Cost Effectiveness and Evaluation Advisory Committee Meeting

DATE: April 27, 2023
TIME: 10:00AM - 4:00PM
LOCATION: Microsoft Teams meeting
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AGENDA:

TIME	TOPIC	PRESENTER(S)	Electric/ Gas/Both	Link or Page #
10:00AM (15 min)	**Welcome/Agenda Review** 1. Agenda check 2. Announcements	Jonathan Belais, NEEA Staff		
10:15 (15 min)	**MRE Update** Amy Webb will provide a brief overview and answer any questions regarding the upcoming market research and evaluation activities outlined in the quarterly newsletter. Objective: Committee awareness of market research and evaluation activities	Amy Webb, NEEA Staff	Both	26
10:30 (90 min)	**Dual Fuel Portfolio Overview** NEEA staff will provide overviews of the 2022 and Business Plan Cycle savings estimates for natural gas and electric portfolios. In addition staff will share portfolio benefit-cost assessment, avoided carbon emissions and peak capacity savings. Objective: Inform and address committee questions regarding NEEA's savings portfolio and other value metrics.	NEEA Staff	Both	3 (Gas) 9 (Electric)
12:00PM (60 min)	**LUNCH BREAK**			

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TIME	TOPIC	PRESENTER(S)	Electric/ Gas/Both	Link or Page #
1:00 (90 min)	**Key Assumption Updates** NEEA staff will highlight key assumption updates, including: • Extended Motor Products (XMP) Baseline and Savings Estimate Review • Luminaire Level Lighting Controls (LLLC) Extrapolation Methodology • Baseline for Retail Product Portfolio Refrigerators Objective: Inform committee members, gather feedback, and questions regarding updated assumptions.	NEEA Staff	Both	17 (XMP) 19 (LLLC) 20 (Full Report)
2:30 (10 min)	**BREAK**			
2:40 (60 min)	**Market Updates** NEEA staff will review highlights from NEEA's work in the market through 2022. Objective: Inform committee of market drivers and achievements that are driving the savings results	NEEA Staff	Electric	
3:40 (15 min)	**Wrap up**		Both	

Memorandum

April 27, 2023

TO: Cost Effectiveness Advisory Committee

FROM: Ryan Brown, Manager - Planning and Analytics
Stephanie Rider, Director - Data, Planning and Analytics

CC: Susan Hermenet, Vice President - Analytics, Research and Evaluation
Peter Christeleit, Manager, Natural Gas Portfolio

SUBJECT: Natural Gas 2022 Annual Report and Business Cycle Savings Update

Background

NEEA is an alliance of utilities and energy efficiency organizations that pools resources and shares risks to transform markets toward energy efficiency that benefits consumers in the Northwest. NEEA's role is to establish technology and market conditions that advance energy efficiency in markets in a sustainable way.

Energy savings are enabled by the alliance's market transformation efforts in removing market barriers, influencing energy codes and appliance standards, and investment in tools, training, resources, data, and research to support greater efficiency. These market transformation efforts seek to effect sustainable changes in markets, which then result in energy savings.

NEEA is a dual fuel organization and there is a companion memo to this that outlines the updates for the electric portion of NEEA's portfolio. For more information about NEEA's savings and cost effectiveness operational guidelines as well as other reference documentation please visit the Portal on NEEA.org (https://neea.org/portal/savings-reports).

NEEA Energy Savings Approach

NEEA's work in the region and in the market is designed to create long-term, sustainable changes that transform markets to support greater efficiency over the long-term. NEEA aims to manage a portfolio that spans early development of technologies and market transformation opportunities, through program and market development, and finally to the long-term, sustained state of efficiency well beyond NEEA's direct investment in these markets.

NEEA's tracking and reporting of energy savings is a measure of the resulting benefits of change in the market toward energy efficiency. NEEA employs a lifecycle management framework for each program in the portfolio. The bolded programs under Market Development in Table 1 are included in our regional reporting of savings above market transformation baseline **("Co-Created Savings")** for 2022 as they are at the stage of recognizing market change and savings above baseline. In all cases, NEEA tracks and reports

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incremental first year savings on an annual basis to monitor both adoption levels and associated energy savings.

Table 1: Natural Gas Programs in NEEA's portfolio	
Program Development	Market Development
Efficient Gas Water Heaters High-Performance Windows	Efficient Rooftop Units[1] New Construction: Residential Building Codes New Construction: Commercial Building Codes Products: State Standards

2022 Savings Results

NEEA estimates and reports the annual energy savings from the NEEA portfolio each year as one way to support the ongoing long-term viability and estimation of the market transformation value as well as to serve as a foundation for funder needs and their local regulatory reporting activities. Table 2 highlights the actual reported savings for 2022.

Table 2: 2022 Co-Created Savings
827,379[2] annual Therms

The market transformation portfolio for natural gas is in early maturity. The reportable gas savings for 2022 come predominantly from new construction, through both residential and commercial building codes. The specific codes NEEA is reporting 2022 savings on are the IECC 2018 Idaho code for residential, the WSEC 2018 code for both residential and commercial, and the OR 2021 OEESC for commercial. The current gas new construction savings forecast is lower than previously expected due to a delay in advancement of gas measures in the recent Oregon code, as well as recent studies by NEEA of WSEC 2018 code that indicate a decline in the use of gas for space and water heating in new residential construction (see Appendix A below for additional discussion of code savings by state).

Additional Metrics

In addition to tracking and reporting the co-created energy savings for NEEA's regional portfolio, NEEA staff also estimates the regional value of a set of additional metrics.

Benefit Cost Assessment

One such metric is the benefit cost assessment of the NEEA portfolio. For our current Cycle 6 portfolio, there is now one market transformation program that has advanced into market development: Efficient Rooftop Units. Leveraging regional assumptions and data from the Northwest Power and Conservation Council's (NWPCC) ProCost tool, NEEA has assessed the benefit-cost ratio for this program at 1.1-1.6. As new programs advance into market development, we will add those to the portfolio aggregation for this metric.

[1] NEEA's HVAC Supplier Data Collection for 2022 is underway and as in prior years will be available for analysis in Q3 2023. NEEA will report 2022 regional market savings from Efficient Rooftop Units when that data is available and analyzed.

[2] This value does not include savings from Efficient Rooftop Units. See footnote 1 above.

Avoided Carbon Emissions

NEEA staff also partners with the NWPCC to enable the regional reporting for avoided carbon emissions. For the estimation of avoided carbon emissions, NEEA includes the benefit from all of the co-created savings of the gas portfolio. The 2022 co-created savings value of 827,379 Therms translates to a total of over 4,800 tons of avoided carbon emissions in 2022, at a monetized value of $323,838.

Savings Forecast – 2020-2024 Business Plan

It is important to look at a longer time horizon for NEEA's Market Transformation portfolio. The above figures provide an annual snapshot but need to be considered in the context of the market transformation horizon in which NEEA works.

Table 3: 2020-2024 Savings			2020-2024 Business Plan Range	2020-2024 Current Forecast *(range)*
Fuel	**Unit of Measurement**	**Savings Category**		
Gas	Annual Therms	Total Regional[3]	11-18M	4.0M *(3.5M-5.4M)*
Gas	Tons	Avoided Carbon	n/a	16,400 *(15,600-24,200)*

The natural gas market transformation portfolio remains in early development stages, and in addition to longer than expected product commercialization timelines for efficient gas products in the space and water heating markets, energy savings potential through code advancement has been impacted by rapidly changing state energy codes and policy discussions that are impacting builder fuel decisions in the new construction markets. As a result, the natural gas portfolio is not expected to meet the savings expectations forecast at time of the business plan for this cycle.

As NEEA continues to invest in emerging technology opportunities for the portfolio, additional savings streams will continue to materialize. In addition to the code and standard savings that are currently being reported to funders, the following programs are projected to deliver savings in the coming years:

Table 4: Savings Expectations		
Program	**Products**	**Year Expected for Reporting**
New Construction: Commercial Code	Specific proposals advanced in WA 2018 Specific proposals advanced in 2021 OEESC Working on future code development in ID	2021 2021 TBD
New Construction: Residential Code	Residential Codes WA 2018 IECC 2018 with Idaho amendments Or. Specialty Code 2023	2021 2021 2024
Efficient Rooftop Units	Efficient Rooftop Units	2022 (Available in Q4)
Products: State and Federal Standards	Commercial Kitchen Equipment (WA) Commercial Kitchen Equipment (OR) Commercial Boilers (Federal)	2021 2022 2023
High-Performance Windows	Windows	2023/2024[4]
Efficient Gas Water Heater	Gas Heat Pump Water Heaters	TBD

[3] NEEA's 2020-2024 Business Plan only included Total Regional Savings forecast range for Natural Gas.

