Cost Effectiveness and Evaluation Advisory Committee Meeting

DATE: August 24, 2023
TIME: 9:15AM - 12:00PM
LOCATION: Microsoft Teams meeting

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AGENDA:

TIME	TOPIC	PRESENTER(S)	Electric/ Gas/Both	Link or Page #
9:15am (15 min)	**Welcome/Agenda Review** 1. Agenda check 2. Announcements	Jonathan Belais, NEEA Staff		
9:30 (30 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	Link

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TIME	TOPIC	PRESENTER(S)	Electric/ Gas/Both	Link or Page #
10:00 (45 min)	**Milestone Review: Advanced Heat Pumps** Review of available cost-effectiveness and savings information for the Advanced Heat Pumps initiative, scheduled for milestone review at the upcoming Regional Portfolio Advisory Committee (RPAC). Objective: Inform and discuss any questions or suggestions	Lauren Bates, Havala Hanson, and Suzi Asmus; NEEA Staff	Electric	4
10:45 (10 min)	Break			
10:55 (15 min)	**Dual Fuel Measurement and Reporting Work Group** Update and discussion regarding proposed work group to establish guidelines for NEEA to use when calculating and reporting benefits of dual fuel measures. Objective: Inform committee members and answer questions	Ryan Brown, NEEA Staff	Both	11
11:10 (15 min)	**Key Assumption Updates** NEEA staff will highlight key assumption updates and answer questions from committee members. Objective: Inform committee members, gather feedback, and questions regarding updated assumptions.	Ryan Brown, NEEA Staff	Electric	Link

TIME	TOPIC	PRESENTER(S)	Electric/ Gas/Both	Link or Page #
11:25 (30 min)	**Assessment of NEEA's Approach to the Evaluation of Market Transformation Programs** Share out and discussion of the purpose, methodologies, and key findings from this third-party assessment. Objective: Inform committee members and answer questions.	Amy Webb, NEEA Staff	Both	13
11:55 (5 min)	Wrap up		Both	

Memorandum

August 17, 2023

TO: Cost Effectiveness Advisory Committee

FROM: Havala Hanson, Ph.D., Manager, Planning and Analysis, Stephanie Rider, Director, Data, Planning and Analytics

SUBJECT: Advanced Heat Pump (AHP) Energy Savings and Cost Effectiveness Data and Assumptions

The purpose of this memo is to inform committee members about the data collected and the analytic approaches underpinning the Advanced Heat Pump (AHP) program energy savings and cost effectiveness calculations. We further welcome committee members to provide feedback and input. The AHP program is planning to advance into the market development phase of the Initiative Lifecyle (ILC) pending a Regional Portfolio Advisory Committee vote on August 29. In preparation, NEEA compiled and analyzed data and evidence to estimate cost effectiveness of the program throughout the market transformation process. The resulting assumptions—evaluated by a third party and presented to this committee in advance of the vote—will be applied to energy savings reporting, which is anticipated to begin in 2025.

To build greater efficiency into out-of-the-box heat pump systems in a landscape of increasing heat pump installations, the program has identified a set of efficiency features or system capabilities ("improvements") that have the potential to meaningfully increase installed heat pump system efficiency.

The data and methods presented in this memo pertain specifically to the program's first heat pump improvement—low load efficient heat pumps—and is limited to central ducted systems. A low load efficient heat pump operates very efficiently when under mild outdoor conditions, such as between 30°F and 50°F. Data collection, research and analysis is planned to prepare key assumptions for other improvements the program identified, such as cold climate capable heat pumps and connected commissioning, and for other types of heat pumps that include the improvements (e.g., ductless heat pumps). Once developed, key assumptions will be third-party evaluated and presented at future CEAC meetings.

Alongside an overview of the data and methods used to develop low load efficient heat pump key assumptions, this memo describes the resulting key assumptions. It further summarizes recommendations from the third-party review of NEEA's naturally occurring baseline forecast and key assumptions. NEEA staff will discuss the key modeling assumptions and third-party reviewer feedback during the August 24 CEAC meeting. We welcome feedback from CEAC members.

Advanced Heat Pump program

Heat pumps now dominate the market for electrically conditioned homes,[1] far outpacing electric resistance and forced air furnace sales in new construction and retrofits.[2] These trends are expected to continue and quicken given the federal and utility incentives for heat pumps, code, and consumer interest in the benefits of heat pumps. While heat pumps are substantially more efficient than electric resistance and forced air furnace systems, real world energy metering shows that they often fall short of energy savings potential. Heat pumps are complex systems that are impacted by many factors and operating conditions including climate, ducts, envelope, installation, and operation preferences. This complexity has created challenges for energy efficiency. In addition, the drivers for more efficient performance are not well understood or differentiated in the market.

The AHP program aims to address the market's lack of awareness of what delivers efficiency and capacity to differentiate products with the heat pump improvements NEEA identified with three strategic interventions: 1) validating energy savings and establishing metrics to identify qualifying products; 2) building support among manufacturers and efficiency partners for incorporating recommended improvements into specifications and standards; and 3) leveraging existing manufacturer, distributor, and efficiency program training and marketing to drive contractor and consumer awareness and education. Including low load efficient heat pumps and nine other improvements NEEA identified for further investigation, the program estimates a technical potential of roughly 350 aMW in energy savings if all these technologies are universally adopted. Within the technical potential, NEEA forecasts that market transformation efforts related to central ducted low load efficient heat pumps could yield approximately 35 aMW in total regional savings and 21 aMW in co-created savings above a naturally occurring baseline over 20 years.

