Cost-effectiveness & Evaluation Advisory Committee Meeting

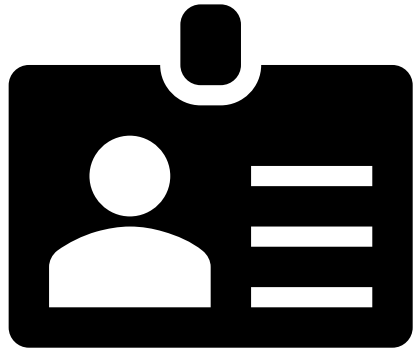
Northwest Energy Efficiency Alliance

August 24, 2023

CLASSIFICATION LEVEL: PUBLIC

Introductions

- Name
- Organization
- Question(s) for today?



Agenda

9:15AM	Welcome/Agenda Review
9:30	MRE Update
10:00	Milestone Review: Advanced Heat Pumps
10:45	BREAK
10:55	Dual Fuel Measurement and Reporting Work Group
11:10	Key Assumption Updates
11:25	Assessment of NEEA's Approach to the Evaluation of Market Transformation Programs
11:45	Wrap Up

Why are we here again?

CEAC Charter

Responsibilities

1. Review and advise regarding NEEA cost-effectiveness and savings information to inform annual reporting.
2. Review and advise regarding market transformation cost and savings measurement and estimation methods.
3. Review evaluation findings that affect cost and savings information to inform annual reporting.
4. Work with your organization to provide NEEA staff with relevant incentive data for regional tracking and reporting purposes.
5. Review and advise regarding new market research and evaluation methodologies.

Public Outreach on 2025-2029 Plans

- Plans posted to *neea.org/plans*
- Public comment period from late June – early August
- Strong participation in regional webinars and presentations
- Feedback review at September Board workshop
- Final plans for vote at December Board Meeting

Market Research and Evaluation (MRE) Update

Objectives

- Committee awareness of market research and evaluation activities

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 ~

TABLE OF CONTENTS

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

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*			✓
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*			✓
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

High-Performance Windows (Residential) Naturally Occurring Baseline Review

Fan Systems Market Characterization

Codes Market Progress Evaluation Report (MPER)

HP HVAC Market Progress Evaluation Report (MPER)

Efficient Rooftop Units (ERTUs) Market Progress Evaluation Report (MPER)

Milestone Review: Advanced Heat Pumps

Objectives

- Inform and discuss any questions or suggestions

Advanced Heat Pumps: Key Assumptions

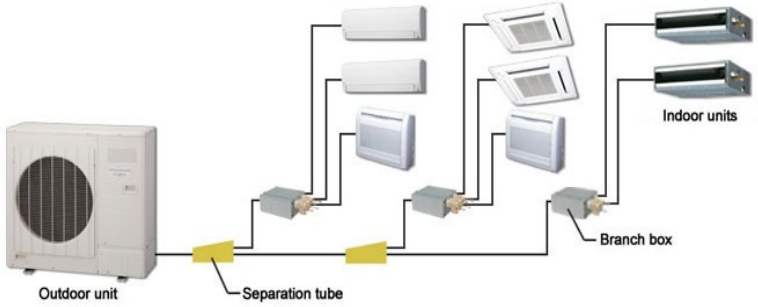
Havala Hanson, Ph.D., Lauren Bates, Suzi Asmus

NEEA

August 24, 2023

Advanced Heat Pump Program

By 2030, average installed efficiency of residential-size HPs is 30% more efficient than 2017 average.



