Appendix D

Demand Side Management

2020 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 being made on the further development of methods to quantify and value the impact peak demand reductions have on utility transmission, supply and distribution systems. Specifically, this appendix addresses the following purposes:

1. 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 2019 energy efficiency and solar generation measures.
2. 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 for linking the areas where investments are needed in demographic and load data for program targeting.
    - Possible enhancements to cost-effectiveness analyses considering capacity and other values to the grid.
3. 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 identify where and how Energy Trust programs reduce demand on critical elements of the power delivery system.

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 electricity, 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. 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 2019, 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. 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[1]. 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 space heat end-use savings were developed by NW Natural. Energy Trust relied on peak-hour factors developed by NW Natural for all end-uses. These factors are used to calculate gas peak reductions by end-use at the measure level.

Energy Trust's electric efficiency programs resulted in the following peak demand reduction estimates for 2019.

Table 1. 2019 Net electric system efficiency peak demand reduction estimates (MW) at generator

Utility	Summer MW	Winter MW	Total aMW Saved
PGE	37.8	42.0	32.8
Pacific Power	22.2	27.6	20.5
Total	**60.0**	**69.6**	**53.3**

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

Table 2. 2019 Net natural gas system efficiency peak demand reduction estimates (therms)

Utility	Peak-day therms	Peak-hour therms	Total therms Saved
Northwest Natural	62,394	4,304	5,019,618
Cascade Natural Gas	5,632	389	498,517
Avista	4,603	333	384,599
Total	**72,628**	**5,026**	**5,902,734**

The above 2019 tables do not include Northwest Energy Efficiency Alliance activities. Energy Trust does not disaggregate market transformation savings into end-use profiles that would allow us to quantify peak demand savings.

Peak demand reduction estimates from solar electric generation

Energy Trust estimated 2019 average peak demand contributions from residential and non-residential solar electric projects. Energy Trust estimated average generation from installed solar projects for multiple

[1] https://nwcouncil.app.box.com/s/ph0by9u53vygowx42rms5oytojhdmg5x

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 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.

Table 3. 2019 solar electric generation peak demand reduction estimates (MW)

Utility	Summer MW	Winter MW	Total Generation (MWh)
PGE	2.65	1.15	12,765
Pacific Power	2.95	0.65	11,041
Total	**5.60**	**1.80**	**23,806**

Figure 1: Average Hourly summer solar generation profile from all 2019 solar installations in Portland General Electric territory.

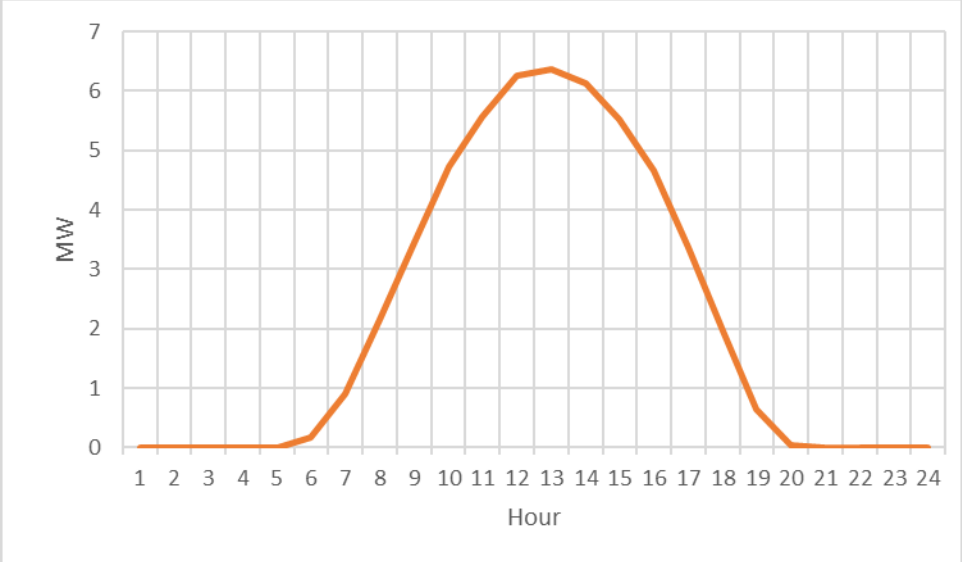


Figure 2: Average Hourly winter solar generation profile from all 2019 solar installations in Portland General Electric territory.