Key Assumptions: Central Ducted Low Load Efficient Heat Pumps

The following sections describe data, methods, and results for:

1) Market size;
2) Measure life;
3) Unit energy savings, and;
4) Cost effectiveness

NEEA has also developed and had a third-party review data and methods for estimating a naturally occurring baseline for central ducted low load efficient heat pumps. As recommended by evaluators, NEEA will conduct sensitivity analysis on the baseline with newly acquired 2022 sales data. After completing sensitivity analysis and prior to reporting savings in 2025, NEEA will present the data, methods, and resulting baseline to this committee. At the same time, NEEA will present its methodology for tracking market adoption, which relies on the same sales data used to develop the naturally occurring baseline.

[1] See Table 2 of BPA's Northwest HVAC Sales & Trends 2016-21 and the BPA Residential HVAC Model.

[2] See Kirszner et al. (2022), Study of Influences on Northwest VSHP Adoption and Kirszner et al. (2022), Residential HVAC Contractor Market Research.

Market size

The target market is comprised of sales of central ducted[3] VSHPs installed in single family homes. The market size described in this memo applies to all improvements in the AHP program that occur in central ducted variable speed heat pumps (VSHPs). This encompasses central ducted low load efficient heat pumps and central ducted heat pumps with other improvements, such as cold climate capability and connected commissioning.

Data

Our understanding of regional VSHP sales is grounded primarily in the BPA Residential HVAC Momentum Savings Model, which was developed under consultation of an expert review panel that included three NEEA staff members. Technical inputs to estimating regional product flow (total regional sales) are a product of several stock and sales data sources, relying heavily on many datasets NEEA collects and maintains:

- Residential stock assessments, RBSA I (2011) and RBSA II (2016)
- HVAC supplier sales data, including full category sales data that represented approximately 34% of the air source heat pump market in 2021
- Seventh and 2021 Power Plans (new construction and demolition rate assumptions)
- US Census New Residential Construction

Methods

To estimate the 20-year market size—VSHP sales between 2024 and 2043—NEEA conducted an ordinary least squares regression that bounds growth within conservative projections of total HVAC sales and within air source heat pump (ASHP) sales. NEEA analysts used predicted values from the regression analysis on historical data to forecast future sales within bounds that do not allow any technology to decline to zero sales and do not allow any technology to increase beyond half of total market sales. Variable speed heat pumps are bounded not to exceed 80 percent of the air source heat pump market.

Results

Table 1. Estimated regional primary HVAC system product flow by technology from 2024 through 2043

Electric furnace	Zonal	Ductless heat pump	Central ducted air source heat pump		Other, including gas	Total
			All	Variable speed		
13,595	485,663	2,041,814	2,116,921	1,503,603	2,825,215	8,986,811

Considerations

Observable sales vs. regional product flow. It is important to quantify the entire regional market to elucidate the potential opportunity of the program. However, the annual HVAC supplier sales data

[3] Additional research is necessary to include other types of VSHPs, including ductless VSHPs. The market size will be updated and presented to this committee once evidence is available to develop key assumptions for savings reporting.

collection provides the single source of observable sales data to calculate low load efficient heat pump energy savings and it does not include full market data. NEEA will base savings estimates on observable records to start. Omitting extrapolation produces conservative savings estimates. Likewise, the estimated market share for the naturally occurring baseline is based on and will be applied to observable sales rather than being extrapolated to the whole market.

The 2021 HVAC supplier data is estimated to include roughly one third of air source heat pump sales. The 2022 data collection included an additional large distributor. Observable sales could represent as much as half of the market, though analysis to estimate sales market share is underway.[4] It should be available in late 2023 or early 2024.

As the market share of heat pumps sold in the Northwest represented in NEEA's HVAC supplier sales data collection increases, we will understand more about product flow for low load efficient heat pumps and will consider methods for extrapolating to sales that are not observed in the data collection. If used to calculate savings or estimate naturally occurring baselines in the future, data and methods will be evaluated by a third party and presented to this committee for review.

Influence on savings forecasts. Market size exerts a large influence on savings forecasts. The rate of variable speed heat pump market share growth among all HVAC system sales will be monitored closely to inform both the immediate and long-term potential for low load efficient VSHPs and other system improvements in this program.

Measure life

A measure life of 15 years is based on ASHRAE's median lifetime expectancy estimates. This estimate is conservative, relative to estimates from other data sources (16.4 years from the US DOE TSD, 16.8 years from the OSTI National Survey Data, on average; and 18 years from RTF measures).

Unit energy savings

UES is derived from field-calibrated energy modeling conducted by Minnesota Center for Energy and Environment Environment (MN CEE,) (2022). Specifically, savings rates come from a follow-up analysis to the study centered on low load efficient VSHPs. The full report is available on neea.org. The follow-up study is not yet published, but is available to committee members upon request.