[4] High-performance Windows and Efficient Gas Water Heaters have yet to advance into the market development phase so the expected first year of savings reporting remains uncertain.

Appendix A: Program-Specific Updates

The following descriptions of progress made in each of the areas of NEEA's gas Market Transformation portfolio were provided in the memos provided to funders along with 2022 Natural Gas Savings Reports.

New Construction: Building Codes

NEEA employs a consistent approach to involvement with and support for the code process in each state and for each sector; however, each state has different code timing, needs and opportunities. The sections below describe the current status for each individual state code process.

New Construction: Residential Building Codes

Washington

Washington's 2018 residential code went into effect in February 2021. The code includes fuel normalization credits that favor the use of electric fuels over natural gas. NEEA completed a post code adoption market research report[5] in May 2022 to assess the early effects of the credits on building practices. The study, which was based on 178 approved permits for single-family homes throughout the state, showed that approximately 12% of the builders chose natural gas space heating and water heating. Previously, most builders selected natural gas.

NEEA has since conducted a follow-up study to allow more time for builders to adjust to the new code and to collect data on single-family homes that have been built under the code. The new study used data from virtual home audits to assess compliance with the code and explore gas use throughout the home, including whether homes built under code have gas hookups, dual-fuel systems, and gas appliances. NEEA is using the draft results for both the 2022 savings estimate and to update the 2021 estimates. The draft results estimate that the compliance rate is between 76-78% and that 18% of the new homes are using gas as the primary source for space heating. NEEA plans to finalize this study by mid-2023 and will present the full results of the study to the Natural Gas Advisory Committee later this year.

NEEA expects the share of homes with gas as the primary fuel source will continue to remain low over the next few years. Washington also adopted the 2021 WSEC in late 2022. Currently, builders do not have commercially available natural gas HVAC and water heating products to help them meet this new code that goes into effect in July 2023. The implication for NEEA's gas portfolio is a reduction in the current savings forecast of approximately 0.36 MM Therms statewide from NEEA's Q3 2022 update. The reduction will show up in the 2024 annual savings estimates to NEEA's Washington funders. Meanwhile, NEEA is working on opportunities to propose new efficient gas products for the next code advancement. These include:

- Gas Heat Pumps
- Dual-fuel Heat Pumps
- Efficient Gas Water Heaters

NEEA expects at least one manufacturer to begin selling residential Gas Heat Pumps in 2023. This product might be the best opportunity to add as an option in the WSEC 2024. NEEA will contribute to the code path by testing the products as soon as they become commercially available. If they work well, the gas team could develop a Market Transformation program to increase adoption prior to the next code update.

NEEA will also continue to monitor advancement in other gas products such as hearths, backup generators, and kitchen equipment that can be used in residential new construction.

Finally, NEEA will monitor the effects this new code has on fuels selection in residential homes.

[5] https://neea.org/resources/washington-residential-post-code-market-research-report

Oregon

NEEA is currently working on code proposals for the 2023 Oregon Residential Specialty Code. The actual savings rate will depend on final approval by the state. The current forecast assumes 55 therms per single-family home. NEEA expects the code will be adopted in 2023. Afterwards, NEEA will update the therms estimate.

Idaho

Idaho adopted IECC 2018 in 2021. Gas savings from the new code was approximately 13% across all homes.[6] This reflects the effects of code-mandated insulation/window improvements and air tightness improvements on gas-heated homes.

New Construction: Commercial Building Codes

Washington

The 2022 savings come from work on the 2018 Washington State Energy Code, which went into effect in February 2021. The share of new construction floor area permitted under the code begins to ramp up from the code effective date. The savings analysis comes from NORESCO.[7] NEEA also worked on code proposals for the 2021 Washington State Energy Code, which was approved in late 2022. Similar to the process on the residential side, NEEA will monitor the effects the new code will have on the adoption of gas-fuel products in commercial new construction.

Oregon

The 2021 savings come from work on the 2021 Oregon Energy Efficiency Specialty Code, which went into effect in October 2021. The share of new construction floor area permitted under the code begins to ramp up in late 2021. The savings analysis comes from Pacific Northwest National Laboratory.[8] NEEA is now working on code proposals for Oregon Energy Efficiency Specialty Code 2023.

Idaho

Idaho's version of IECC 2018 became effective in 2021 but had little effect on commercial natural gas usage, according to analysis by PNNL[9]. NEEA will continue to work on the next code cycle.

Products: Standards

Federal Standards

The Department of Energy published a new Commercial Packaged Boilers standard in 2020. NEEA and its energy efficiency partners influenced the outcome of the rule making by supporting a more stringent efficiency level, according to an evaluation completed by Michaels Energy in 2022[10]. The standard goes into effect in 2023.

State Standards

NEEA is reporting Net Market Effects savings from the Oregon and Washington commercial equipment appliance standards based on draft evaluation results from Michaels Energy. The company determined that NEEA and its partners had a primary role in providing regional data and generating alignment among stakeholders on the Oregon and Washington commercial kitchen equipment standards. The draft evaluation allocates 10 percent of the savings to above baseline adoption. NEEA will publish the full results in late May 2023.

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[6] See analysis at neea.org, portal login, savings, codes.

[7] NORESCO. 2022. 2018 Washington State Energy Code Energy Savings Analysis for Nonresidential Buildings.

[8] https://www.energycodes.gov/prototype-building-models

[9] Pacific Northwest National Laboratory. 2018. Energy and Energy Cost Savings Analysis of the 2018 IECC for Commercial Buildings. Raw data. Analysis of 2018 IECC energy use intensity for commercial new construction.

[10] https://neea.org/resources/commercial-boilers-standard-evaluation

Programs

Efficient Rooftop Units

The Efficient Rooftop Units program advanced to Market Development[11] in late 2022. The program's goal is to accelerate the adoption of efficient gas rooftop units in the like-for-like replacement market while working to influence the adoption of improved test procedures and more stringent federal standards. NEEA expects to measure progress above baseline as early as 2022. To measure savings, NEEA collects sales data annually from HVAC distributors and manufacturers in addition to data from the annual local utility program survey. The HVAC sales data for 2022 will likely not be available until August 2023 because of the time needed for recruitment and data submission. NEEA expects the data collection process to improve over time as the number of participating manufacturers and distributors grows. Pending on-time HVAC sales data delivery, NEEA will report savings for 2022 as soon as feasible.
Currently, the program is forecasting 12,000-80,000 therms of co-created savings for the 2020-2024 Business Plan.

High Performance Windows

The program goal is to stimulate national builder and consumer demand for high-performance windows, and will partner with manufacturers to meet that demand with scaled production. NEEA worked closely with ENERGY STAR to increase the current specification level to a 0.22 U-value performance level and plans to work within the building code process to include this specification level as a measure in future building codes. NEEA is aiming for the program to advance to Market Development in 2024.

Efficient Gas Water Heaters

The program is in early development and has a technical potential of 100-200 MM Therms for Oregon, Washington, and Northern Idaho. While there are still many unknowns, NEEA is evaluating the likelihood of a product launch for a Gas Heat Pump Water Heater by 2025. This will likely be preceded by a large scale North American field study which will include the first units installed in the NW. NEEA will provide forecasted savings when a product launch timeline and associated market adoption forecast are more certain.

[11] The purpose of this phase is to create lasting market change through direct market interventions designed to remove barriers, leverage market opportunities, and tap influencers and existing channels for diffusion. Interventions are strategic, planned and adaptively managed as market dynamics change and more information is gained. During annual planning, NEEA staff look for the most impactful market levers and activities that could bolster or accelerate the achievement of alliance MT goals.

Memorandum

April 27, 2023

TO: Cost Effectiveness and Evaluation Advisory Committee

FROM: Ryan Brown, Manager - Planning and Analytics
Stephanie Rider, Director - Data, Planning and Analytics

CC: Susan Hermenet, Vice President - Analytics, Research and Evaluation

SUBJECT: Electric 2022 Annual Report and Business Cycle Savings Update

Background

NEEA is an alliance of utilities and energy efficiency organizations that pools resources and shares risks to transform markets toward energy efficiency that benefits consumers in the Northwest. NEEA's role is to establish technology and market conditions that advance energy efficiency in markets in a sustainable way.

Energy savings are enabled by the alliance's market transformation efforts in removing market barriers, influencing energy codes and appliance standards, and investment in tools, training, resources, data, and research to support greater efficiency. These market transformation efforts seek to effect sustainable changes in markets, which then result in energy savings.

NEEA is a dual fuel organization and there is a companion memo to this that outlines the updates for the natural gas portion of NEEA's portfolio. For more information about NEEA's savings and cost effectiveness operational guidelines as well as other reference documentation please visit the Portal on NEEA.org (https://neea.org/portal/savings-reports).

