. Peak Reduction: Day-Ahead Hourly Dispatch





Thermostat Aggregator Benefit Modeling

Unexpected Challenges

- Universal Communication Modules (UCMs) for connected water heater programs – major manufacturer dropped out as project was launching
- Delays acquiring first run manufactured UCMs
- Inability to deliver fuel switching incentives – hard to reach gas customers
- NEPA restrictions
- Personnel changes (DOE, PGE, ETO, Marketing)
- Longer than planned schedule for vendor contracting of DERMS platform

Lessons Learned

- Build out redundancy within teams
- Build in more time
  - Critical for second round of testing due to the emerging state of new technologies being tested
  - For federal review of project elements that require input from multiple offices
- Communicate early and often with contractor installers
- Availability of technologies to meet the use cases can be limited by events beyond our control (e.g., software and hardware platform limitations)

Future Work

Continue Customer Programs

- Increase customer participation and DERs in the project area

Complete Technical Work

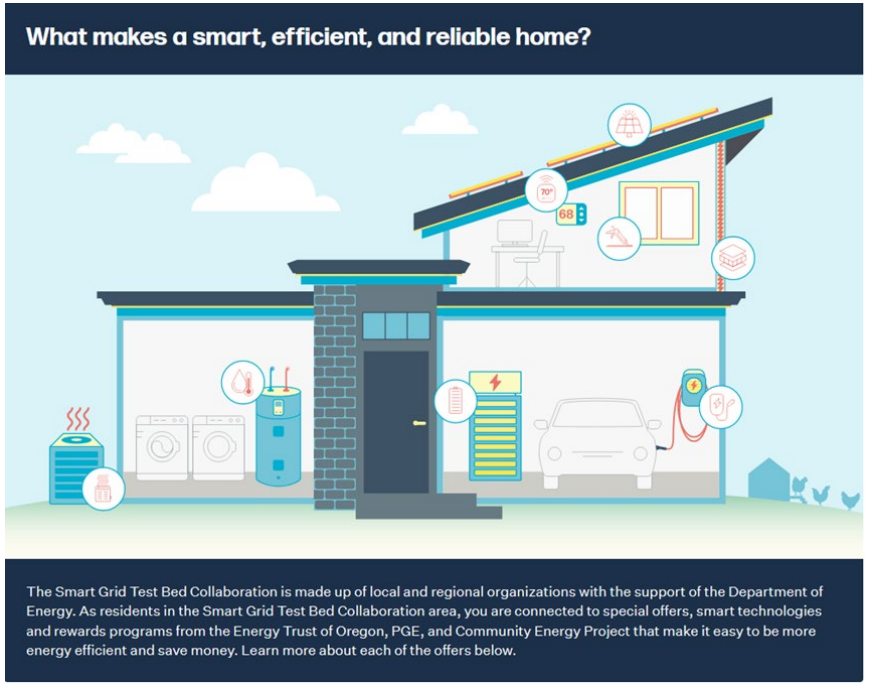
- Complete DERMS platform installation at NREL and PGE
- Complete technical modeling and identify new call strategies, frequency, rotation, etc. to meet use cases based on lab testing results (beyond demand response)
- Refine the combined value of EE and DR when installed in a concentrated area.

