Appendix D

Demand Side Management

2023 OR IRP

Impacts on utility peak demand

This appendix provides an annual update on Energy Trust's impacts on utility demand. It describes ongoing and future approaches to work with utilities and other stakeholders to employ distributed energy resources to mitigate peak demand on a systemwide basis for utilities, alleviate local distribution system constraints and lower utility costs for the benefit of ratepayers. This appendix also discusses the impacts energy efficiency and renewable resources have on peak demand and the progress toward further development of methods to quantify and value the impact that peak demand reductions have on utility transmission, supply and distribution systems.

Specifically, this appendix addresses the following purposes:

- Report Energy Trust annual program impacts on peak demand for electric and natural gas utilities. This includes:
    - Expected winter and summer coincident peak capacity contribution estimates from 2021 energy efficiency and solar generation measures.
- Assess data and tools needed to link utility system management objectives to specific Energy Trust actions. These might include:
    - Actionable information about opportunities to avoid specific system investments.
    - Description of methods, including areas of collaboration with utility partners, for linking the areas where investments are needed in demographic and load data for program targeting.
    - Possible enhancements or updates regarding peak impact valuation and measurement used in cost-effectiveness analyses.
- Identify and report on complementary pilots and initiatives that reduce peak demand and meet corresponding grid optimization objectives, developed in coordination with utilities. This includes:
    - Work with utilities to plan where and how Energy Trust programs and measures reduce demand on critical elements of the power delivery system while optimizing co-benefits through coordinated planning.

A. Report the value of current program impacts on peak demand

Energy Trust helps customers install energy efficiency and renewable generation measures that not only save energy and offset electric and gas loads, but also provide additional benefits to the utility system and to ratepayers. Energy Trust will continue to improve its understanding of how energy efficiency savings and renewable generation provide these additional benefits to utilities in context with utility integrated resource planning and the evolving policy landscape. Energy Trust is incorporating this evolving knowledge into avoided cost benefit calculations to estimate the value of impacts of energy efficiency activities on utilities' peak demand.

Peak demand reduction estimates from energy efficiency

For 2021, Energy Trust estimated peak demand reductions from electric and gas energy-efficiency projects by calculating the percent of annual energy savings that occur during the system's peak time periods identified by utilities, and documented and approved by the Oregon Public Utility Commission (OPUC) for use in the calculation of Energy Trust avoided costs via OPUC docket UM 1893.[1] To estimate the portion of electric energy savings in those periods, Energy Trust relied on load profiles taken from the Northwest Power and Conservation Council's Seventh Power Plan.[2] For natural gas, Energy Trust calculated both peak-day demand reductions and peak-hour demand reductions by relying on peak factors from two sources: Peak day factors were based on electric analogs taken from the Northwest Power and Conservation Council's Seventh Power Plan for several end-uses, and peak day factors for

[1] The most recent information on capacity values and calculations used in UM 1893 is available online: https://apps.puc.state.or.us/orders/2021ords/21-476.pdf
[2] https://nwcouncil.app.box.com/s/ph0by9u53vygowx42rms5oytojhdmg5x

space heat end-use savings were developed by NW Natural. Peak hour factors were also based on electric analogs taken from the Northwest Power and Conservation Council's Seventh Power Plan for several end-uses, and peak hour factors for space heat end-use savings were developed by NW Natural.[3] These factors are used to calculate gas peak reductions by end-use at the measure level.

Energy Trust's and NEEA's efficiency programs resulted in the following peak demand reduction estimates for 2021.

Table 1. 2021 electric system efficiency peak demand reduction estimates (MW) at generator

Utility	Summer MW	Winter MW	Total aMW Saved
PGE	32.75	35.99	24.20
Pacific Power	26.51	34.76	19.79
Total	**59.26**	**70.75**	**43.99**

For gas measures, Energy Trust calculated peak-day and peak-hour natural gas savings, presented in the table below.