NEEA Energy Savings Approach

NEEA's work in the region and in the market is designed to create long-term, sustainable changes that transform markets to support greater efficiency over the long-term. NEEA aims to manage a portfolio that spans early development of technologies and market transformation opportunities, through program and market development, and finally to the long-term, sustained state of efficiency well beyond NEEA's direct investment in these markets, such as in a change in an energy code or adoption of a new appliance standard.

NEEA's tracking and reporting of energy savings is a measure of the resulting benefits of change in the market toward energy efficiency. NEEA employs a lifecycle management framework for each program in the portfolio. The programs listed below that are bolded are included in our regional reporting of savings above market transformation baseline **("Co-Created Savings")** for 2022. In all cases, NEEA tracks and

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reports incremental first year savings on an annual basis to monitor both adoption levels and associated energy savings. NEEA tracks savings above both the market transformation baseline and the Power Plan baseline, for various regulatory reporting purposes.

Table 1: Programs in NEEA's portfolio

Program Development	Market Development	Previous Investments
High-Performance Windows	Heat Pump Water Heater	Reduced Wattage Lamp Replacement
Fan Systems	Luminaire Level Lighting Control	Efficient Homes
	Retail Product Portfolio	Ductless Heat Pumps
	Manufactured Home	Strategic Energy Management
	Efficient Pumps	
	High-Performance HVAC	
	New Construction: Residential Building Codes	
	New Construction: Commercial Building Codes	
	Products: Federal and State Standards	

2022 Savings Results

NEEA estimates and reports the annual energy savings from the NEEA portfolio each year in order to support the ongoing long-term viability and estimation of the market transformation value as well as to serve as a foundation for funder needs and their local regulatory reporting activities.

As with every annual reporting update, NEEA receives and analyzes full year market data as well as new evaluation reports that inform updates to market trends, adoption estimates and unit energy savings estimates or other key assumptions as needed. After incorporating these updates, co-created savings across all investments in NEEA's portfolio grew by 2.7 aMW from the prior year showing an increasing overall trend for the portfolio.

Table 2: 2022 Electric Co-Created Savings		2021 Reported	2022 Reported
All Investments	aMW	36.0	38.7

This increasing trend was due to a number of market developments including:

- continued market share gains for Heat Pump Water Heaters driven by the 'Boring but Efficient' awareness campaign and builders continuing to use Heat Pump Water Heaters in new construction.
- new construction savings increases in both commercial and residential as projects are built under new codes that have become effective in each state.

See Appendix A for more details about updates and market progress by program.

Net Market Effect savings are also tabulated as part of NEEA's annual reporting. NEEA staff coordinate with funding partners each year to tally the efficient units that are being tracked and reported at the local level. NEEA does this only to avoid double-counting savings, not to assign attribution to NEEA. This year, NEEA staff aggregated a total of 11.3 aMW through local programs in the markets NEEA is tracking, resulting in Net Market Effect savings of 27.5 aMW for 2022.

Savings Forecast – 2020-2024 Business Plan

It is important to look at a longer time horizon for NEEA's Market Transformation portfolio. The above figures provide an annual and year-over-year snapshot, but they need to be considered in the context of the market transformation horizon in which NEEA works.

A primary focus for NEEA's portfolio for Cycle 6 has been to ensure continued growth in two programs: Heat Pump Water Heaters (HPWH) and Retail Products Portfolio (RPP), and in increasing diversity in the portfolio. NEEA has seen great traction in both programs. RPP is actively influencing many ENERGY STAR and federal energy appliance standards, including ENERGY STAR version 9 for Televisions which is expected to be the largest energy saver for the program going forward. HPWH is seeing continued growth in total units and has become a staple measure in new construction in Washington and Oregon in particular. In addition, NEEA facilitated a joint recommendation to the U.S. Department of Energy on active federal standard rulemaking for water heating that was signed by efficiency advocates as well as manufacturers and industry groups.

NEEA is also tracking the continued utilization of the SEM program across the utilities in our region. NEEA launched this program in 2010 within the industrial segment and has since transitioned to managing the education platform, known as the SEM Hub, to enable utilities across the region to expand SEM to the many other customers across commercial and industrial spaces. NEEA has tracked over 71.6 aMW since 2011 on behalf of the region, and the volume of energy savings through SEM remained relatively consistent in 2022, at 8.75 aMW in total.

The other primary focus for NEEA's portfolio in Cycle 6 has been to diversify the portfolio composition in terms of sectors addressed, the risk profile of the portfolio and other portfolio metrics. This will aid the development of a long-term, sustainable portfolio that creates a continuation of energy savings for the region well into the future. Meaningful progress was made in 2022 in this regard as NEEA advanced 2 new programs into market development, both with long-term value. In order to build for Cycle 7, NEEA also advanced 2 concepts into the program development portfolio: Efficient Fans and Variable Speed Heat Pumps (Residential). These are intended to unlock earlier savings potential to build up a consistent value stream in the nearer term for our region. NEEA expects to bring these programs to market and recognize energy savings as early as 2025.

Overall, NEEA is pleased that the forecasted energy and carbon savings for this 2020-2024 business cycle are exceeding the planned expectations as a result of all of our efforts toward sustained efficiency in the region. As seen in Table 3 below, NEEA has tracked 114 aMW of co-created savings, 37 aMW of local programs, and 77 aMW of net market effects during the first three years of this business cycle (2020-2022).

Table 3: 2020-2024 Electric Savings (aMW)	**2020-2024 Business Plan Range**	**2020-2024 Current Forecast** *(range)*	**Cycle to Date** (2020-2022)
Savings Category			

Co-Created	115-152 n/a	161 *(144-176)* [12] SEM: 46 *(39-49)*	85 29
Local Programs			37
Net Market Effects			77

Additional Metrics

In addition to tracking and reporting the co-created savings for NEEA's regional portfolio, NEEA staff also estimates the regional value of a set of additional metrics.

Benefit Cost Assessment

One such metric is the benefit cost assessment of the NEEA portfolio. NEEA's goal is to have a portfolio benefit-cost ratio greater than 1. As mentioned above, there are 2 new programs that advanced into market development during 2022 which is the point at which programs contribute to the portfolio cost effectiveness calculation. This makes a total of 6 market transformation programs that constitute the portfolio benefit-cost assessment: Retail Products Portfolio, Heat Pump Water Heaters, Manufactured Homes, Luminaire Level Lighting Controls, Efficient Pumps, and High-Performance HVAC (see table 1 above). Leveraging data from the Northwest Power and Conservation Council's (NWPCC) ProCost tool for the 2021 Power Plan, NEEA has assessed the long-term total benefit-cost ratio for the market transformation portfolio at 1.99.

Peak Capacity and Avoided Carbon Emissions

NEEA staff also uses data from the NWPCC to enable the regional reporting for both peak capacity value and avoided carbon emissions. For 2022, the peak capacity value is a regional value assessed on all programs contributing co-created savings (see table 1), for a total benefit to the region of 75 MW of winter peak and 57 MW of summer peak savings.

For the estimation of avoided carbon emissions, NEEA includes the benefit from all of the co-created savings of the electric and gas portfolios. The 2022 co-created savings value of 38.7 aMW translates to a total of approximately 170,000 tons of avoided carbon emissions in 2022, at a monetized value of $11.7 million.

Table 4: 2020-2024 Additional Co-Created Value Metrics

	Avoided Carbon Emissions (tons)	Winter Peak Savings (MW)	Summer Peak Savings (MW)
2022	170,000	75	57
2020-2024	803,000-983,000	330-405	270-330

[12] Strategic Energy Management savings were not included in the forecast at the time NEEA's 2020-2024 Business Plan was under development so they are removed to compare with the business plan forecasted range of savings.

Appendix A: Program-Specific Information

2022 Highlights

Overall, NEEA is estimating the region produced nearly 39 aMW of co-created and 27 aMW of net market effects savings in 2022. NEEA influenced the creation of these savings through market transformation work that spans in-market programs, building codes, federal and state standards, emerging technology, as well as complementary data collection and research efforts. The following sections highlights this work for 2022.

In-market Programs

NEEA operates a portfolio of Market Transformation programs in seven cross-sector groups—consumer products, building envelope, HVAC, lighting, motors, new construction, and water heating. The programs within these sectors intervene in markets to create lasting change by removing barriers and leveraging opportunities.