Market Barriers & Opportunities

Barriers

Lack of awareness of energy efficient improvements and their value propositions

Lack of product differentiation for improvements that impact efficiency and capacity

Opportunities

Increasing end user demand, incentives and requirements for IAQ, Decarbonization and Cooling (AC)

Many other programs/orgs investing and incenting HPs

Spec updates enable manufacturers to differentiate more efficient products for competitive advantage

Market Transformation Approach

Promote existing, cost-effective improvements in all residential heat pumps

Locking in improvements by influencing specifications and federal standards

Resulting in continuous improvement in the average installed efficiency and increased peak savings

Intervention Approach

Differentiate qualifying products for each improvement in the market

Build adoption among manufacturers and efficiency program partners

Influence specification and standards bodies to include improvements

Heat Pump Improvements

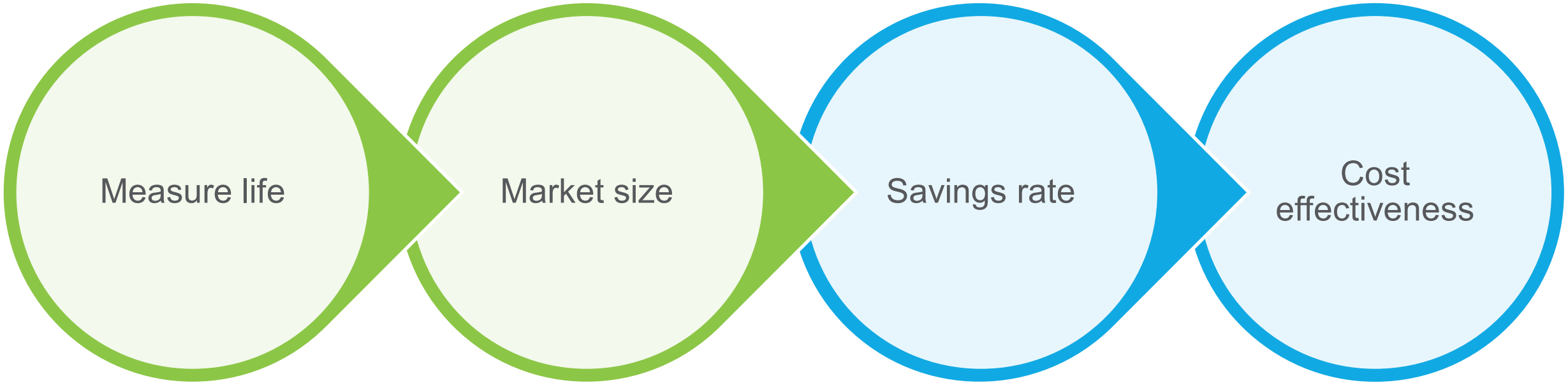
Low load efficient	Today
Cold climate capable; Connected commissioning	Soon
No duct losses; Standby losses; Crankcase heater; Auto demand response; Adaptive defrost; Drain pan heater	Maybe

Product definition: Low Load Efficient Heat Pumps

- A heat pump that operates very efficiently under mild outdoor conditions (e.g., 30°F–50°F)
- Method of identification:
  - Heat pump has a minimum capacity coefficient of performance at 47°F (MinCapCOP47F) of at least 4.5.
- Assumptions under review for **central ducted systems only**
  - Assumptions for ductless systems are under development

Key assumptions to review today

Relevant to central ducted
low load efficient only

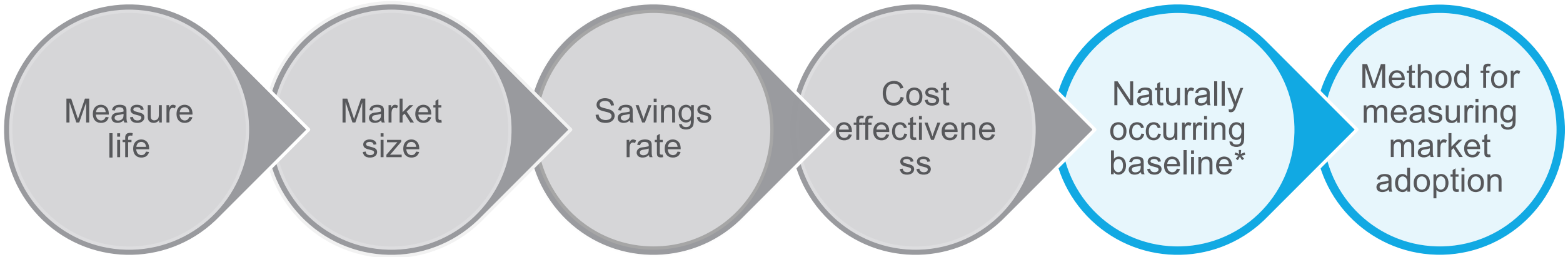


Relevant to all improvements

Future CEAC meeting topics before reporting savings in 2025:
Naturally occurring baseline and methodology for measuring market adoption