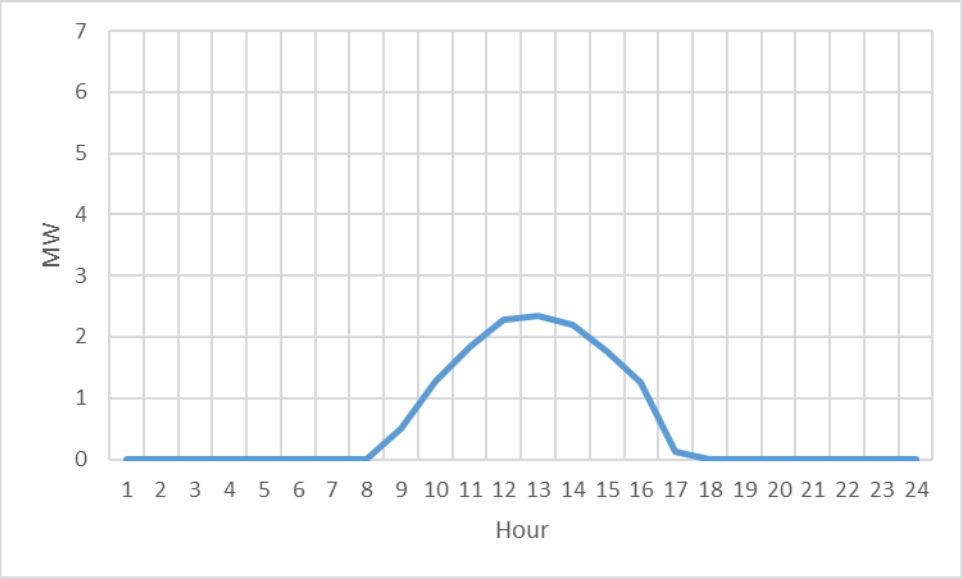


Figure 3: Average Hourly summer solar generation profile from all 2019 solar installations in Pacific Power territory.