Heat Pump Water Heaters (HPWH)

Regional sales of Heat Pump Water Heaters in 2022 increased by approximately 17% over the prior year. NEEA successfully completed in-person installer training for installers in Montana alongside a cold climate pilot program to help drive adoption within the state. Regionally, NEEA completed the 'Boring but Efficient' awareness campaign, which led to an increase in awareness and drove successful conversions to heat pump water heaters for customers inside the NEEA service territory. At a national level, the market saw the introduction of Demand Response Testing to achieve an ENERGY STAR label and ANSI/CTA-2045 standards, both of which are met by heat pump water heaters currently on the market. Additionally, NEEA participated in the development of a joint recommendation to U.S. Department of Energy (DOE) alongside industry and consumer advocates which will affect the upcoming national water heater standard. HPWHs are also an option that builders commonly use to meet the Washington residential building codes. NEEA will continue to work in the water heating market to sustain the momentum.

Retail Products Portfolio

NEEA expects savings from its Retail Products Portfolio to increase as a share of its portfolio savings over time. In 2022, manufacturer shipments of appliances decreased for refrigerators and laundry equipment, but ENERGY STAR and ENERGY STAR Most Efficient product market share remained strong across all categories in 2022.

Looking forward, NEEA is anticipating a new development in Television performance could bring significant savings in 2023. NEEA's television efforts began several years ago, resulting in a NEEA-developed test procedure to better estimate energy usage. The test procedure was adopted by ENERGY STAR and the Consumer Technology Association (CTA-2045-C and D) and is scheduled for adoption by the DOE in 2023. Additionally, as part of NEEA's work on TVs, major manufacturers have committed to a voluntary agreement to provide their TV energy performance, which will provide consumers with more transparent information on TV energy consumption and inform future midstream incentives through the program. The voluntary agreement will also provide energy use estimates to provide more accurate tracking of energy savings from the new ENERGY STAR specification. NEEA expects to begin reporting market progress for ENERGY STAR Televisions in 2023, which has been a large focus for the program in recent years.

Manufactured Homes

The DOE established a new energy code for manufactured homes (enforced by U.S. Department of Housing & Urban Development (HUD)). The new code goes into effect May 31st as does the requirements for U.S.

Environmental Protection Agency ENERGY STAR and DOE Zero Energy Ready that define eligibility for a $2,500 and $5,000 federal manufacturer tax credit respectively. The federal standard change and these programs were influenced by market evidence provided by NEEA's Manufactured Home program. The DOE specification is roughly equivalent to the NEEM 1.1 with the addition of a heat pump. NEEA is currently collaborating with DOE to define in-factory actions to ensure a good post code change transition.

Extend Motor Products—Pumps

Market adoption of efficient pumps in commercial applications is meeting expectations. One aspect of the program is to differentiate efficient pumps and circulators through the usage of energy rating labels. NEEA interviewed market actors in 2022 to develop this market transformation strategy and increase adoption of energy efficient pumps and circulators.

New Construction: Building Codes

The NEEA Codes and Standards efforts support regional stakeholders in the development and adoption, training, and implementation of energy building codes. Each state in the region has different code timing, needs and opportunities. The following describes the current status for each individual state code process.

- **Washington**: The new code, 2021 WSEC, is expected to go into effect July 1, 2023. The new Washington residential energy code will be among the first to require electric or gas heat pumps for space and water heating in many cases. Washington's new commercial code will require electric heat pumps for primary space and water heating.
- **Montana:** The 2021 IECC was adopted by Montana with weakening residential energy code amendments. Based on Pacific Northwest National Laboratory's 2021 IECC analysis, Montana's new residential and commercial energy codes are roughly 4% and 11% more efficient, respectively, than its prior codes.
- **Oregon:** NEEA is currently working on the next Oregon code. On the Commercial side, Oregon formalized its process of adopting the most recent version of ASHRAE 90.1 as the energy provisions of its commercial energy code, the Oregon Energy Efficiency Specialty Code (OEESC). On the residential side, NEEA submitted four code change proposals, and a representative of NEEA was selected to fill one of the nine seats on the Oregon Building Codes Division. One of the proposals submitted by NEEA was recommended for approval by the committee. NEEA expects to begin reporting savings from these code changes in 2024.
- **Idaho:** Based on Pacific Northwest National Laboratory's 2018 IECC analysis, Idaho's new commercial energy code is roughly 3.9% more efficient than prior code.[13] The residential code is approximately 11.6% more efficient.[14]

Products: Federal and State Appliance Standards

NEEA signed onto more than 75 comments on federal standards/test procedure updates for 53 different products including pumps, fans and blowers, clothes washers, and water heaters. Through these comments, NEEA provides strategic direction to support the process. In the long-term, the new standards could bring the Northwest additional energy savings. The energy savings analyses will be conducted over the upcoming years and published with future annual reports as data becomes available.

Emerging Technology

New Programs

[13] PNNL-28125.pdf

[14] Go to neea.org, portal login, savings, codes

NEEA moved its High-Performance HVAC program into Market Development in 2022. The program aims to transform the commercial HVAC market in the Northwest through the adoption of a very high efficiency dedicated outside air system (DOAS) approach that pairs high efficiency HVAC equipment with set design principles that optimize efficiency. Primary interventions include motivating manufacturers and distributors to promote the system approach, defraying the incremental cost of ERVs/HRVs, providing education and training to manufacturers, distributors, and designers, raising supply chain awareness of system approach benefits, and providing market data and evidence to influence the advancement of local, state, and federal codes to require elements of the entire system approach.

NEEA is also working on programs for Fans (Commercial & Industrial), most efficient Variable Speed Heat Pumps, and High-Performance Windows (Residential).

Voluntary Standards/Test Procedure Work

Six ENERGY STAR specifications were finalized or went into effect that NEEA has provided input into, three of which will significantly impact the region. Version 6.1 for Central and Ductless Air Conditioners and Heat Pump was finalized in January 2022 and became effective in January 2023; Water Heater v 5.0, which covers electric, gas, heat pump water heaters, and tankless water heaters, was finalized in July of 2022 and becomes effective in April of 2023. Lastly, Television v 9.0 was released in January 2022 and became effective in October 2022. The ENERGY STAR label will help markets and regional energy efficiency programs differentiate the most efficient products.

Data Collection and Research

Market Data and Research

NEEA plays a key role in regional market research needed to develop Market Transformation programs, assess their performance, and find new opportunities in the market. NEEA completed several studies in 2022 including an annual progress evaluation for the Heat Pump Water Heaters program, a supply chain awareness study for the Extended Motor Products program, and a market research study for variable speed heat pumps in the Northwest. These studies bring increased understanding of the market opportunity for these efficient products, as well as NEEA's progress toward its Market Transformation goals.

NEEA also leverages its relationships with key market actors on a regional and national scale to collect data. These relationships afford NEEA access to key sales and shipment data from manufacturers, distributors, and retailers. The data informs NEEA's program strategy as well as enables the region to track and report adoption of efficient technologies.

Stock Assessments

Stock assessments are an important complement to market research, providing another lens for identifying efficiency opportunities and tracking regional progress. NEEA is in the process of publishing the third Residential Building Stock Assessment (RBSA). The RBSA provides data on the existing housing stock in the Northwest to help with planning. The third RBSA includes the addition of tracking solar panels, electric vehicle chargers, presence of electric vehicles and accessory dwelling units. NEEA staff with regional stakeholders are currently in the planning phase for the next Commercial Building Stock Assessment.

End Use Load Research (EULR)

The EULR project is an ongoing regional study designed to gather accurate end-use load profiles for electrically powered equipment in homes and businesses. NEEA presented findings in 2022 to its Working Group on how to use the end-use load research data in nine ways other than energy efficiency including electrification, decarbonization, electric vehicle load growth, battery energy storage, distribution planning, power quality, demand response / flexible end-use load, load forecasting, and ratemaking for improved

price signals. The project also analyzed 2021 data, comparing it to historical end-use loads and identifying the evolving impacts of COVID-19.

NEEA completed its initial database transfers to a cloud data warehouse platform that can efficiently manage the massive database of billions of observations coming from continuously metering hundreds of homes with thousands of end-uses at 1-minute intervals. The public dataset is now downloaded from NEEA.org by universities, consulting firms, government agencies, and utilities. Meanwhile, NEEA will continue to gather more data. In 2022, NEEA installed continuous end-use metering by circuit in an additional 146 Northwest homes and 45 commercial office/retail buildings.

