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June 2, 2021

MEMORANDUM

- TO: Council Members
- FROM: Kevin Smit

SUBJECT: End-Use Load Research and the Impacts of COVID

BACKGROUND:

- Presenters: David Clement, Northwest Energy Efficiency Alliance
- Summary: The End-Use Load Research (EULR) project is a region-wide effort to collect detailed electricity consumption by end-use from homes and businesses. The project was started in 2016 and metering of individual homes began in 2018 and commercial building metering began in 2019. The metering collects consumption data at the 1-minute level which provides a detailed look and when and how much electricity is being consumed. These data will enable planners and evaluators to estimate the impacts of energy efficiency and demand response measures and programs more accurately.

Since the metering was initiated pre-COVID, and continued during 2020 and now into 2021, we now have data that show some of the impacts on our consumption habits. The presentation will highlight these findings.

Funding for this effort is provided primarily by northwest utilities and the project is managed by the Northwest Energy Efficiency Alliance (NEEA).

Relevance: The EULR project will result in a substantial new data set that shows how Northwest homes and businesses use their electricity. The Council utilizes

these data numerous ways including the development of our energy efficiency potential estimates for the Power Plan.

- Workplan: B.1.1 Conservation Continue coordinating with NEEA and other regional entities to improve our end-use data. Also B.1.4 enhance our understanding of the capacity impacts of EE.
 B.2.2 Demand Response Coordinate with regional entities regarding the impacts of DR.
 B.3.3 Load Forecasting continued enhancement of the council's forecasting models.
- Background: The region last conduced an end-use load study in 1980. The Council has been and continues to use the load shape data from that study in its load forecasting and energy efficiency estimates for power planning. About ten years ago, Council and Council staff began encouraging the region to develop and implement another end-use metering study. This led to the current study that is being funded by a dozen regional utilities plus the National Renewable Energy Laboratory and the Department of Energy and managed by NEEA.

Northwest End Use Load Research Project

Northwest Power & Conservation Council June 9, 2021

David Clement

Senior Program Manager, NEEA



Introduction

Background

ELCAP, the last large end-use load study was conducted in the late 1980s.

Since then, end use technologies and the ways we use energy have changed dramatically.











Home Energy Metering Study (HEMS)

400 homes, targeting high-priority HVAC end uses

Over 200 installed and metering today



Commercial Energy Metering Study (CEMS)

100 buildings, targeting office and retail

Installations were just getting started when COVID-19 arrived



A Building Stock Assessment Information Base

Residential (RBSA)

- 1,100 homes
- Detailed electronics, appliances, lighting, insulation

Commercial (CBSA)

- 860 buildings
- 12 building types
- Detailed lighting, water heating, refrigeration



How We Capture Residential End Use Data





1-Minute Data Provides Acute Insight Into Residential Electricity Use





Research Value to the Region Identified by the Project Working Group

Energy Efficiency





Demand Response



Load Forecasting



Transmission & Distribution Planning

Integrated Resource Planning



Transmission and Distribution Planning





Financial Planning and Rate-making



Project Timeline Lengthens a Year With COVID-19

2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
		Home Met	ering Install	s Begin					
		•	Commerci	al Metering	Installs Beg	in			
Project Start	Planning & Scoping								
				H	ome Meteri	ng			
					Com	mercial Me	tering		

Note: Timeline subject to change pending COVID impacts.

COVID-19 Impacts to Residential Electricity Demand

COVID-19: Higher Residential Demand Reported



Northwest Residential Load Shape During COVID-19 From March 2020 Through January 2021



Source: Evergreen Economics



COVID-19 Impacts Not Consistent Over Time Defining COVID-19 Phases

Phase 1: Start of the Pandemic

Starts when "mobility" begins to decline (early March 2020) and ends when stay-athome orders are issued (late March 2020)

• Phase 2: Shelter-in-Place

Ends at the first stage of reopening (June 2020)

• Phase 3: Summer Re-Opening

Ends when the first lifted restriction is reissued (mid-November 2020)

Phase 4: Late Fall / Winter Surge

Ends at the end of our analysis (January 31, 2021)



Whole Home Load Shape Phases During COVID-19





Phase 1	Phase 2	Phase 3	Phase 4	
March 3, March 25,	Jun	e 5, Novem	ber 15, Febru	uary 1,
2020 2020	20	20 20	20 21	021

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Changes in Kitchen Electricity Use During COVID-19



Source: Evergreen Economics



Kitchen and Laundry Increased Hot Water Demand



Source: Evergreen Economics

An Unexpected Impact: Ductless Heat Pumps



Summary

COVID-19 Impacts & Opportunities

Pre-, during-, and post-COVID EULR data can provide deep insight into how the pandemic has changed our short and longterm energy use and behaviors.

Access Publicly Available Data

- 15-minute residential data is free to download
- Sharing of analyses and findings is encouraged





The Northwest End Use Load Research (EULR) project is a regional study designed to gather accurate load profiles for electrically-powered equipment in homes and businesses. Funded by Northwest utilities and interested stakeholders, the project will run for five years, collecting energy use data in one-minute intervals. Detailed energy information of this scope has not been collected since the ELCAP project, which was completed in 1990.

To support advancements in energy efficiency, as well as utility forecasting and planning efforts, EULR participants have agreed to make 15-minute interval data publicly available without cost. All personallyidentifiable information has been removed from the dataset.

Additional information including: Instructions for accessing the metering data; The database schema showing the relationships between all the tables; A data dictionary with details on variable types and the unit of measurement; and a step-by-step analysis guide to walk new users through the full process of preparing the data for load-shape analysis can be found in the Home Energy Metering Study Public Data User Guide.

To access the first year of home energy metering data, please enter your information below.

Important Note: We recommend the use of specialized software such as R. Python or SAS as these files are large and complex. Each quarterly extract contains as many as 150 individual files that must be joined or merged together prior to any individual, in their compressed form, individual quarterly downloads may range from 11 to 500 MB. Once downloaded and incompressed acets quarterly extract mange from 10 MB to 5 GB.

DATA REQUEST FORM

Academic Institution + Building Modeling	Modeling





Billions of data points & wide application



One-of-a-kind study, including pre-, during, & post-pandemic period



Data has extraordinary potential to inform and help in shaping our energy future



neea.org/EULR

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CINREL

EnergyTrust

of Oregon

Seattle City Light

TACOMA POWER

PUBLIC UTILITY DISTRICT NO. 1

neea

David Clement

David is a Senior Program Manager with the Northwest Energy Efficiency Alliance (NEEA). He leads the Northwest End Use Load Research project, consisting of the Home Energy Metering Study (HEMS) and the Commercial Energy Metering Study (CEMS). In prior positions, David was Director of Resource Planning, Forecasting, & Analysis for Seattle City Light, where he led five integrated resource plans (IRPs). He also was Director of the Electric Transmission and Western Energy Services at Cambridge Energy Research Associates (CERA). At PacifiCorp, he managed Corporate Strategic Planning and was a Senior Analyst in the Economic Development and Load Forecasting Departments. He holds a Masters in Agricultural & Resource Economics from Oregon State University.