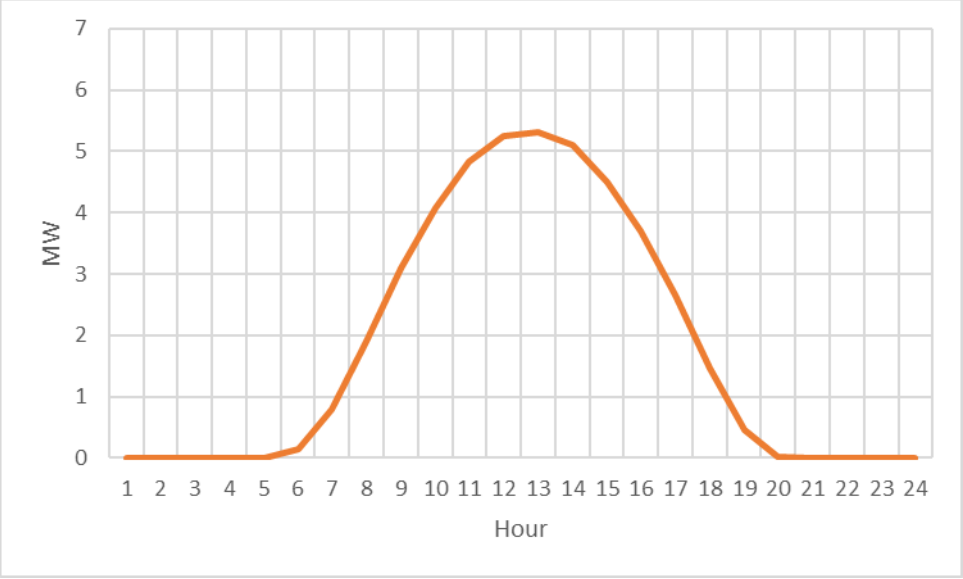
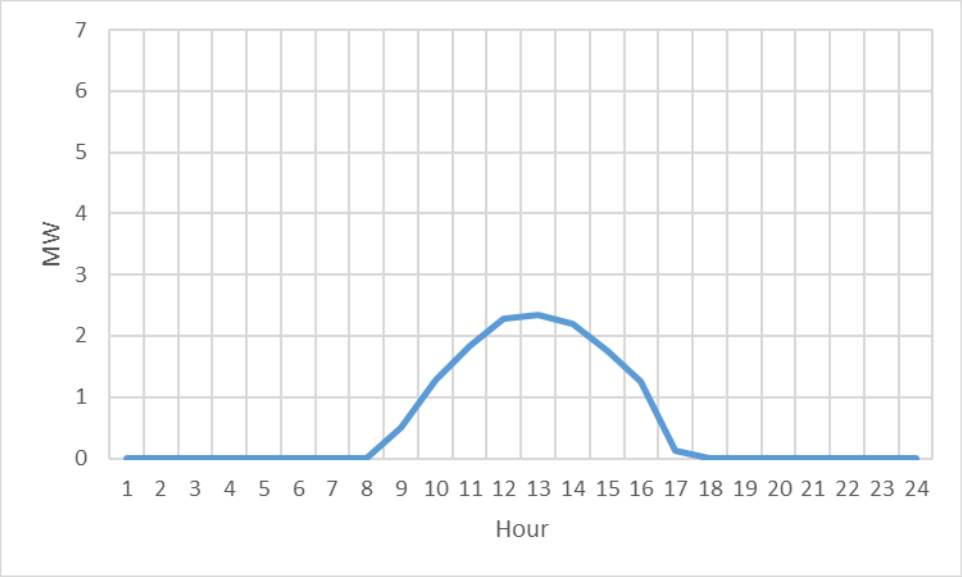


Figure 4: Average Hourly winter solar generation profile from all 2019 solar installations in Pacific Power territory.



The above 2019 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

Energy Trust began to work with Kevala Analytics as part of a U.S. Department of Energy grant to share past renewable energy and energy efficiency project information to facilitate planning for the interconnection and integration of distributed energy resources such as energy efficiency, solar and solar plus storage. In 2020, Energy Trust will continue that work under a contract in order to continue to explore the ability of the tool to provide transparency into localized grid constraints, areas of increased interconnection cost and the impacts on the distribution grid of delivering distributed energy resources. Energy Trust will coordinate with stakeholders as appropriate and all results will be shared with the OPUC, PGE and Pacific Power.

Beginning in September of 2018, Energy Trust and Portland General Electric (PGE) partnered to deliver direct installation (DI) of smart thermostats in PGE's territory. Customers receiving DI smart thermostats are required to be automatically enrolled in PGE's Smart Thermostat Demand Response (DR) program. In 2019, the direct install offering led approximately 4,200 smart thermostats being installed in homes in PGE's territory. PGE uses advanced metering infrastructure (AMI) technology throughout its system, with AMI producing 15-minute interval readings collected on meters for homes and businesses. AMI data's availability, paired with Energy Trust program data, provided a unique and rich dataset that can be used to fill gaps about our understanding of a smart thermostat's energy

efficiency and DR impacts throughout each hour of the year. In 2019, Energy Trust contracted with the Cadmus Group Inc. to develop a savings profile for smart thermostats. Energy Trust will work with the RTF to operationalize smart thermostat savings shapes when they are completed in 2021.

The Northwest Energy Efficiency Alliance (NEEA) and regional stakeholders began the End-Use Load Research (EULR) project in 2019 to help gather meter data for load profile development. 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 (HEMS) and the Commercial Energy Metering Study (CEMS), aim to address deficiencies for a number of end-use profiles. The EULR Study is a key component of Energy Trust's strategy to update end use and whole home load shape estimations. 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 have the potential to 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 exploring offering 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.