Memorandum – *Agenda item*

April 27, 2023

TO: Cost-Effectiveness Advisory Committee (CEAC)

FROM: Evan Hatteberg, Market Analyst

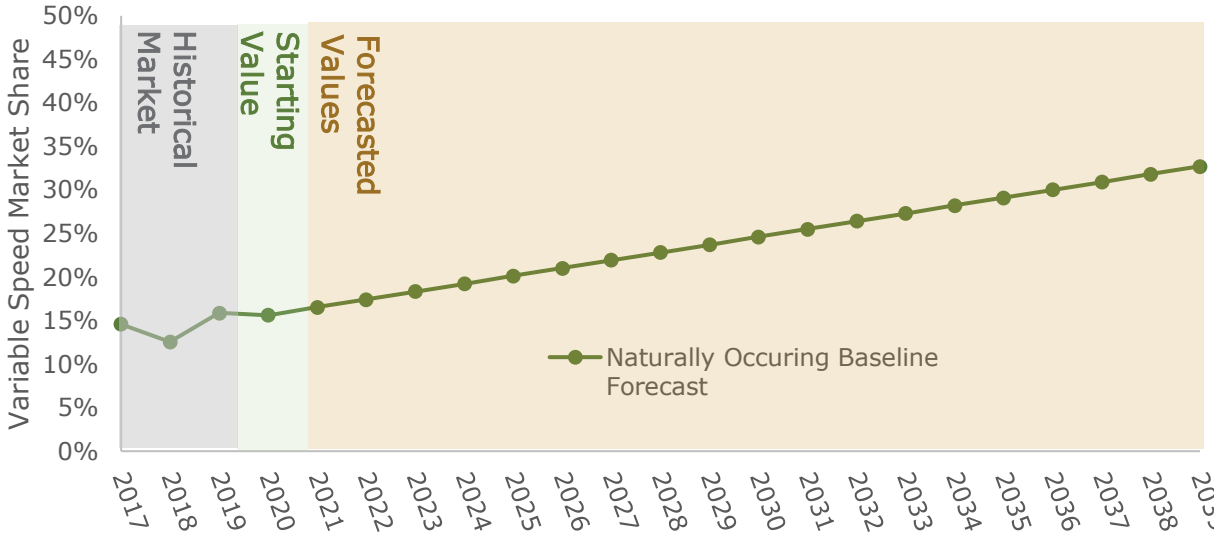
SUBJECT: XMP Pumps Variable-Load Baseline and Constant-Load to Variable-Load Savings Review

NEEA will inform the Committee about the completion of Apex Analytics' third-party review and provide an opportunity for Committee feedback on (a) NEEA's variable-load clean-water pump baseline market share estimates, and (b) NEEA's savings estimation method for variable-load pumps replacing constant-load pumps.

Variable-Load Baseline Market Share

Establishing a naturally occurring baseline forecast is a key input to assess the potential value of NEEA investment. This data is used to estimate both Co-Created Savings and Net Market Effects, two above-baseline savings values that NEEA tracks annually. Apex reviewed NEEA documents, relevant sales data, and calculations underlying NEEA's estimates of baseline market share for variable-load pumps, and then provided feedback and recommendations. NEEA has accepted Apex's recommendations and has updated the naturally occurring baseline market share forecast to align with these recommendations. NEEA will use a linear forecast based on historical sales data from the three years prior to the start of its forecast as the starting point for the naturally occurring baseline. To forecast beyond the start of NEEA's intervention, NEEA will assume an absolute annual growth rate of 0.9% for variable speed market share. See Figure 1 for planned naturally occurring baseline forecast.

Figure 1: Baseline Market Share Forecast



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Variable-Load to Constant-Load Pump Replacement Savings

As there is no current RTF measure to estimate the savings of Variable-Load to Constant-Load Pump Replacement; NEEA developed an internal savings estimation approach, and contracted with Apex Analytics to validate the approach. To review NEEA's savings estimation approaches for the replacement of constant-load pumps with variable-load equipment, Apex compared the savings estimation methods used in other jurisdictions to assess whether NEEA's proposed savings approach provides comparable savings estimates. Based on this review, Apex determined that NEEA's savings estimation method was potentially too conservative for pumps with higher horsepower, depending on application. Apex recommended that NEEA consider incorporating additional facility-level information into its savings estimates for variable-load pumps and reassessing a possible correlation between pump horsepower and kWh/hp savings. Due to limited data on higher horsepower constant-load pumps to variable-load pump replacements, for the time being NEEA will continue using the current conservative savings estimate, and depending on resources NEEA may update the savings method to fully capture the savings of higher horsepower variable-load pumps.

For more detail see the full report on NEEA.org:
https://neea.org/resources/extended-motor-products-variable-load-baseline-and-constant-load-to-variable-load-savings-key-assumptions-review

Contact Evan Hatteberg, ehatteberg@neea.org, with additional questions.

Memorandum

April 20, 2023

TO: Cost-Effectiveness Advisory Committee (CEAC)

FROM: Kathryn Bae, Senior Market Analyst

SUBJECT: NEEA's Methodology to Extrapolate Manufacturer Sales Data to the Region for Luminaire Level Lighting Controls

In 2022, NEEA developed an extrapolation methodology to estimate annual Luminaire Level Lighting Controls (LLLC) sales in the entire region. Anecdotal evidence of the growing interest in LLLCs from market actors was consistent with the sales data from LLLC manufacturers. The sales data shows a steady growth in regional sales as well as in each state. Local Programs data also reflected a growth in LLLC units claimed by the utilities across the region. The collective information gave confidence for NEEA to extrapolate LLLC sales to the region in its 2022 Annual Report. The purpose of this memo is to explain to the Cost Effectiveness Advisory Committee how NEEA extrapolates LLLC sales to the region and gather input on the approach.

Resulting Regional LLLC Units for 2022

NEEA estimated 33,665 units of LLLC were sold to the four-state region in 2022. Of the total units, 14,208 units (42%) come from a report covering sales to the region by seven manufacturers, and the remaining 19,457 units (58%) are the extrapolated sales by the LLLC manufacturers listed on the Design Lights Consortium's qualified product list whose sales are not covered in the sales report.

Extrapolation Methodology

There are 24 LLLC manufacturers on the Design Lights Consortium's (DLC) qualified product list. NEEA obtains LLLC sales to four states—Idaho, Montana, Oregon, and Washington—from seven of the 24 manufacturers through a third-party aggregator. Local Programs Survey responses suggest that utility programs cover some of the LLLC sales beyond the 7 LLLC manufacturers. For each manufacturer on the DLC list, NEEA estimates the market share based on past years' LLLC sales data collected from regional lighting distributors[15] and knowledge of the market share of each manufacturer then extrapolates the sales data.

The Cadmus Group conducted a third-party review of the extrapolation methodology and concluded that the extrapolation was reasonable and supported by quantitative and qualitative sources. Per their recommendation, NEEA will continue to pursue sales data from additional LLLC manufacturers as well as explore other datasets to improve the coverage of the estimated sales. The report on the methodology review is available on NEEA's website.

[15] NEEA stopped collecting LLLC sales data from the distributors in 2020.

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2023 Q2 Key Assumptions Quarterly Report

WHAT'S NEW:

Hello Everyone,

The update period for 2022 Annual Reporting is wrapping up! This key assumption report contains the final set of updates relevant to 2022 reporting of energy savings in NEEA's portfolio.

Select updates in this report will be shared at the upcoming meeting. If there are updates you are curious about, please bring your questions or contact us in advance.

As well, you can find NEEA's new Annual Report Data Sources and Estimation Approaches posted on the Funder Portal on neea.org.

NEEA's planning team looks forward to seeing everyone at the next Cost Effectiveness Advisory Committee meeting on April 27, 2023.

~ **Stephanie Rider**, Director, Planning & Analytics ~

TABLE OF CONTENTS

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PUBLISH DATE: MONTH DAY, YEAR

Luminaire Level Lighting Controls Key Assumption Review

Luminaire Level Lighting Controls (LLLC)

In late 2022, NEEA contracted with the Cadmus Group to conduct a review of key assumptions for its LLLC program. The review led NEEA to update two key assumptions in its savings calculation.

2022 is the first year NEEA is reporting total regional savings based on LLLC sales extrapolated to the region. NEEA developed an extrapolation methodology based on LLLC sales data from seven manufacturers and the sales data previously collected from lighting distributors. The Cadmus Group reviewed the extrapolation and found it reasonable and supported quantitatively and qualitatively. Because extrapolation is based on market shares under 50%, Cadmus recommended NEEA to continue to pursue sales data from additional LLLC manufacturers and triangulate results based on various methods. For 2022, the extrapolation approach resulted in reported sales from the manufacturers covering an estimated 42% of the total regional LLLC sales and the remaining 58% of the sales are extrapolated.

NEEA uses the lighting control savings fraction (CSF) from the RTF's Non-Residential Lighting Standard Protocol. The CSF is the percentage change in lighting energy consumption from a lighting system with controls compared to one with a manual on/off switch. The Cadmus Group found that approximately 20% of commercial buildings had lighting controls prior to the start of NEEA's LLLC program and recommended removing the baseline CSF in the savings calculation for LLLC installed in existing buildings.