Table 2. 2021 Net natural gas system efficiency peak demand reduction estimates (therms)

Utility	Peak-day therms	Peak-hour therms	Total therms Saved
Northwest Natural	79,877	6,003	6,162,437
Cascade Natural Gas	7,197	369	525,372
Avista	6,144	546	408,163
Total	**93,218**	**6,918**	**7,095,972**

Peak demand reduction estimates from solar electric generation

Energy Trust estimated 2021 average peak demand contributions from residential and non-residential solar electric projects. Energy Trust estimated average generation from installed solar projects for multiple locations throughout Energy Trust territory during peak hours by using monthly generation profiles for representative project types based on variation caused by shading, tilt, orientation and geographic location. Actual historic or real time peak contributions for each project varies based on time of day and weather. Table 3 shows the average solar generation over the peak period identified by each utility for each season. The figures below show the average daily solar generation profile shape by season and utility.

[3] Northwest Natural peak factors can be found in Chapter 4 of Northwest Natural's 2018 IRP on pages 4.7 and 4.8. Available online https://webfrontend-sc-pd.azureedge.net/-/media/nwnatural/pdfs/nwnatural_2018_irp.pdf?la=en&rev=f4f7b91117c94e498d04f5f13ce3b776&hash=73D349C4E84F57B9CE6B10C65F10B789

Figure 1: Hourly summer solar generation profile from all 2021 solar installations in Portland General Electric territory

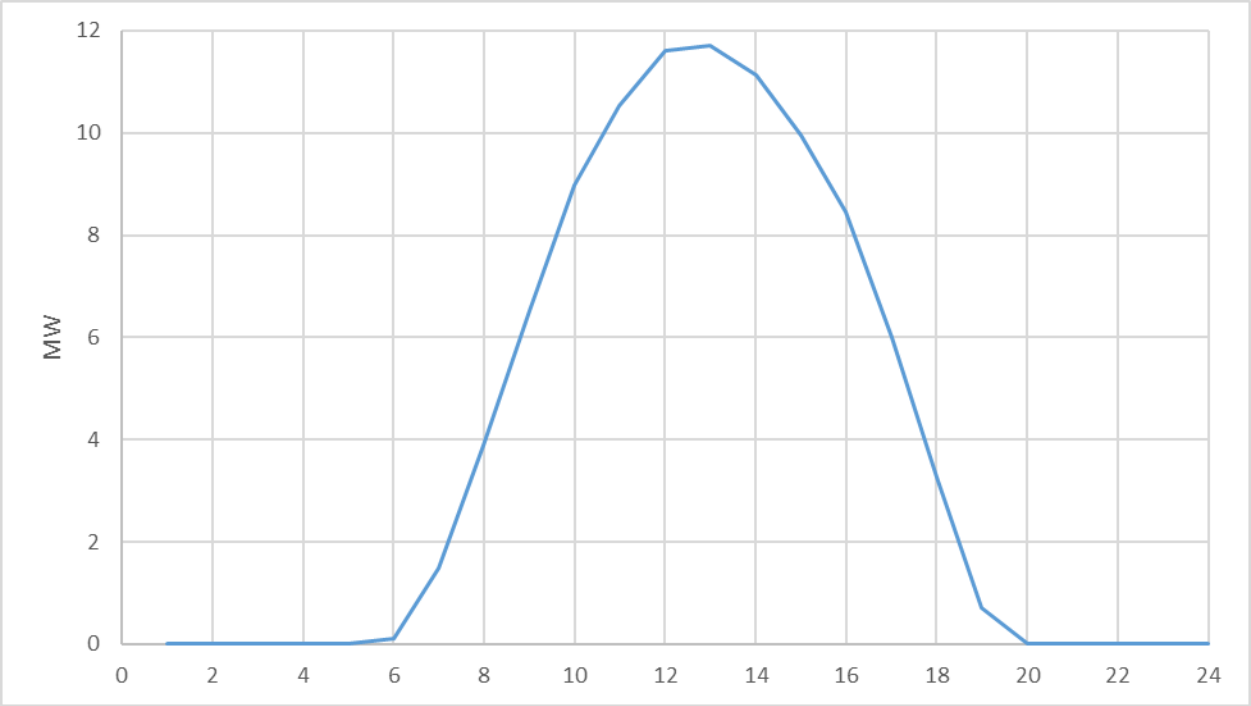


Figure 2: Hourly winter solar generation profile from all 2021 solar installations in Portland General Electric territory