Energy Trust is working on the following grid optimization related efforts:

Coordination with Portland General Electric

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 provided advice on the design of the test bed and feedback on the written pilot proposal PGE submitted to the OPUC. While awaiting the

OPUC's decision on the proposal, Energy Trust is helping PGE further prepare for the test bed through the development of coordinated marketing arrangements and joint measures as described below.

In 2019, Energy Trust worked with PGE to help expand the customer base of smart thermostats that could be enrolled in PGE's demand response program. One of the primary points of coordination with PGE is the residential thermostat direct-install program where Energy Trust and PGE co-fund the installation of qualified smart thermostats in targeted locations with the intention of reaching respective energy efficiency and demand response objectives. In 2019, Energy Trust worked with PGE to launch a pilot aiming to install smart thermostats in small- to medium-sized businesses and evaluate the energy and demand curtailment impacts of smart thermostats in these businesses.

Grid Harmonization New Home Construction

In 2019, Energy Trust completed a research effort to understand opportunities for Energy Trust residential new construction programs to deliver benefits to the grid. This exploration revealed that in the future, distributed energy resources (DERs) will deliver significant value for residential customers and utilities. The research suggested that program and installation costs of DERs could be reduced if DERs were considered and adopted during the construction of a home as opposed to being retrofitted into the home at a future date. DERs identified during this research included demand response enablement, solar or solar readiness, electric vehicle charging, battery storage, and others. In 2020, Energy Trust plans to work with stakeholders to begin integrating existing and new emerging DER technologies into the Energy Performance Score (EPS) program design.

Targeted load management pilots with utilities

Energy Trust collaborated with Pacific Power to implement a targeted load management pilot in the North Santiam Canyon from July 2017 through Dec. 2018. The goal of that pilot was to test the quick deployment of energy efficiency in a targeted area. The targeted area has 180 projects completed, compared to 170 projects within the baseline period, representing a 6% increase in participation in the targeted area. In addition, all the projects implemented saved 6,451,932 kWh representing 878 kW of summer peak demand reduction and 901 kW of gross winter peak reduction. In 2019, Energy Trust collaborated with Pacific Power to launch a second targeted load management pilot in the Phoenix area. This pilot builds off the learnings of the North Santiam Canyon by increasing the flexibility of Energy Trust's energy efficiency and solar program offerings and delivery strategies and testing the efficacy of additional tactics to achieve demand reduction objectives. One example is integrating and promoting pilot measures that have the potential to achieve greater peak savings and provide increased incentives up to the maximum incentive allowed under current avoided costs to achieve pilot goals. The implementation phase of the pilot began June 1, 2019 and will continue through December 2020.

In 2019, Energy Trust and NW Natural continued development of a three-phased 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 constraints. NW Natural filed the pilot

proposal with the OPUC as an amendment to their 2018 Integrated Resource Plan (IRP) in the spring of 2019. The proposal includes pilot design, a research hypothesis, key research questions and the overall objectives of the pilot. The team initially planned to launch in Silverton Aug. 1, 2020 but changed gears and launched in the Creswell and Cottage Grove areas in September 2019 after discovering a lack of available data in Silverton. The project is currently in Phase 1, promoting increased marketing and outreach to the area to determine impacts. Phase 1 is set to run through July 2020. Phase 2 (Aug. 2020 – July 2021) will focus on providing increased incentives up to our current cost-effectiveness caps. Phase 3 (Aug. 2021– July2022) is pending OPUC approval and aims to look at applying a localized avoided cost value for the project area.

Quantifying peak natural gas savings with NW Natural

Energy Trust continued working with NW Natural to improve our avoided cost methodology as part of OPUC AR 621 to incorporate the supply and distribution capacity values associated with peak savings. In 2019, Energy Trust began using peak hour values for avoided natural gas distribution costs, aligning more closely with utility system planners. In 2020, Energy Trust hopes to continue to advance our understanding of peak hour coincident factors for natural gas and improve the list of end-uses and peak hour factors used to assess natural gas end-use coincidence during a peak hour.