The follow-up study found a 14 percent energy savings in heating zone 1, a 13 percent energy savings in heating zone 2 and an eight percent energy savings in heating zone 3. This equates to energy savings of 920, 1,200, and 1,240 kWh for heating zones 1, 2, and, 3, respectively.

Field study calibration. MN CEE calibrated their energy models to a field study they conducted on cold climate VSHPs.[5] One of four central ducted heat pumps in the study had "much higher COPs (~4.0) in the shoulder seasons than the three other ducted systems (~3.0)" (p.37). This unit nears the threshold for

[4] Cadeo Group is conducting analysis on behalf of BPA to inform updates to their Residential HVAC Momentum Savings Model.

[5] Schoenbauer, B. & Kessler, N. (2017). Cold climate air source heat pump. Minneapolis, MN: Center for Energy and Environment. https://www.mncee.org/sites/default/files/report-files/cold-climate_0.pdf

NEEA's product specification (4.5) and consumed less energy relative to the other three VSHPs in the study (145 kWh vs an average of 213 kWh, respectively).

Third-party review comments

NEEA's independent evaluator, Cadmus, recommended that NEEA use savings rates from the follow-up study rather than the primary study. The primary study, which is published, creates VSHP archetypes with different values on several performance metrics. Each is compared to a "Reference VSHP." The "Mild Master" archetype represents a low load efficient VSHP with a minimum capacity coefficient of performance at 47°F (MinCapCOP47F) of 5.0 relative to the reference VSHP's 4.0. However, it also differs from the reference VSHP on other performance metrics. The follow-up analysis isolates the influence of low load efficiency by keeping all metrics consistent between the reference VSHP and the low load efficient VSHP apart from the 4.0 to 5.0 difference in MinCapCOP47F.

MN CEE's analysis modeled results for Portland, OR, Boise, ID, and Bozeman, MT. Boise is categorized in heating zone 1 according to RTF documentation but is near the heating zone 2 range. Cadmus's analysis of climate data informed their recommendation that Boise is a valid substitute for heating zone 2 in the absence of more precise data.

Cadmus further recommended NEEA continue to conduct research in the region to refine its initial UES estimates. NEEA accepted this recommendation along with those described above. The program team has integrated this recommendation into its plans once it transitions to the Market Development phase of the Initiative Lifecycle (ILC). When evidence is available, NEEA will have UES estimates evaluated by a third party and presented to this committee.

Considerations

The energy use of any primary HVAC system varies based on building conditions, system configurations, and occupant behaviors. These include the condition of ducts and home insulation, the location of thermostats, the types and placements of auxiliary heating systems, and whether or not the occupant sets back the temperature at night, to name a few. As part of its program activities, NEEA plans to conduct additional laboratory and/or field research, regularly scan for relevant publications, and collaborate with other organizations to gather additional data to inform UES for low load efficient heat pumps over the next one to two years. Refinements to UES based on new evidence will be evaluated by a third party and presented to this committee.

Incremental cost and benefit-cost analysis findings

Data

NEEA determined incremental cost through a hedonic regression model with data from online storefronts, which uses pricing as a proxy for cost. In addition, estimated costs of the components of low load efficient heat pumps that drive their efficiency gains inform estimates.

MN CEE conducted interviews with manufacturers as part of their VSHP Product Assessment and Analysis report. During interviews with MN CEE researchers, manufacturers noted that equipment costs advertised on online storefronts are a good source of consistent pricing data. Online storefronts, according to the report, "offer distributors a low-cost way to sell equipment and typically represent the base cost at which manufacturers allow their equipment to be sold, known as the minimum allowable price" (p.8). NEEA staff searched several online storefronts for variable speed heat pumps and cross-referenced model numbers with the NEEP cold climate heat pump list to identify each heat pump's MinCapCOP47F value, which allowed NEEA to then identify low load efficient heat pumps.

Methods

NEEA staff used a robust linear regression model to account for variation in price among qualifying and non-qualifying products that could be explained by brand, SEER, and capacity. A robust linear model was chosen to mitigate the effect of outliers.

Installation, maintenance, materials, profit, and overhead are assumed to be equivalent between low load efficient and non-low load efficient units. There is no evidence that these vary for low load efficient and non-low load efficient units (i.e., there is no evidence of premium pricing for good MinCapCOP47F; there are no special manufacturing, installation, or maintenance requirements for low load efficient units).

Results

Regression results were used to predict the incremental cost of moving from the 2021 sales-weighted mean MinCapCOP47F for an inefficient unit (3.4) to the 2021 sales-weighted mean MinCapCOP47 for a low load efficient unit (4.8). The resulting value was $2.96 per unit.

Third-party review comments

After reviewing data and methodology and interviewing NEEA's product manager to learn more about the components that drive low load efficiency—primarily firmware—Cadmus agreed that the incremental cost of low load efficient VSHPs should be between $3–10.

NEEA acknowledged that a limitation of the online storefront data is that the sample is not representative of the full market. Data for some major brands were not accessible (e.g., Trane) or were only accessible for a small number of models that did not include both low load efficient and inefficient units (e.g., Daikin). In response, Cadmus recommended that NEEA replicate its cost data collection as a sensitivity analysis to test for bias given the unrepresentative sample.