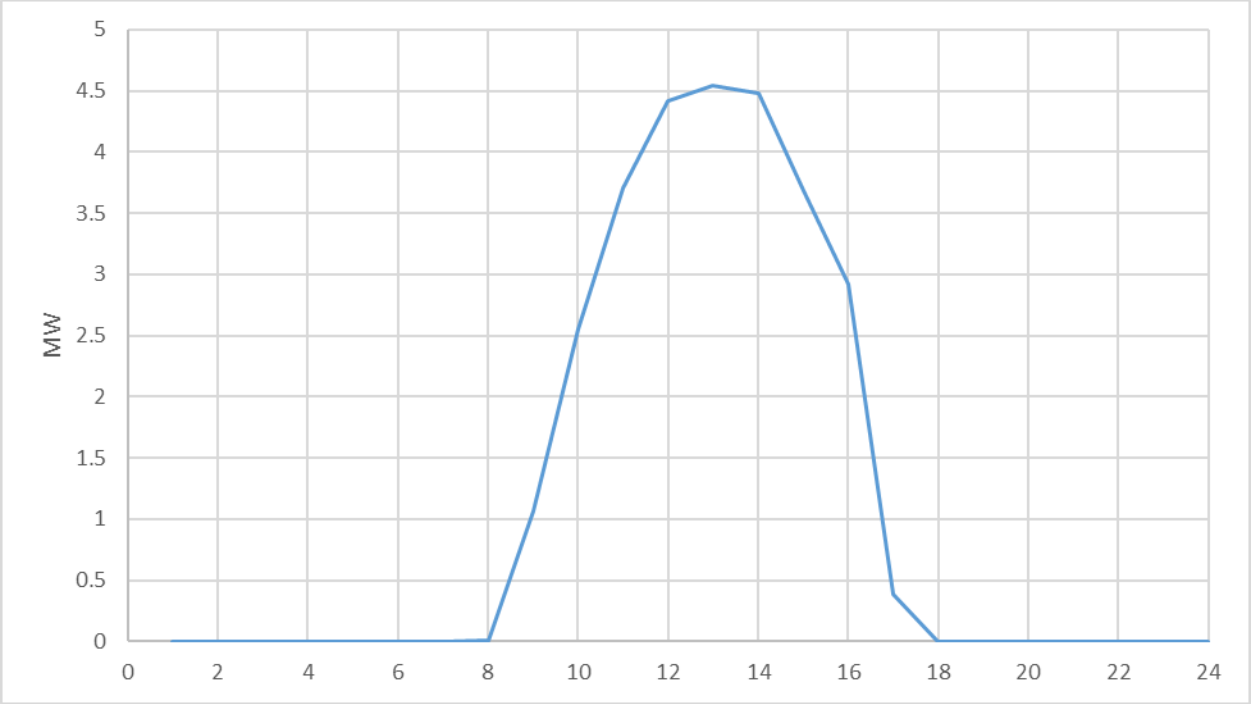


Figure 3: Hourly summer solar generation profile from all 2021 solar installations in Pacific Power territory