Key assumptions to discuss at future meetings

Relevant to central ducted low load efficient only



*The naturally occurring baseline has been third-party evaluated. See evaluation report on neea.org

Measure life

Data sources & Results

- **Data source**: ASHRAE median lifetime expectancy estimates
- **Result**: 15 years
  - Consistent with BPA Residential HVAC Momentum Savings Model
  - Alternative data sources: US DOE TSD (16.4 years), US DOE OSTI National Survey Data (16.8 years) and RTF ASHP upgrade measure (18 years)
  - A shorter measure life reflects the theory that federal incentives may influence some consumers to replace systems before equipment failure

Market size

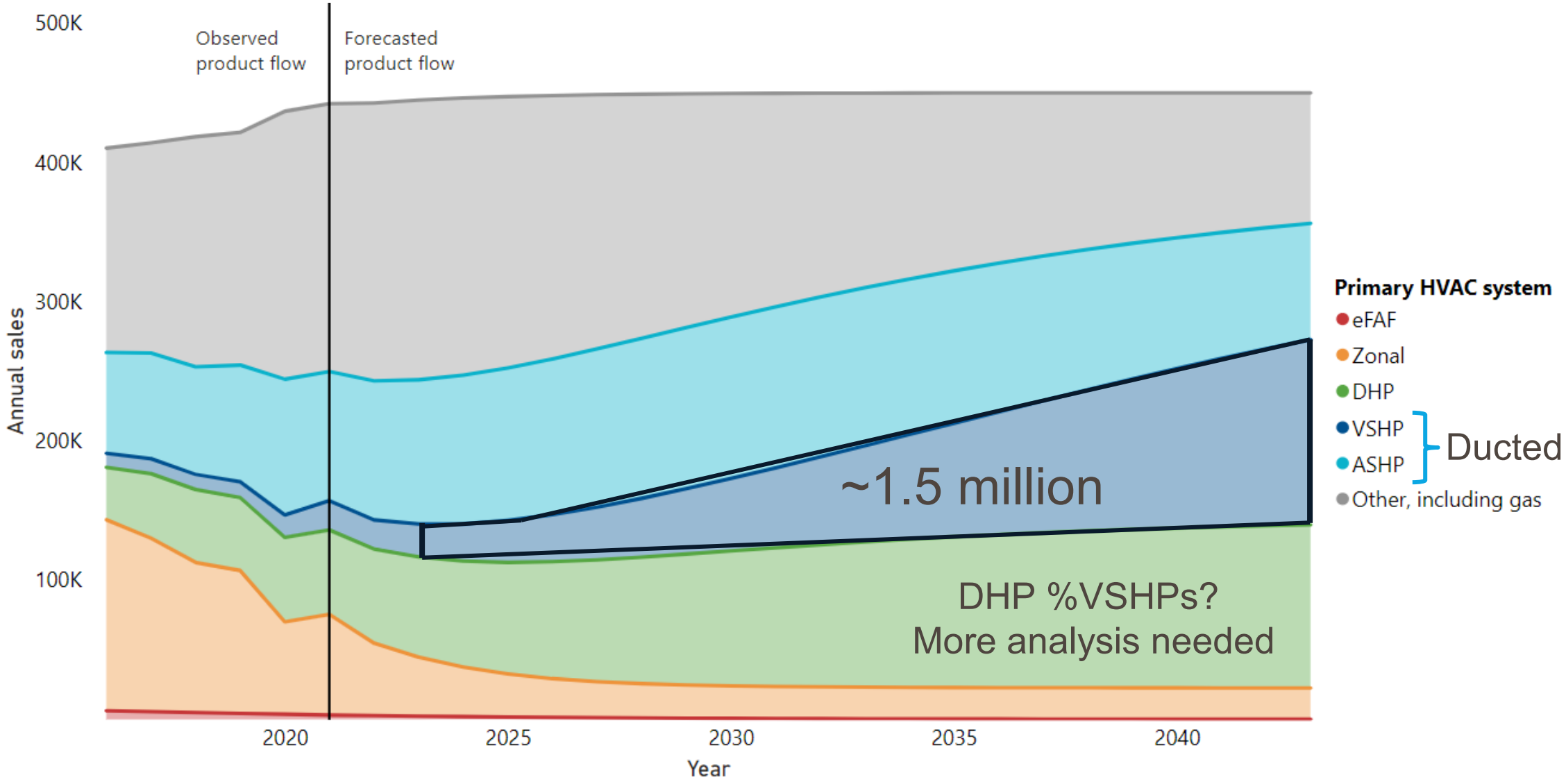
Data sources

- **Definition**: Sales of variable speed heat pumps (VSHPs)
- **Quantitative**: BPA/Cadeo Residential HVAC Momentum Savings Model estimations of regional product flow
- **Qualitative**: Market research on likely trends in residential HVAC heating and cooling system purchases, including two regional studies conducted for NEEA.

Estimation method and result

- **Estimation method**: Linear regression forecasts product flow
  - Separate estimates for total sales and each product based on product market share within total sales.
  - Predictions are bounded within a range based on 2016–2021 sales trends and market research.
- **Result**: Approximately 1.5 million central ducted variable speed heat pump sales between 2024 and 2043

Market size forecast, by year



* Observed product flow includes extrapolated units.

Considerations

- **Observable sales vs. regional product flow**. Omitting extrapolation to the entire market will produce conservative savings estimates while we learn about market share outside HVAC supplier sales data
- **Influence on savings forecasts**. Changes in market size, such as faster or slower growth in VSHP sales, can have a large effect on savings forecasts. NEEA will monitor quantitative and qualitative data closely to inform forecast updates.