Benefit-cost ratio

NEEA staff calculated a benefit-cost ratio using the maximum value of the third-party reviewer's recommended range ($10) and the UES estimates from the MN CEE report to calculate a benefit-cost ratio for central ducted low load efficient heat pumps. The analysis included separate measures for each of three heating zones (1, 2, and 3). The results represent weighted averages among heating zones 1, 2, and 3 based on the distribution of RBSA II (2017) ASHP stock (84.7%, 13.5%, and 1.8%, respectively).

Using ProCost 5.07 with 2021P assumptions, the benefit-cost ratio is 79. We conducted a sensitivity analysis to estimate cost effectiveness across a range of savings rates and costs. We found that a 10-fold increase in price ($100) and a roughly 90 percent drop in UES (down to 160 kWh/year), results in a benefit-cost ratio of 1.0. This suggests a high level of confidence in the cost effectiveness of the measure.

Third-party evaluation status

NEEA expects to observe low load efficient heat pump adoption and begin reporting savings above baseline beginning in 2025 for units sold during the 2024 calendar year. In preparation, NEEA developed a naturally occurring baseline forecast and savings assumptions. Cadmus evaluated these assumptions between February and June. NEEA accepted the independent party's recommendations, which are reflected in this memo and throughout NEEA's reporting henceforth. The evaluation report is available on neea.org. Additionally, the key assumptions will be documented and published in our regional key assumptions report. Naturally occurring baseline assumptions will be presented to this committee after sensitivity analysis is completed using new data, as recommended by evaluators. The baseline and key assumption evaluation included the following research questions:

Unit Energy Savings (UES)

- Are the data and methods used to determine LLE VSHP UES reasonable and sufficient for credible accounting of energy savings?
    - What data and methods are strongest for estimating UES (MN CEE study, MN CEE study plus follow-up analysis, or another)?
    - How well does the UES evidence apply to heating zone 2 (HZ2)?
    - What recommendations does the contractor have for defining an HZ2 UES?
    - How should UES for sales records without a "ship-to" zip code (which NEEA uses to determine heating zone) be handled (for example, using RTF climate weights, sales-weighted average, COP is an instantaneous metric defined as energy output divided by energy input or other data/methods for extrapolating a UES for these units without an assigned heating zone)?
    - What refinements, if any, are needed to NEEA's data sources and methods?

<u>Incremental Cost</u>

- 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?
    - How should data from multiple sources be integrated?
    - What refinements, if any, are needed to NEEA's data sources and methods?

<u>Baseline Forecast</u>

- 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?

Memorandum

July 14, 2023

TO: Cost Effectiveness Advisory Committee
Natural Gas Advisory Committee
Regional Portfolio Advisory Committee

FROM: Ryan Brown, NEEA, Manager Planning and Analysis
Peter Christeleit, NEEA, Manager Natural Gas Portfolio & Strategy

SUBJECT: Dual Fuel Measurement and Reporting Methodology Work Group

Background and Purpose

As the region continues to respond to decarbonization policies there is an increasing need to consider solutions that use or indirectly impact usage of both natural gas and electricity. One such concept is for dual fuel residential HVAC systems where an electric Air-Source Heat Pump is paired with a gas furnace in a home. This solution is beginning to gain popularity not only in the market, but with utility programs in the region and across the country. NEEA staff are currently evaluating whether to advance a concept for a dual fuel HVAC market transformation program as well.

There are complexities about how savings, efficiency, peak reduction, and carbon emissions are valued, measured, and reported for a program such as this. For these reasons, NEEA proposes forming a Cost Effectiveness Advisory Committee (CEAC)-based workgroup to collaboratively develop guidelines for NEEA to use when calculating and reporting on the aforementioned metrics. These guidelines would be used for NEEA's regional work only.

Membership

This work group would consist of 10-15 members representing an array of regional perspectives including NEEA gas-only, dual-fuel, and electric-only funders, utility commission staff, and other technical experts from regional organizations such as the NW Power and Conservation Council and Regional Technical Forum.

Proposed work plan

NEEA staff are proposing a series of collaborative 1–2-hour sessions that would begin in Q3 2023 and run roughly every other month through the next 6-9 months to develop a guideline document. This process will have to be adaptively managed as it unfolds, but here is a rough outline of how those meetings may play out:

Expectations of work group members

Work group members will be expected to do the following:

- Attend meetings on an approximately bi-monthly basis
- Bring expertise and a willingness to lean in to finding solutions to complex questions
- Review and provide comment on materials between meetings as needed
- Represent their organization's position, which will include socializing drafts, soliciting feedback, and getting buy-in from their colleagues and supervisors

Please let Ryan Brown (rbrown@neea.org) know who from your organization you would like to attend by July 31st so that we can schedule the first meeting to kick off this effort.

Memorandum *– Agenda item*

August 2, 2023

TO: Cost-effectiveness and Evaluation Advisory Committee (CEAC)

FROM: Amy Webb, Sr. Manager, Market Research and Evaluation

SUBJECT: Key Findings from the Recent Assessment of MRE's Approaches to the Evaluation of Market Transformation Programs and NEEA's Plans for Incorporating the Recommendations

Context:

NEEA applies the principles of adaptive management in the evidence-based design of its Market Transformation (MT) programs. One of the purposes of NEEA's Market Progress Evaluation (MPER) and other evaluation reports is to provide key inputs to this continuous practice. Evaluation efforts are led by third-party evaluators and delivered at specific program milestones. NEEA's Market Research and Evaluation (MRE) team is the internal functional group tasked with scoping and managing these evaluations and communicating the insights back to internal program teams and alliance partners.