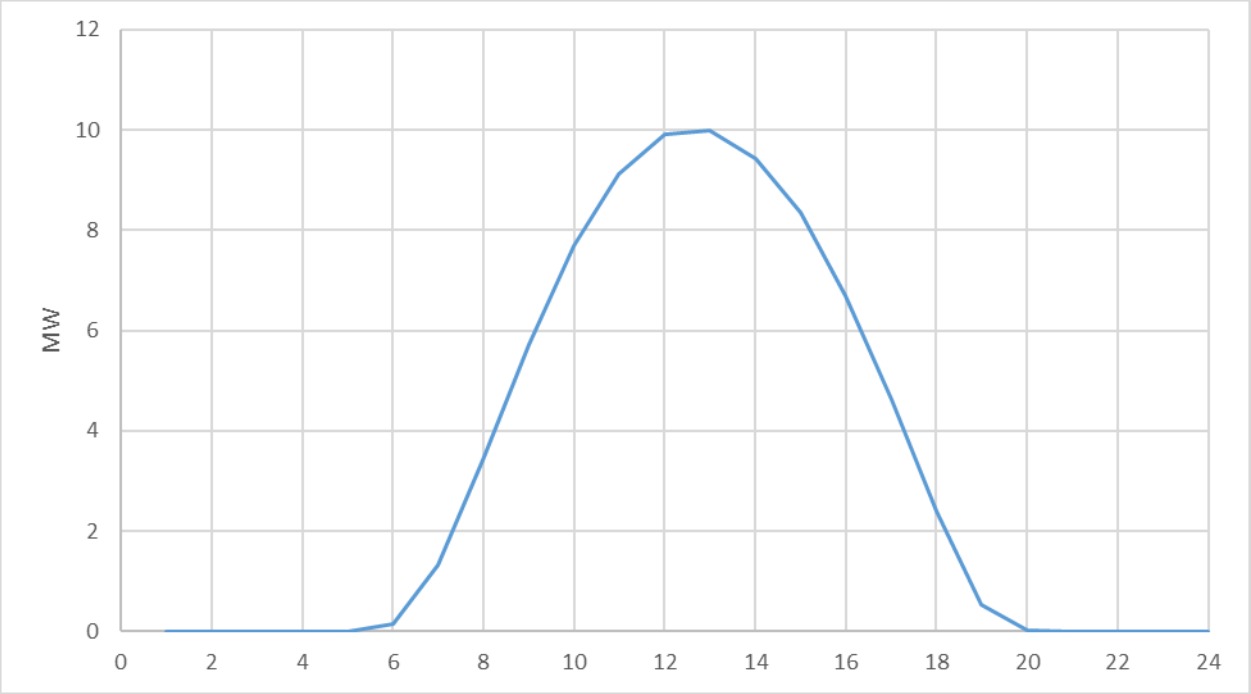
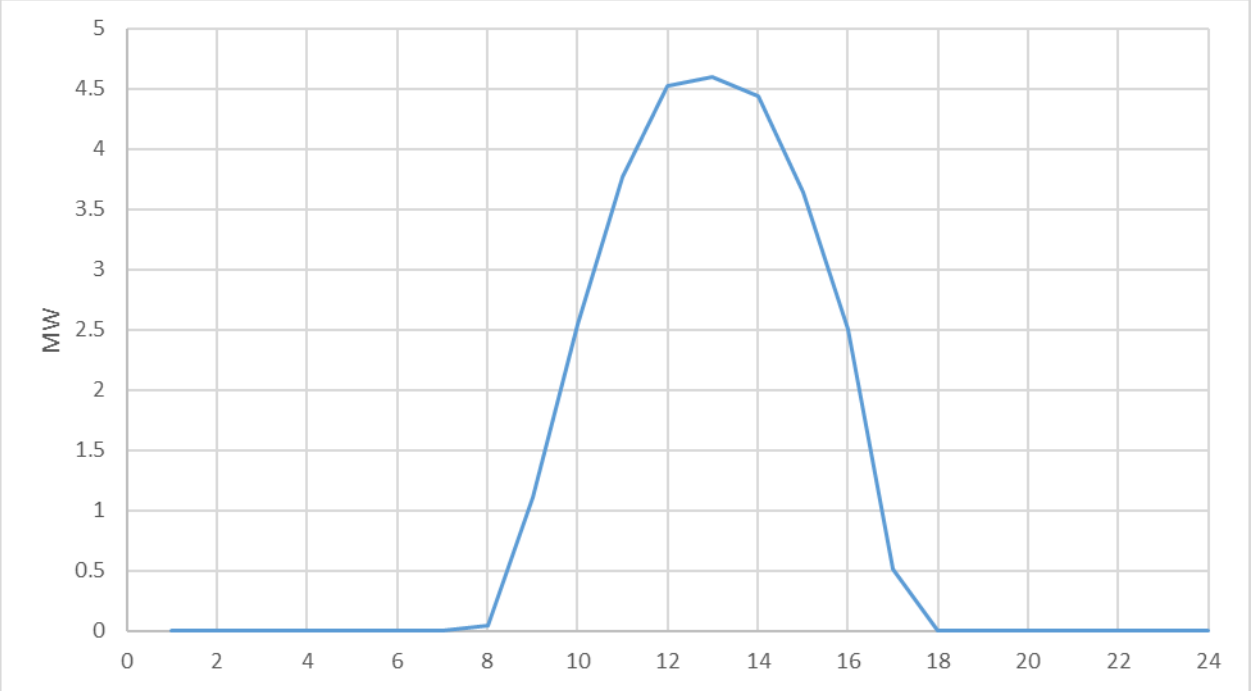


Figure 4: Hourly winter solar generation profile from all 2021 solar installations in Pacific Power territory



The above 2021 tables and figures exclude demand reduction estimates from renewable energy generation projects other than solar electric projects. Energy Trust has not incorporated these impacts into reporting because there are a relatively small number of projects with high degrees of production

variability. More work is required to estimate the demand contributions of these projects and Energy Trust will consider doing so in future reporting.