Demonstrate Control Strategies in Field

- Prepare operational teams and execute live control strategies

Learnings

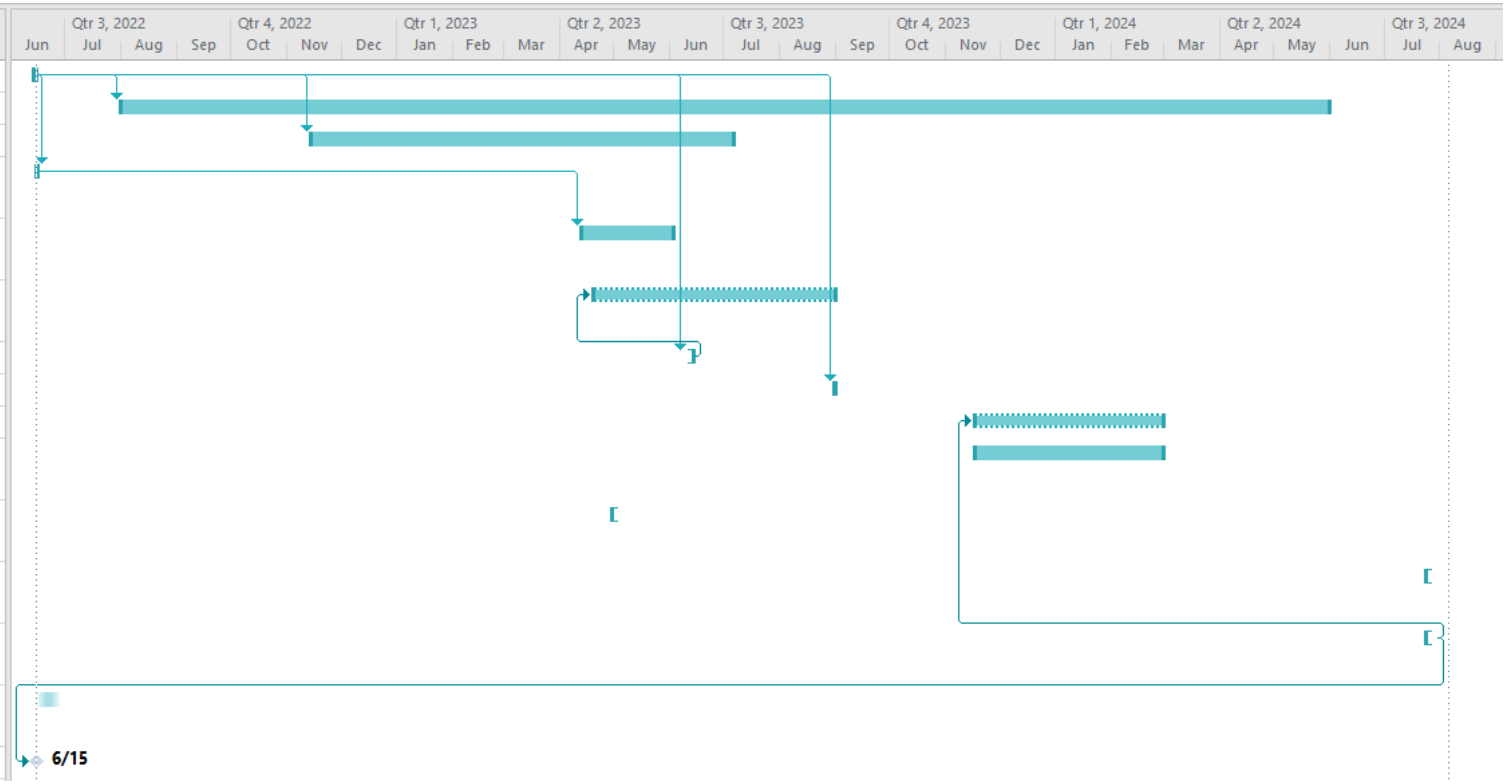
- Incorporate learnings and best practices into DERMS platform deployment at PGE and customer programs delivered by PGE



Reference Slides

Project Execution

Task Type	Task Name	Milestone Description	Mileston Number
M	Project Management	Hold kickoff meeting and submit required plans	1.1
M	Project Evaluation	Complete Evaluation Plan and Submit to DOE	2.1
M	Project Evaluation	Review and approval of Human Subjects Testing	2.1.1
M	Connected Communities Cohort and National Coordinator	Attend Connected Communities FOA Kickoff Meeting	3.1
M	Grid Modeling, Simulation, and Analysis	PGE delivers the feeder data to NREL needed to develop the Digital Twin	4.1
M	Grid Modeling, Simulation, and Analysis	Complete Digital Twin and DER Adoption Scenario modeling	4.2
M	Go-To Market Preparation	Finalized development of customer adoption cai	5
	Go/No-Go	The project will continue if the team is successfu	0
M	Campaign Launch	Launch marketing campaign to Overlook/Arbor I	6
M	Engagement, Enrollment, and Commissioning	Begin active recruitment efforts within the community	7.1
M	Evaluation of Advanced Controls and Dispatch Optimization	Memo outlining gaps in the selected ADMS/DERMS architecture	8.1
M	Evaluation of Advanced Controls and Dispatch Optimization	Finalize evaluation of DER control strategies within the Digital Twin	8.2
M	Demonstration of Advanced Controls in NREL's Test Bed	Complete installation of PGE's ADMS/DERMS software on NREL servers	9.1
M	Demonstration of Advanced Controls in NREL's Test Bed	Complete testing of DER controls strategies within NREL ADMS Test Bed	9.2
GNG	Go/No-Go	The project will continue if the team successfully	0



- Project BP1 began in Q2 2022 and moved to BP2 in Q3 2023
- No Cost Time Extension (NCTE): Potential extension of BP2 to allow additional time for customer installation of DERs and full integration of DERMs platform at NREL (and advanced modeling)

Team

Matt Hubbard

Principal Investigator

Annabelle Pratt

Chief Engineer

Megan Greenauer

Program Manager, Communities and New Initiatives

Claire Swanback

Project Manager