To demonstrate our commitment to continuous improvement, NEEA contracted with Michael Harnar, Ph.D., of Pointed Arrows Consulting and the Interim Director of the Interdisciplinary PhD in Evaluation program at Western Michigan University, to conduct an independent review of NEEA's approaches to the evaluation of its MT programs. The assessment focused on programs' MPERs, but also considered Market Characterizations and other procedural elements of NEEA's evaluation approaches. The study, ongoing through 2021 and 2022, produced a report entitled, "Assessment of NEEA's Approach to the Evaluation of Market Transformation Programs."

The objectives of this memo are to provide a brief description of the methodologies used for the assessment, to describe the major recommendations, and to provide a link to the assessment final report for CEAC members to review in advance of the upcoming CEAC meeting. At the August 24th CEAC meeting, Amy Webb, Sr. Manager of MRE, will present more detail on the key findings from this assessment and will provide an overview of MRE's action plan to incorporate recommendations.

The assessment was grounded in a recently uncovered, unpublished metaevaluation checklist (dated 2016) that builds upon commonly used Joint Committee on Standards for Educational Evaluation (JCSEE) Program Evaluation Standards (PrgES). The PrgES is a checklist that provides an independent framework for rating evaluations against five standards – utility, propriety, feasibility, accuracy, evaluation accountability – with a varying number of statements attached to each standard so that 30 statements are provided to apply to an evaluation. The assessment of NEEA's work was a seminal effort in the use of this emerging evaluation tool.

The assessment included the following key activities:

1. A review of evaluation deliverables and other program documents for three MT programs (Ductless Heat Pumps, Luminaire Level Lighting Controls, and Heat Pump Water Heaters)
2. Interviews with NEEA program staff across a variety of functional roles

3. Cross-resource synthesis of MT evaluations as described in documents and interviews and compared against two frameworks: a published source on market transformation evaluation best practices[6] and the PrgES checklist.

Overall, the assessment found "laudatory practices" in NEEA's approach to MT evaluation. "MRE treats market transformation as a program that has an underlying logic around which evaluation questions are developed and answered. The theory of change embedded in the market progress indicator tables and the connection of the indicators to the logic model as operationalized outcomes makes transparent the linkages between actions and outcomes and defines expectations of the market."

The assessment also recommended a few opportunities for improvement.

- Evaluation reporting contributes to NEEA's program success by documenting the MT story. MRE could advance this practice through the use of contribution analysis, which could also further strengthen the credibility of NEEA's MT evaluations.
- To improve evaluation propriety, NEEA should adopt a statement about adherence to evaluation standards and ethical principles.
- MRE could support their programs' claims about MT progress by incorporating a process to entertain plausible alternative hypotheses for observed market outcomes.
- MRE is encouraged to include more diverse perspectives in all phases of evaluation by adding a process of critical review by those outside the program team.
- MRE should make more transparent and explicit its efforts to examine the accountability of evaluation design, procedures employed, information collected, and outcomes.

As a result of the assessment, MRE will invest in improvements to our tools and processes in the coming year. We have recently selected a set of formal, industry-recognized evaluation standards with which we align our practice and have prepared a statement of commitment to these principles and standards which we state in our job posting, contractor requests for proposals, and other guiding documents. Additionally, MRE will explore contribution analysis as a method to refine our practice of documenting and sharing the story of market transformation for a program. At the August 24th CEAC meeting, members will learn more details about NEEA's plans for implementing the recommendations of the assessment.

Our Ask of You:

Please come to the meeting with any questions you have about the Assessment of NEEA's Approach to MT Evaluation Report.

Contact Amy Webb (awebb@neea.org) if you'd like to connect before the August 24th CEAC meeting

[6] Nevius, M., Hoefgen, L., Wilson-Wright, L. and Browne, C. (2013). A Review of effective practices for the planning, design, implementation, and evaluation of market transformation efforts. NMR Group, Inc. www.calmac.org https://www.calmac.org/publications/FINAL_NMR_MT_Practices_Report_20131125.pdf

2023 Q3 Key Assumptions Quarterly Report

WHAT'S NEW:

Greetings from the NEEA Data, Planning and Analytics team!

Each quarter, NEEA staff bring a review of updates or new Key Assumptions used in the reporting of cost effectiveness and energy savings to the committee.

This Q3 report covers one Key Assumption change from the Washington Residential Code Evaluation. Additionally, NEEA is working to advance a Residential Heat Pump program and has developed the set of Key Assumptions to be used in the benefit-cost assessment for the program (memo provided in the Q3 CEAC meeting packet).

As always, committee members can access the full set of assumptions for each reporting year on NEEA's Funder Portal.