Unit energy savings (UES)

Data and methods

- Field-calibrated energy modeling study specific to central ducted low-load efficient VSHPs
  - **Field data** are from 2017 MN CEE study with four central ducted units.
  - **Energy modeling data** are from a 2022 MN CEE study that isolates the influence of MinCapCOP47F on energy savings.

Results

Heating zone	Percent savings	kWh/yr savings
1 (Portland, OR)	14	920
2 (Boise, ID)	13	1,200
3 (Bozeman, MT)	8	1,240

Considerations

- HVAC system energy use varies based on building conditions, system conditions and occupant behaviors
- NEEA plans to conduct additional laboratory and/or field research and to collaborate with other organizations to gather a robust body of UES evidence
- UES refinements will be evaluated by a third party and presented to CEAC

Cost effectiveness

Data and method

- **Element that drives efficiency**: Firmware, electronic expansion valve
- **Data**: Online storefront data, as recommended in manufacturer interviews (MN CEE, 2022)
- **Method**:
  1. Build hedonic pricing model to isolate the value of MinCapCOP47F from known predictors of heat pump pricing, including brand, SEER, and capacity.
  2. Apply predicted values to the difference in sales-weighted average MinCapCOP47F among inefficient and efficient units in 2021 HVAC supplier sales data

Incremental cost results

- Model-estimated = $3
- Electronic expansion valve = $10

Benefit-cost ratio results

Inputs

Heating zone	kWh/yr savings	Distribution of heat pumps according to RBSA II*	Incremental cost	RTF ProCost tool
1	920	85%	$10	v.5.07 2021P assumptions
2	1,200	13%		
3	1,240	2%		

Heating-zone weighted benefit-cost ratio: 79

Considerations

- Online storefront data is not representative of the full market. NEEA will replicate data collection and analysis as a sensitivity analysis.