B. Assess data and tools needed to link utility grid objectives to specific Energy Trust actions

Beginning in September of 2018, Energy Trust and Portland General Electric (PGE) partnered to deliver direct installation of smart thermostats for PGE customers. Customers receiving direct installation of smart thermostats are required to be automatically enrolled in PGE's Smart Thermostat Demand Response program. PGE customers can also receive discounts on smart thermostats through the PGE Online Marketplace program. In 2021, the direct installation and online marketplace offerings led to approximately 7,000 smart thermostats installed in homes in PGE's territory. Due to budget restrictions, the direct installation program will be discontinued in 2022.

The Northwest Energy Efficiency Alliance (NEEA) and regional stakeholders continued the End-Use Load Research project in 2021 to help gather meter data for load profile development. While COVID-19 slowed the pace of installations at metering sites during 2021, the project is still ongoing and initial data has been made available for review and analysis. The Northwest has not conducted large-scale studies on how different types of residential and commercial customers use electricity on a daily basis for almost 30 years. The Home Energy Metering Study and the Commercial Energy Metering Study aim to address deficiencies for a number of end-use profiles. The End-Use Load Research project is a key component of Energy Trust's strategy to adopt updated end use and whole home load shape estimations when they become available. This study design was informed by a collaborative planning effort conducted by NEEA's partners, including Energy Trust. The main objective of this study is to develop a robust characterization of energy consumption of key heating and cooling measures to support planning and implementation to pursue clean energy goals and support utility information needs. Key benefits include:

- An updated framework to assess the contributions energy efficiency technologies make to reducing utility peak demand.
- A better understanding of how to integrate renewable energy into the grid, increasing reliability as the deployment of distributed generation and new end use technologies increases over time; and
- Prioritized data by end use for application in a range of utility functions including demand response, load forecasting and resource planning.

C. Report on and Energy Trust activities that help meet grid objectives in coordination with utilities

Energy-efficiency programs help electric and natural gas utilities address demand-related challenges. Energy Trust can provide further benefit to utility systems by increasing the saturation of energy-efficient, demand response-capable equipment (such as internet connected thermostats and heat pump water heaters with built in Wi-Fi), providing additional options for utilities when considering potential demand response programs. Utility demand response programs can use this equipment as a resource in reacting to peak demand events.

Through targeted load management pilot designs, Energy Trust is collaborating with utility partners to offer additional incentives for measures and services that contribute to coincident peak demand reduction. Additionally, Energy Trust's well-established program marketing and outreach efforts, sales channels, contractor connections and customer relationships may prove valuable to utilities in marketing combined efficiency and demand management equipment and service packages. In 2020, the OPUC issued guidelines to investor-owned electric utilities to develop distribution system plans for their grid

systems. Energy Trust has been tracking developments related to these distribution system plans via OPUC docket UM 2005. Going forward in 2022, Energy Trust expects to work collaboratively with utilities to provide data in support of these plans and to structure related pilots that emerge from these plans. Pending utility identified grid needs, Energy Trust also expects to provide additional efficiency and renewable investments for localized areas to support utility distribution system needs.

Coordination with Portland General Electric

Smart Grid Test Bed

Energy Trust acts as a representative on PGE's advisory committee for its Smart Grid Test Bed Demand Response pilot. In this role, Energy Trust provides advice on the design of the test bed and feedback on the phase two pilot, which was approved in 2021. In addition to coordination on the Smart Grid Test Bed, Energy Trust is working with PGE to support the test bed through the development of coordinated marketing arrangements and joint measures.

Smart Grid Asset Load Management & Optimized Neighborhood (SALMON)

In 2021, the U.S. Department of Energy awarded a Connected Communities grant to PGE for the Smart Grid Asset Load Management & Optimized Neighborhood (SALMON) project. This project will help transform neighborhoods into virtual power plants while reducing utility bills and avoiding greenhouse gas emissions through helping buildings to get optimized for DR grid interactions. Energy Trust helped support the grant process in 2021 and will collaborate with PGE, Community Energy Project, Northwest Energy Efficiency Alliance and the National Renewable Energy Laboratory to implement this project in 2022.