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

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Questions about this report may be addressed to:

Stephanie Rider
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PUBLISH DATE: August 17, 2023

Advanced Heat Pump Program Advancement

Advanced Heat Pump (AHP)

NEEA's new Advanced Heat Pump (AHP) program will soon be presented to the Regional Portfolio Advisory Committee, and the committee will decide if the AHP program will progress into the Market Development phase of NEEA's Initiative Lifecycle (ILC). NEEA staff will present the benefit cost analysis as well as key assumptions and data sources for the program during the upcoming Q3 Cost Effectiveness Advisory Committee meeting. More information on NEEA's ILC phases can be found in the 2023 Operations Plan.

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Washington Residential Code Evaluation

Residential Code

NEEA finalized the Washington Residential Code Evaluation in June 2023. The report collected data to inform the estimation of energy savings resulting from NEEA and its partners' involvement in the Washington State Residential Energy Code (WSEC-2018) process. The final estimate of the percentage of homes built in the state with natural gas space and water heating was 21% as opposed to the draft estimate NEEA was using of 22% in the 2022 Annual Report. NEEA is applying this update to estimate natural gas savings from the WSEC 2018 code starting in 2022.

You can see a full description of the Washington Residential Code Evaluation in the Q1 Market Research and Evaluation Newsletter, page 18. NEEA presented details on the study's methodology and results at the July Natural Gas Advisory Committee meeting.

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TOGETHER *We Are Transforming the Northwest*

2023 Q2 Market Research & Evaluation Quarterly Newsletter

WHAT'S NEW:

Welcome to NEEA's Market Research and Evaluation (MRE) quarterly newsletter! Spring is in the air, although it has felt more like summer on several occasions. Whether it's 95° or 70°, springtime in the Northwest is magical.

After a very busy first half of the year, the MRE team is thankful to be wrapping up several studies. The project tracker on the next two pages outlines the studies that are in the reporting stage. Look for those reports to post to NEEA's website in the next few weeks. Links are included throughout the newsletter for those reports that may be of interest. As far as studies that are currently in the field, two major efforts that recently launched: the electric High-Performance HVAC and natural gas Efficient Rooftop Units Market Progress Evaluation Reports (MPERs). These are large evaluation efforts for NEEA's two commercial HVAC Market Transformation programs. They are the first MPERs for both programs, and as such will include elements of formative evaluation to support refinements to program design. In addition to tracking progress against pre-defined market progress indicators, these early market progress evaluations also include data collection aimed at validating key elements of the program theory. Take a look at what's coming up, and as always, reach out with any questions, suggestions or other feedback.

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

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Amy Webb

Sr. Manager, Market Research & Evaluation

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PUBLISH DATE: June 15, 2023

At a Glance

MARKET RESEARCH & EVALUATION PROJECTS

		PLANNING*	FIELDING*	REPORTING*
Integrated Systems	High-Performance HVAC: *Market Progress Evaluation Report #1*		✓	
	Efficient Rooftop Units: *Market Progress Evaluation Report #1*		✓	
	Luminaire Level Lighting Controls: *Market Progress Evaluation Report #2*			✓
	High-Performance Windows: *Naturally Occurring Baseline Review*			✓
	Variable Speed Heat Pumps: *Baseline and Key Assumptions Review*			✓
	Natural Gas Portfolio and Strategy: *Dual-Fuel and Gas Heat Pump Market Research*			✓
	Better Bricks: *Commercial Building Market Research*	✓		
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: *Installer Focus Groups*			✓
	Heat Pump Water Heaters: *Cold Climate Demonstration Installation Project*			✓
	Heat Pump Water Heaters: *Challenging Installation Scenarios*			✓
	Heat Pump Water Heaters: *Market Progress Evaluation Report #7*		✓	
	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

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

High-Performance HVAC | **FIELDING**

As of late 2022, NEEA's High Performance HVAC program is actively intervening in the market to enhance awareness and adoption of very high efficiency Dedicated Outside Air Systems (DOAS) for electrically heated commercial buildings across the region. This study will be the first evaluation of the program's Market Transformation efforts. The 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's selected evaluation team is a consortium composed of Apex Analytics, NMR Group, and Tallgrass Market Research. This evaluation study will be conducted in close coordination with the Market Progress Evaluation for the Efficient RTUs program. NEEA will kick off the evaluation in June or July and continue the fall of 2024. A final report is anticipated in Q4 2024.

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Market Progress Evaluation Report #1

Efficient Rooftop Units (RTU) | **FIELDING**

As of late 2022, NEEA's Efficient RTU program is actively promoting efficient RTUs for gas-heated commercial buildings across the region. This study will be the first evaluation of the program's Market Transformation efforts. The 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's selected evaluation team is a consortium composed of Apex Analytics, NMR Group, and Tallgrass Market Research. This evaluation study will be conducted in close coordination with the Market Progress Evaluation for the High-Performance HVAC program. NEEA will kick off the evaluation in June or July and continue through the fall of 2024. A final report is anticipated in Q4 2024.

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Market Progress Evaluation Report #2

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

NEEA's LLLC program seeks to accelerate the adoption of LLLC in commercial buildings for new construction, major renovation and retrofit projects. NEEA launched the study in September, 2022. Interviews and surveys were collected from November 2022 through May of 2023 with stakeholders, manufacturers, installers, designers, specifiers, and decision makers, in order to address the following questions: 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? and; 3) 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?