A final report is available on neea.org.

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Luminaire Level Lighting Controls Incremental Cost Study

Luminaire Level Lighting Controls (LLLC)

NEEA contracted with Energy Solutions to conduct the biennial incremental cost study of LLLC. Compared to 2020, the 2022 study observed more than 30% decrease in incremental per-fixture costs across all 3 types of LLLC systems: smart, clever, and clever-hybrid. NEEA updated the incremental cost assumption in its cost effectiveness calculation. A final report is available on neea.org.

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Refrigerator Naturally Occurring Baseline Revision and Review | Retail Product Portfolio (RPP)

NEEA originally contracted with APEX Analytics to develop a naturally-occuring baseline for advanced refrigerators in early 2022. This baseline relied in part on market share trends for these refrigerators derived from retail sales data acquired by the RPP program. Later in 2022, many more refrigerator models were listed as acheiving the ENERGY STAR© Emerging Technology Award, which allowed NEEA to revise the market share estimates used in the baseline analysis. NEEA is now working with APEX Analytics to update the baseline. This update increases the share of the adoption that is considered to be naturally-occuring and decreases the co-created savings for refrigerators.

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Washington Residential Code Evaluation

Residential Codes

NEEA has been working on a Washington Residential Code Evaluation report to review assumptions underlying the estimation of energy savings resulting from NEEA and its partners' involvement in the Washington State Residential Energy Code (WSEC-2018) process. While the report will not be finalized and published until Q2, the Codes team had enough information from that study to update its estimate of the percentage of homes built in the state with natural gas space and water heating. The new estimate is 18%, an increase from 12% in the previously published Washington Residential Post-Code Market Research Report. The team also updated the compliance rate from 91% (2019-2020 Washington Residential New Construction Code Study) to 76% based on the preliminary results.

NEEA applied the code compliance update to both its electric and natural gas savings estimates for WSEC-2018. However, NEEA only applied the fuel selection update to its gas savings report. NEEA will update the electric side after it completes its savings analysis for WSEC-2021, which should be effective in July. The new analysis will break the electric savings rates by HVAC type for the new and previous codes.

You can see a full description of the Washington Residential Code Evaluation in the Q1 Market Research and Evaluation Newsletter. Once the report is finalized, NEEA plans to share details on methodology and results at the May Natural Gas Board Committee meeting and the Q3 NGAC and CEAC meetings.

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TOGETHER *We Are Transforming the Northwest*

2023 Q1 Market Research & Evaluation Quarterly Newsletter

WHAT'S NEW:

Hello everyone!

The Market Research and Evaluation (MRE) team is pleased to bring you this quarter's MRE newsletter. The team is looking ahead to a second quarter of lots of reports! More than half of the twenty-three studies that are currently have underway anticipate final reports to post in the next three months. These reports become key assets to the Market Transformation programs they serve, as well as to the region. NEEA's evaluation reports, such as Market Progress Evaluation and Market Characterization reports, not only assess and document progress toward expected market outcomes, but they also provide market insights to help refine the program and improve its effectiveness at transforming the market.

A few of the evaluation projects you will see described in the newsletter do not have an explicit program adaptive management use case. Examples include baseline reviews, cost-benefit model reviews, and key assumptions reviews. MRE is not tracking progress toward outcomes in these studies, and the team is not using the results to refine the program. Instead, the results of these evaluations help to refine the modeled savings for the program. They validate the model assumptions (or, as the case may be, reject them or suggest improvements) and they help to refine the accuracy of the estimated costs and benefits associated with the program's market influence. Thank you for taking some time to read over the newsletter. Please reach out with any questions or suggestions. Until next time, I hope you have a wonderful spring!

~ **Amy Webb**, Sr. Manager, Market Research & Evaluation ~

TABLE OF CONTENTS

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PUBLISH DATE: March 15, 2023

At a Glance

MARKET RESEARCH & EVALUATION PROJECTS

		PLANNING*	FIELDING*	REPORTING*
Integrated Systems	Efficient Rooftop Units: *Market Progress Evaluation Report #1*	✓		
	High-Performance HVAC: *Market Progress Evaluation Report #1*	✓		
	High-Performance Windows: *Naturally Occurring Baseline Review*		✓	
	Luminaire Level Lighting Controls: *Incremental Cost Study*			✓
	Luminaire Level Lighting Controls: *Key Assumptions Review*			✓
	Luminaire Level Lighting Controls: *Market Progress Evaluation Report #2*		✓	
	Natural Gas Portfolio and Strategy: *Dual-Fuel and Gas Heat Pump Market Research*			✓
	Variable Speed Heat Pumps: *Baseline and Key Assumptions Review*			✓
Products	Efficient Fans: *Fan System Market Characterization*		✓	
	Motor-Driven Products: *Commercial Adjustable Speed Drive Market Penetration Research*			✓
	Heat Pump Water Heaters: *Benefit/Cost Model Review*			✓
	Heat Pump Water Heaters: *Market Research: Challenging Installation Scenarios*			✓
	Heat Pump Water Heaters: *Market Progress Evaluation Report #7*		✓	
	Heat Pump Water Heaters: *Installer Focus Groups*		✓	
	Retail Product Portfolio: *Refrigerator Baseline Update*			✓
	Retail Product Portfolio: *Market Progress Evaluation Report #2*			✓

DUAL FUEL (Electric & Natural Gas) PROJECTS:

NATURAL GAS PROJECTS:

***PLANNING:** MRE projects from inception through proposal selection

***FIELDING:** MRE projects from kick-off through the completion of field work

***REPORTING:** MRE projects in the analysis/synthesis stage through report posting

At a Glance

MARKET RESEARCH & EVALUATION PROJECTS

Codes, Standards, New Construction

Long-term Monitoring & Tracking

	PLANNING*	FIELDING*	REPORTING*
Standards: *Commercial Kitchen Equipment and High CRI Lamp Oregon and Washington State Standards Evaluation*			✓
Residential Codes: *Idaho and Montana Residential Code Evaluations*		✓	
Residential Codes: *Washington Residential Code Evaluation*			✓
Commercial and Residential Codes: *Market Progress Evaluation Report #2*			✓
Commercial Codes: *Idaho Commercial New Construction Code Evaluation*	✓		
Commercial Codes: *Montana Commercial New Construction Code Evaluation*		✓	
Ductless Heat Pump Long-Term Monitoring and Tracking, Year 2			✓

DUAL FUEL (Electric & Natural Gas) PROJECTS:

NATURAL GAS PROJECTS:

***PLANNING:** MRE projects from inception through proposal selection

***FIELDING:** MRE projects from kick-off through the completion of field work

***REPORTING:** MRE projects in the analysis/synthesis stage through report posting

Market Progress Evaluation Report #1

Efficient Rooftop Units (ERTU) | **PLANNING**

As of late 2022, NEEA's ERTU program is actively engaging in the market to adopt ERTUs for gas-heated commercial buildings across the region. This Market Progress Evaluation (MPER) will be the first evaluation of the program's Market Transformation efforts. The program's overarching objectives for the study are to:

1. Provide timely and actionable formative evaluation findings and recommendations to enable continuous improvement of the program;
2. Assess market transformation progress as measured by program Market Progress Indicators; and
3. Qualitatively assess program influence on observed market transfomation.

NEEA will conduct the ERTU MPER in close coordination with the MPER for the High-Performance HVAC Program because these programs engage with the same market actors (commercial HVAC contractors, commercial building decision makers, etc.) and have closely related target markets (existing small- to mid-sized commercial buildings with gas vs. electric heat). Coordination of the MPERs allows NEEA to reduce data collection costs and burdens placed on market actors in the region.

The evaluation will be ongoing through the fall of 2024, with a final report anticipated in Q4 2024.

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Market Progress Evaluation Report #1

High-Performance HVAC | **PLANNING**

As of late 2022, NEEA's High-Performance HVAC program is actively intervening to transform the market for very high efficiency Dedicated Outside Air Systems (DOAS) for electrically heated commercial buildings across the region. This MPER will be the first evaluation of the program's Market Transformation efforts. The program's overarching objectives for the study are to:

1. Provide timely and actionable formative evaluation findings and recommendations to enable continuous improvement of the program;
2. Assess market transformation progress as measured by program Market Progress Indicators; and
3. Qualitatively assess program influence on observed market transfomation.

NEEA will conduct the High-Performance HVAC MPER in close coordination with the MPER for the Efficient RTUs program. The evaluation will be ongoing through the fall of 2024, with a final report anticipated in Q4 2024.