Smart Inverter Demonstration Project

As part of the Smart Grid Test Bed Phase II proposal, PGE submitted a budget and outline for a smart inverter demonstration project that included a role for Energy Trust as a design and implementation partner. The demonstration project will take place from January 2022 through December 2024 and will allow PGE to explore the value of distributed solar as an operational grid resource.

Smart Battery Pilot

In 2020, PGE launched a residential Smart Battery Pilot designed to provide incentives for 525 residential battery energy storage systems located "behind the meter" in customers' homes. The individual customer-owned systems are combined to create a "virtual power plant" that can be used to provide valuable grid services. The five-year pilot will allow PGE to study how to optimize the use of these batteries to benefit the grid, while ensuring that customers also receive the benefits they want from owning the battery. Energy Trust has contracted with PGE to provide implementation support for the PGE pilot and help connect customers and Solar trade ally contractors interested in participating in this program. As part of this pilot, Energy Trust is providing subject matter expertise, support for customer outreach, trade ally education, quality management, application review and upfront incentive processing. Supply chain constraints have impacted the number of projects installed under pilot program however customer interest has increased significantly. In 2021, Energy Trust received 250% more application submissions that included battery storage than the year before. In 2022, we expect an increase in the number of installations due to that interest as supply chain constraints begin to resolve.

EPS Construction "Energy Smart Home" Offers

In 2020, Energy Trust finalized research and prospective plans to integrate distributed energy resources into residential new construction programs to deliver benefits to the grid. This work revealed that, in the future, distributed energy resources will deliver significant value for residential customers and utilities beyond just energy efficiency and solar generation. The research suggested that program and installation costs of distributed energy resources could be reduced if distributed energy resources were considered and adopted during the construction of a home as opposed to being retrofitted into the home at a future date. Measures identified during this research as valuable included grid interactive water heaters, smart thermostats, solar + smart inverters or solar + battery storage, electric vehicle chargers and others. In 2020 Energy Trust rolled out the Energy Smart Home package providing an additional incentive for new

homes that incorporated specific ‘energy smart’ measures. For 2022, Energy Trust simplified the Energy Smart Home package to make it more accessible for builders. Additionally, Energy Trust is studying the integration of solar + storage in new construction as it relates to energy resilience and exploring coordination with PGE on a project in the Smart Grid Test Bed.

Targeted load management pilots with utilities

In 2021, Energy Trust and NW Natural finalized the approach for the third and final phase of a pilot project to determine a value per peak therm that NW Natural can use to vet energy efficiency against other supply side resources to address future location specific capacity constraints. This originated in 2019, when NW Natural filed the pilot proposal with the OPUC as an amendment to their 2018 Integrated Resource Plan (IRP). The proposal included pilot design, a research hypothesis, key research questions and the overall objectives of the pilot.

The pilot area was established in NW Natural territory in Cottage Grove and Creswell, Oregon. A pre-pilot baseline was established for the area based on an average of peak therm and therm savings and project counts during the five years preceding the pilot period. Outliers were addressed by taking a three-year average of the outlier year and the years before and after the outlier year and applying that number as a replacement.

Phase 1 of the pilot completed in July 2020. Phase 1 focused on increasing awareness of Energy Trust and Energy Trust offerings in the targeted area through increased marketing and outreach. While slightly more projects (99 vs 94) were implemented in the pilot area during the first phase than during the baseline period which preceded the pilot, the peak therms saved per project were lower in Phase 1. Therefore, the peak savings realized during Phase 1 did not exceed the peak savings observed during the baseline period. It is believed that this result is related to the COVID-19 pandemic which changed program priorities to focus on impacts on the market at large and also impacted customer behaviors.

During Phase 2 we promoted increased incentives (up to our current cost-effectiveness caps) through targeted marketing and outreach. This resulted in peak therm and annual therm savings that were respectively 90% and 61% greater than were observed during the established baseline period.

Energy Trust is implementing phase 3 of the project from Aug. 1, 2021 - July 31, 2022, under a funding agreement with NW Natural. Energy Trust is providing incrementally increased incentives (above what is cost-effective statewide) based on the application of local avoided cost values for subjecting pilot measures for cost-effectiveness screening using the utility cost test. We are continuing to promote the pilot offerings through targeted marketing, outreach, and participation agreements with trade allies serving the local area.