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Naturally Occurring Baseline Review

High-Performance Windows (HPW) | **REPORTING**

The residential HPW program contracted with Cadmus 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, and; 3) Review and recommend improvements to NEEA's approach to incorporating market drivers of high-performance windows into its naturally occurring baseline.

Fielded research began in Q2 2023 and a final report is anticipated in Q3 2023.

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Baseline and Key Assumptions Review

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

NEEA contracted with Cadmus to provide a third-party review of its naturally occurring market share baseline forecast and key assumptions for Variable Speed Heat Pumps (VSHPs). The VSHP program plans to develop baselines and key assumptions for VSHPs with various efficiency-boosting improvements. The current naturally occurring baseline market share and key assumptions study is for VSHPs with Low Load Efficiency (LLE) (VSHPs that have a Coefficient of Performance of 4.5 or higher when operating at minimum capacity at 47°F). NEEA's primary evaluation questions for the review are:

1. Are the data and methods used to determine Unit Energy Savings (UES) reasonable and sufficient for credible accounting of energy savings?
2. What refinements, if any, are needed to NEEA's UES data sources and methods?
3. 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?
4. What refinements, if any, are needed for NEEA's incremental cost data sources and methods?
5. Is NEEA's naturally occurring baseline market share forecast a reasonable representation of market adoption without invention by NEEA, utility programs, or its partners?
6. What refinements, if any, are needed for NEEA's baseline forecast and what evidence supports these changes?

Cadmus' evaluation team reviewed several of NEEA's documents and data sources to answer these questions. Cadmus recommends NEEA supplement its current data sources with additional incremental cost data and field performance data for LLE VSHPs compared to non-LLE VSHPs, then repeat analyses with the augmented data. Cadmus found NEEA's evidence and assumptions for the naturally occurring baseline to be well supported with evidence, and provided additional suggestions for further data and analyses that could be conducted.

A final report is available on neea.org.

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Dual Fuel and Gas Heat Pump Market Research

Natural Gas Portfolio 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. The four technologies are: residential dual fuel heat pumps (gas furnaces paired with electric heat pumps), residential gas heat pumps, commercial gas heat pumps for space and/or water heating, and commercial dual fuel RTUs.

There are 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 Lieberman Research team interviewed 25 consumers (including 8 who use dual fuel heat pumps in their homes and 1 who uses a gas heat pump), 15 commercial building decision makers (including 3 who use dual fuel RTUs and 2 who use gas heat pumps in commercial buildings), and 16 HVAC contractors. Interviews gathered opinions about the systems before and after providing basic information about their features and possible benefits.

Key findings are that most consumers have a strong preference for HVAC systems that offer both cooling and heating, instead of heating alone, and find reducing their carbon footprint highly desirable. Consumers equate energy efficiency with fuel cost savings. Commercial building decision makers are most interested in improving the return on investment they get from their HVAC systems, e.g. having reliable equipment performance, and improving occupant comfort and productivity. Both commercial building decision makers and HVAC contractors are interested in HVAC systems that will meet decarbonization mandates in state codes.

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 region.

A final report is available on neea.org.

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Commercial Building Market Research | Better Bricks | PLANNING

NEEA is planning to conduct a market research study to inform Better Bricks' support of whole building efficiency. Study research questions are under development but will address this key problem:

Commercial building owners often do not see a clear business case for energy efficiency and do not have easy access to the information and resources needed to consider the impact of energy in their investment decisions. As a result, building owners are often not choosing to invest in operational and capital energy improvements that would enhance their bottom line.

NEEA anticipates kicking off the study in Q3 or Q4 2023.

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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 market barriers
3. Documenting 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 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 final report is anticipated in Q3 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 a final report is anticipated by early Q3 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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Water Heater Installer Focus Groups

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

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 HPWH installers in the Northwest identified several factors and specific structural barriers that can complicate a HPWH 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 recruited and conducted three virtual focus groups across the region with installers and plumbers that have limited experience with HPWH installation. ILLUME also completed six in-depth virtual interviews with installers that were unable to attend the focus group thereby contributing to more robust information. Analysis is currently underway in Q2 and a final report is anticipated in early Q3 2023. Findings will inform future training efforts and help the program improve its messaging campaigns targeted to installers across the region. It should be noted that given some of the overlap in findings between this study and the Cold Climate Demonstration Research project, NEEA will be issuing a combined report of both studies in early Q3 2023.

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Cold Climate Demonstration Installation Project | Heat Pump Water Heaters (HPWH) | REPORTING

In late Q2 2022, NEEA hired ILLUME Advising to conduct an ethnographic study to better understand installer/plumber experiences of installing HPWH in cold climate areas of the Northwest. Recruitment and observation continued from late Q3 2022 through the end of Q1 2023, to best capture actual cold climate installations. The key objectives of the research were to:

1. Observe and describe the types of difficult installations that plumbers and installers face in real time.
2. Identify the solution and problem-solving methods they employed at the time of the installation.
3. Observe installer-customer interactions; for example, how do installers explain the HPWH's functionality, or answer questions at the time of the installation.
4. Gauge customer satisfaction immediately following the installation and then 2-3 months after to gauge their on-going satisfaction with the unit. Additionally, understand if there were any performance issues, they needed help with resulting in call backs.