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Naturally Occuring Baseline Review

High-Performance Windows | **FIELDING**

The residential High-Performance Windows program contracted with The Cadmus Group to launch a third-party review of the program's naturally occurring baseline forecast in Q2 2023. The research objectives for this study are to:

1. Review NEEA's overall approach for estimating the naturally occurring baseline of high-performance windows.
2. Review NEEA's approach to estimating the market average U-value of windows sold in the Northwest prior to the program's intervention.
3. Review and recommend improvements to NEEA's approach to incorporating market drivers of high-performance windows into its naturally occurring baseline. Fielded research will begin in Q2 2023.

Fielded research will begin in Q2 2023, and a final report is anticipated in Q3 2023.

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Incremental Cost Study

Luminaire Level Lighting Controls (LLLC) | **REPORTING**

NEEA contracted with Energy Solutions to conduct the biennial incremental cost study for the LLLC program.

The research objectives for this study are to: 1) document the brands and models available for LLLC systems, 2) estimate the incremental price between non-controlled LED fixtures and LED fixtures with LLLC, 3) estimate and compare the cost of components and energy efficiency capabilities across all three levels of LLLC fixtures (smart, clever, and hybrid), and 4) gain insight into sales of exterior LLLC control systems and fixtures.

A final report is anticipated in Q2 2023.

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Key Assumptions Review

Luminaire Level Lighting Controls (LLLC) | **REPORTING**

NEEA's LLLC program contracted with The Cadmus Group to complete a third-party review of several key assumptions underlying its energy savings model. The research objectives for this study are to: 1) review NEEA's approach for estimating hours of use and control savings fraction for LLLC, 2) explore how NEEA can quantify energy savings that fully represent the adoption of LLLC, given that fixture wattage may decrease over time, and 3) review and recommend improvements to NEEA's approach to estimating the number of LLLC fixtures being sold in the Northwest.

Fielded research completed in Q4 2022, and a final report is anticipated in early Q2 2023.

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Market Progress Evaluation Report #2

Luminaire Level Lighting Controls (LLLC) | **FIELDING**

NEEA's LLLC program seeks to accelerate the adoption of LLLC in commercial buildings for new construction, major renovation, and retrofit projects. NEEA contracted with The Cadmus Group to conduct the second MPER and will address the following questions in this study:

1. How do the program documents clarify and align to convey the program's strategy and planned activities to overcome market barriers and drive market changes that will increase LLLC adoption?
2. To what extent has the program progressed toward achieving its short and mid-term outcomes as tracked through its market progress indicators?
3. How might NEEA program activities be affecting the broader networked lighting control (NLC) market?
4. What leads decision-makers to purchase LLLC (versus other NLC)? What features (including non-energy benefits) do they value leading up to purchase and after the product is installed?

A final report is anticipated in Q3 2023.

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Dual-Fuel and Gas Heat Pump Market Research

Natural Gas Portfolio and Strategy | **REPORTING**

NEEA contracted with Lieberman Research to conduct a market research study to gather HVAC system buyer and HVAC contractor perceptions and (when possible) feedback about four emerging HVAC technologies. Findings from the study will complement ongoing NEEA product research to assess product performance and readiness for Northwest markets. The study will help NEEA determine which, if any, of these technologies to further investigate for market transformation or other types of energy efficiency programs in the Northwest.

The study seeks to answer three main research questions for each of the technologies:

1. What are the value propositions for buyers and HVAC contractors?
2. What are the possible target markets?
3. What are the barriers to adoption?

The four technologies are residential dual-fuel heat pumps, residential gas heat pumps, commercial gas heat pumps for space and/or water heating, and commercial dual-fuel rooftop units. The Lieberman Research team is recruiting and interviewing consumers, commercial building decision makers, and HVAC contractors to address these research questions. Early findings are anticipated in early Q2 2023.

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Baseline and Key Assumptions Review

Variable Speed Heat Pumps (VSHP) | **REPORTING**

Cadmus Group will complete an independent review of NEEA's VSHP naturally occurring baseline market share forecast and key assumptions for modeling savings and other analyses. The evaluation questions for the review are:

1. Are the data and methods used to determine unit energy savings reasonable and sufficient for credible accounting of energy savings? What refinements, if any, are needed to NEEA's data sources and methods?
2. Are data sources and methods for determining the incremental first cost of the measure, and incremental operations and maintenance costs, reasonable and sufficient for credible estimates of cost effectiveness? What refinements, if any, are needed to NEEA's data sources and methods?
3. Is NEEA's naturally occurring baseline forecast a reasonable representation of market adoption without intervention by NEEA, utility programs, or its partners? What refinements, if any, are needed to NEEA's baseline forecast and what evidence supports these changes?

The completed review and final report are anticipated in early Q2 2023, after which findings will be presented to NEEA's Cost-Effectiveness Advisory Committee (CEAC).

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Fan System Market Characterization | Efficient Fans | FIELDING

NEEA contracted with DNV Energy Insights, Inc., to conduct a Market Characterization study to inform development and planning efforts for the Efficient Fans program, which is in the program development stage of NEEA's Initiative Life Cycle. The program aims to accelerate adoption of efficient fans and fan system products, including motors, drives, and controllers, by working upstream with manufactures and highlighting efficiency metrics within their selection software. The initial program focus will be in the commercial and industrial sectors.

The objectives for this Market Characterization study include:

1. Profiling and sizing of the regional fan system market
2. Identifying and prioritizing of market barriers
3. Documenting of market actor motivations and fan system path-to-purchase

A project kick-off was held in February 2023, with data collection scheduled to commence in Q2 2023 and planned to include multiple market actor groups (e.g., fan system manufacturers, manufacturers' representatives, distributors, and end users). The study is expected to conclude by the end of Q3 2023, and a final report is anticipated in Q4 2023.

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Commercial Adjustable Speed Drive Market Penetration Research

Motor-Driven Products | **REPORTING**

As part of NEEA's assessment of intervention opportunities in the market for commercial adjustable-speed drive (ASDs, hereinafter referred to simply as "drives"), NEEA contracted with Johnson Consulting Group, LLC, to conduct a market research study. The study seeks to understand the rate of market penetration for drives in the alliance's four-state region, particularly as pertaining to drives paired with commercial pumps and fans. This research will also provide insight into the decision-making processes and factors underlying market actors' choice to pair drives with commercial pumps and fans. A kickoff meeting took place in October 2022, with sample development completed in January 2023 and data collection activities running through March 2023. A a final report is anticipated in Q2 2023.

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Benefit Cost Model Review

Heat Pump Water Heaters (HPWH) | **REPORTING**

In Q4 2022, NEEA contracted with Larson Energy Research to conduct a review of its Benefit Cost Model for the HPWH program. The work commenced in early 2023 and will result in a final report by early Q2 2023. The key activities include:

1. Reviewing extrapolation methodologies used to estimate manufacturer shipments
2. Assessing NEEA estimates for HPWH market share in single-family new construction
3. Reviewing and validating the modeling assumption underlying the removal of Tier 1 and Tier 2 measures for future years.

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Market Research: Challenging Installation Scenarios

Heat Pump Water Heaters (HPWH) | **REPORTING**

In the summer of 2020, NEEA contracted with Cadeo Group to explore water heater installer experiences with challenging installation scenarios for HPWH equipment. Findings intend to help the HPWH program develop the best approaches to help installers to overcome these difficulties, thereby enabling them to offer HPWHs to their customers as a potential replacement. Furthermore, this study supports the program's Market Transformation objectives by collecting information to inform and support NEEA's efforts in influencing an anticipated Federal water heating standard for HPWHs. Other objectives included:

1. Estimating the prevalence of these scenarios in the regional housing stock
2. Understanding the frequency with which installers encounter each scenario
3. Investigating the level of effort required to overcome challenges
4. Identifying where installers turn for information or solutions

This report complements other regional studies that have explored the prevalence of so called "challenging installations" for HPWHs in the housing stock. NEEA's recently released report, entitled "HPWH in Small Spaces Lab Testing: 'The Amazing Shrinking Room'" also adds to the body of knowledge on this topic. In addition, NEEA is currently conducting observational research of installations in cold climate locations in the Northwest to determine if there are challenges specific to cold climate regions. Plans are underway to prepare the final report summarizing the findings of this study.

A final report is anticipated in Q2 2023.

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Market Progress Evaluation Report #7

Heat Pump Water Heaters (HPWH) | **FIELDING**

NEEA contracted with NMR Group to conduct the seventh Market Progress Evaluation Report (MPER) for the HPWH program. The key objectives of this effort are to:

1. Ensure the logic model accurately reflects how the current Market Transformation theory for the program is being implemented and assess the MPIs for usefulness
2. Estimate 2022 penetration of HPWHs in the region with sales broken out by key attributes
3. Evaluate the program's performance over the course of 2022 in achieving outcomes by measuring against a subset of MPIs tied to the program's highest priority barriers
4. Assess the effectiveness and impact of the "Boring but Efficient" downstream marketing campaign conducted in 2022

The kickoff occurred at the beginning of 2023 and a final report is expected in early Q3 2023.