This research effort ran concurrently with the Water Heater Installer Focus groups. Given that there were some overlaps in the findings between the two studies, NEEA decided it is best to combine the learnings into a single report. NEEA expects the combined report to be made available in early Q3 2023.

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Challenging Installations 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 are intended 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.

A final report is available on neea.org.

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Market Progress Evaluation Report #7

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

NEEA contracted with NMR Group in early 2023 to conduct the 7th Market Progress Evaluation Report (MPER) for the HPWH program. The kickoff occurred at the beginning of 2023 and a final report is expected in early Q3 2023.

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 market progress indicators (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

In Q2 2023, NMR will complete a quantitative survey of general installers in the region, as well as in-depth interviews with a handful of water heater retail representatives to better measure the program's performance over the past year.

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

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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 an updated 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 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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Oregon and Washington High CRI Bulb and Commercial Kitchen Equipment State Standards Evaluations

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 provides 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 available on neea.org.

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Transition Market Progress Evaluation Report

Manufactured Homes | **FIELDING**

NEEA contracted with Apex Analytics, LLC to conduct a transition market progress evaluation of its Manufactured Homes program. This is a key input informing the alliance's decision to transition the program to the Long-Term Monitoring and Tracking (LTMT) phase of the Initiative Life Cycle (ILC) process. In this effort, NEEA strives to confirm that NEEM+ homes will remain viable in the Northwest. Key research objectives are to:

1. Summarize of the initiative's work and achievements since its inception in 2016
2. Track key market progress indicators
3. Recommend viable approaches to conduct subsequent LTMT efforts. This would include proposing an evaluation plan to track any updated Diffusion Indicators

Data collection and analysis will begin in Q2 2023, resulting in a final report by early Q4 2023.

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Idaho Commercial New Construction Code Evaluation

Commercial Code | **FIELDING**

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. Study activities are anticipated to begin in Q3 2023, with a final report anticipated by Q4 2024.

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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 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, are scheduled to commence in Q2 2023 and conclude in Q3 2023. This study includes analysis of billing data; collection of this data is planned to continue through Q4 2023, with analysis and report preparation to follow. NEEA currently anticipates a final report from this study in Q1 2024.

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Market Progress Evaluation Report #2

Commercial and Residential Codes | **FIELDING**

NEEA contracted with ADM Associates to conduct an MPER for its Commercial and Residential Codes efforts. ADM will evaluate the logic and clarity of NEEA's updated codes logic model, make recommendations for improvement, and assess outcomes associated with codes training and education and code influence activities. The project kicked off in October 2022, and NEEA expanded the scope to address an assessment of the Code team's code influence activities in April 2023. A report addressing all research objectives is expected in Q4 2023.

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Idaho Residential Code Evaluation

Residential Codes | **FIELDING**

NEEA contracted with Industrial Economics, Inc. (IEc) to review assumptions underlying its estimation of energy savings resulting from NEEA's and its partners' involvement in the Idaho state code processes. Using data collected through permit review, site visits to residential new construction building sites, and interviews with market actors, this research will address the following objectives:

1. Assess statewide compliance with selected code requirements among single-family homes built under IECC 2018 with Idaho amendments
2. Develop estimates of statewide energy code compliance and compliance within urban and rural jurisdictions separately using data collected on individual code requirements
3. Provide statewide findings regarding primary space and water heating fuel and above-code elements using data collected on individual code requirements

This work kicked off in Q1 2023, and the final evaluation of Idaho's residential energy code is expected in Q4 2023.

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Montana Residential Code Evaluation

Residential Codes | **FIELDING**

NEEA contracted with Industrial Economics, Inc. (IEc) to review assumptions underlying its estimation of energy savings resulting from NEEA's and its partners' involvement in the Montana state code processes. Using data collected through permit review, site visits to residential new construction building sites, and interviews with market actors, this research will address the following objectives:

1. Assess statewide compliance with selected code requirements among single-family homes built under IECC 2018 with Montana amendments
2. Develop estimates of statewide energy code compliance and compliance within urban and rural jurisdictions separately using data collected on individual code requirements
3. Provide statewide findings regarding primary space and water heating fuel and above-code elements using data collected on individual code requirements

This work kicked off in Q1 2023, and the final evaluation of Montana's residential energy code is expected 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 Q3 2023.

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

REPORTING

This study was 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

Using HVAC survey data collected between October 2022 and January 2023, as well as secondary data provided by NEEA, the research team found mixed results. The share of regional HVAC companies offering DHPs remained constant since 2020 (satisfying Diffusion Indicator 3). In contrast, the average installation cost for a single-head DHP increased by 11% compared to 2020 (failing to meet Diffusion Indicator 2). NEEA will continue evaluating diffusion of DHPs with a third DHP LTMT study.

A final report is available on neea.org.

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TOGETHER *We Are Transforming the Northwest*

AVISTA · Bonneville Power Administration · Cascade Natural Gas Corporation · P.U.D. Chelan County · Clark Public Utilities · EnergyTrust of Oregon · Idaho Power An IDACORP Company · NorthWestern Energy

NW Natural · PACIFIC POWER · Portland General Electric · PSE Puget Sound Energy · Seattle City Light · Snohomish County PUD Public Utility District No. 1 · Tacoma Power Tacoma Public Utilities