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Installer Focus Groups | Heat Pump Water Heaters (HPWH) | FIELDING

NEEA contracted with ILLUME Advising in Q4 2022 to conduct qualitative research to better understand any challenges installers and plumbers in the region might face around recommending and installing HPWHs in existing single-family homes. A 2020 survey of HPWHs installers in the Northwest identified several factors and specific structural barriers that can complicate a HWPH retrofit, such as, but not limited to wiring constraints, small installation spaces, physical location of the unit, and proximity to condensate drain. This research provided insight as to how installers in the region might overcome these types of challenges and was specifically focused on installers that had experience with installing HPWHs. In this upcoming research, NEEA will include both active HPWH installers and those with little or no prior experience in HPWH installation across the Northwest. The key objectives of the upcoming research are to:

1. Identify the underlying reasons why installers and plumbers might be resistant to offering and installing HPWHs to customers seeking a new water heater
2. Understand the opinions and thoughts about where and why installers are not recommending and/or installing HPWHs
3. Gauge general level of resistance to code and standard changes among installers
4. Understand how installers might react to the passage of the proposed federal standard
5. Learn about what behaviors they might use to adapt to a new standard

In Q1 and Q2 2023 ILLUME Advising is recruiting for and conducting between six to eight virtual focus groups across the region with installers and plumbers that have limited experience with HPWH installation. A final report is expected in Q2 2023. Findings will inform future training efforts and help the program improve its messaging campaigns targeted to installers across the region.

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Refrigerator Baseline Update | Retail Product Portfolio (RPP) | REPORTING

ENERGY STAR® awarded a 2020-2021 Emerging Technology Award (ETA) to advanced adaptive compressors used in refrigerators and freezers and then extended the award into 2022. The number of qualifying models listed by manufacturers increased significantly in 2022. NEEA used the expanded list to re-assess the market share of qualifying products prior to the ETA and found that there was a higher proportion of qualifying products being sold in the market prior to the ETA than previously believed. As a result, NEEA contracted Apex Analytics to review the findings of the 2022 Refrigerator and Freezer Influence Assessment and Baseline Review they conducted for NEEA using the updated market share data. This project began in Q1 2023 and a final report is anticipated in Q2 2023.

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Market Progress Evaluation Report #2 | Retail Product Portfolio (RPP) | REPORTING

NEEA's RPP program provides mid-stream incentives to retailers for sales of qualifying efficient products, such as refrigerators and clothes washers, to influence retail assortment and product promotion, obtain access to sales data, and ultimately influence the ENERGY STAR specification or federal standard. NEEA contracted with TRC to conduct the second MPER for RPP to meet the following research objectives:

1. Review NEEA's updated RPP logic model and make recommendations for improvement
2. Document activities and outputs and assess progress on applicable market progress indicators (MPIs) for each product in the program's portfolio
3. Evaluate NEEA's methodology for extrapolating short-term savings to the full market

RPP MPER #2 kicked off in July 2022. A final report is expected in Q2 2023.

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Commercial Kitchen Equipment and High CRI Lamp Oregon and Washington State Standards Evaluation

Standards | **REPORTING**

NEEA's Codes and Standards team engaged in efforts to support the development of state standards in Oregon and Washington for commercial kitchen equipment (fryers and steam cookers) and high color rendering index (CRI) lamps. NEEA contracted with Michaels Energy to conduct a qualitative assessment of NEEA's influence on the standards processes in Oregon and Washington. The study intends to provide a quantitative estimate of the share of savings resulting from the standards that are the outcome of NEEA and other efficiency organizations' efforts. The project kicked off in August 2022 and a final report is anticipated in Q2 2023.

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Idaho and Montana Residential Codes Evaluation

Residential Codes | **FIELDING**

NEEA contracted with IEc to review assumptions underlying its estimation of energy savings resulting from NEEA and its partners' involvement in the Idaho and Montana state code processes. This research will involve assessing compliance with 2018 IECC with Idaho amendments and 2018 IECC with Montana amendments and addressing market research questions of interest to NEEA's Codes & Standards team. This work kicked off in Q1 2023 and final reports are anticipated in Q4 2023.

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Washington Residential Code Evaluation

Residential Codes | REPORTING

NEEA contracted with TRC to review assumptions underlying its estimation of energy savings resulting from NEEA and its partners' involvement in the Washington State Residential Energy Code (WSEC-2018) process. To understand the characteristics of homes built under WSEC-2018, TRC will conduct virtual audits with owners of single-family homes built under the code and assess data from the Residential Energy Services Network (RESNET) database for homes built under WSEC-2018. They will also collect permits for all homes included in the virtual audit and RESNET samples. TRC will conduct analyses to:

1. Estimate residential new construction compliance for single-family homes built under WSEC-2018
2. Assess NEEA's approach for estimating compliance for 2–4-unit multifamily buildings
3. Determine the compliance pathways builders are taking to meet WSEC-2018 code requirements in single-family residential buildings
4. Determine fuel selection for space and water heating in single-family residential buildings built under WSEC-2018
5. Assess how well permits represent completed homes built under WSEC-2018
6. Assess the efficacy and potential replicability of the study methodology over time and across states in the Northwest (Idaho, Montana, Oregon and Washington)

This project kicked off in June 2022, and data collection is underway. A final report is anticipated in Q2 2023.

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Market Progress Evaluation Report #2

Commercial and Residential Codes | **REPORTING**

NEEA contracted with ADM Associates to conduct a MPER for its Commercial and Residential Codes efforts. ADM will evaluate the logic and clarity of the updated Codes logic model, make recommendations for improvement and assess outcomes associated with Codes training and education activities. The project kicked off in October 2022 and a report from the first suite of study activities is expected in early Q2 2023.

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Idaho Commercial New Construction Code Evaluation

Commercial Codes | **PLANNING**

The Idaho Commercial New Construction Code Evaluation study will focus on (a) assessing the path(s) by which and degree to which code compliance is achieved with the amended 2018 International Energy Conservation Code (IECC) in newly constructed buildings, and (b) measuring the energy performance of a subset of these buildings as compared with the average energy performance of buildings constructed under previous code. The results of the study will provide direction to the development and implementation efforts of the NEEA Codes team and will provide other regional code stakeholders guidance in targeting their energy efficiency work in the commercial new construction sector. The study is expected to begin in Q3 2023 and a final report is anticipated in Q4 2023.

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Montana Commercial New Construction Code Evaluation

Commercial Codes | **FIELDING**

The Montana Commercial New Construction Code Evaluation study is focused on (a) assessing the path(s) by which and degree to which code compliance is achieved with the 2018 International Energy Conservation Code (IECC) in newly constructed buildings, and (b) measuring the energy performance of a subset of these buildings as compared with the average energy performance of buildings constructed under previous code. The results of the study will provide direction to the development and implementation efforts of the NEEA Codes team and will provide other regional code stakeholders guidance in targeting their energy efficiency work in the commercial new construction sector. NEEA contracted with Michaels Energy to undertake this study. The study design and methodology selected for this project focuses on permit data as the primary source of construction and compliance information, with virtual or in-person site visits planned for a subsample of participating buildings in order to validate the accuracy of permit data.

The project kicked off in mid-Q2 2022, with planning and sample development continuing through late Q4 2022. Data collection, including interviews with site contacts, desk review of permit data, and in-person/virtual site visits, is scheduled to commence in Q1 2023 and conclude in Q2 2023. This study also includes analysis of billing data and collection of this data is planned to continue through late Q3 2023, with analysis and report preparation to follow. A final report is anticipated in Q1 2024.

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Ductless Heat Pump Long-Term Monitoring and Tracking, Year 2

REPORTING

This study is the second Long-Term Monitoring and Tracking (LTMT) study for DHPs. NEEA intends to conduct the study annually to monitor signs of diffusion of DHPs in NEEA's three target markets (single family homes with zonal heating, single family homes with electric forced air furnaces, and manufactured homes with electric forced air furnaces). Each year, the study will track four diffusion indicators:

1. The number of DHPs installed in single-family homes to displace/replace electric zonal heat or electric forced-air furnaces is increasing
2. The installed cost for a single-head system remains constant or decreases
3. The share of regional HVAC companies/installers offering DHPs remains constant or is increasing
4. The number of counties in the region with HVAC companies that install DHPs remains constant or is increasing

Evaluation contractor Johnson Consulting Group conducted three surveys of HVAC contractors for the study, as well as utilized secondary data from NEEA. A final report is anticipated in Q2 2023.

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