Third party review

Third party review

- Evaluator was Cadmus Group
- Review completed between February and April 2023
- Evaluators read all studies NEEA used to create the baseline and inform key assumptions
- Evaluators interviewed NEEA staff and MN CEE staff to answer questions about the studies and clarify assumptions
- Evaluation report published June 12th.

Third party review findings

Unit Energy Savings

- The MN CEE study findings NEEA used to inform its UES estimate were based on ideal ASHP behavior.
  - Check the behavior of actual installed ASAPs via limited field tests or confirm ASHP behavior with manufacturers
  - Round kWh savings to the nearest 10 to indicate less precision
- Determine if the minimum capacity Coefficient of Performance in the NEEP cold climate ASHP database is based on modeling
- Replicate analyses with 2022 HVAC supplier sales data

Third party review findings

Incremental First Cost and Cost Effectiveness

- Explicitly note that no incremental Operations and Maintenance costs are expected
- Collect more price data from online storefronts and re-run analysis
  - Use $3-10 incremental cost estimate in the meantime

Upcoming activities and presentations

Activity	Estimated CEAC review timing
RPAC vote, August 27, 2023	N/A
Present methodology for tracking market adoption	Q4, 2023 or Q1, 2024
Replicate baseline data collection and analysis with 2022 and 2023 HVAC supplier data, available Q3, 2024	Q4, 2024 or Q1, 2025
Continue gathering evidence to refine UES and incremental cost estimates for central ducted Low Load Efficient VSHPs	Q4, 2024 or as available
Gather and third-party evaluate evidence for UES and incremental cost for: • Ductless and other types of Low Load Efficient VSHPs • Other AHP improvements and types of heat pumps	Cold climate capable: 2024 Connected commissioning: 2024 or 2025 Others: As available

Dual Fuel Measurement and Reporting Work Group

Objectives

- Update and discussion regarding proposed work group to establish guidelines for NEEA to use when calculating and reporting benefits of dual fuel measures.

Dual Fuel Measurement Workgroup

Purpose:
Develop guidelines for NEEA to use when calculating and reporting savings, peak load reductions, and avoided emissions from Dual Fuel Market Transformation programs

CEAC-based workgroup

10-15 members (NEEA funders, commission staff, and other technical experts)

3-5 meetings from Q3 2023 to Q1 2024

Email Ryan Brown (rbrown@neea.org) with questions

 |

Approximate Timeline

Meeting 1 - August	•Work group background and objective •Groundrules and expectations
Meeting 2 - October	•Results of literature review •Proposed outline of guideline document
First draft distributed	•Work group feedback provided asynchronously
Meeting 3 - December	•Discuss feedback and how it will be incorporated •Determine if more rounds of review are needed
Final draft distributed	•When ready, the near-final draft will be distributed for final review
Meeting 4 - February	•Final draft overview and celebration!
Advisory Committees	•Share with the Cost Effectiveness, Natural Gas, and Regional Portfolio Advisory Committees

Literature Review Materials

- Current policy in region:
  - Regional Technical Forum / NW Power and Conservation Council
- Extra-regional dual fuel measure documentation:
  - Minnesota Center for Energy and the Environment
  - Vermont Gas
  - Fortis BC

- Are there other sources the workgroup should consider?

Key Assumptions Updates

Objectives

- ❑ Inform committee members, gather feedback, and questions regarding updated assumptions.

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 ~

TABLE OF CONTENTS

Available in meeting packet and at https://neea.org/portal/savings-reports

Assessment of NEEA's Approach to the Evaluation of Market Transformation Programs

Objectives

- Inform committee members and answer questions.

Assessment of MRE Approaches to Evaluating Market Transformation Programs

Amy Webb

Sr. Manager of MRE, NEEA

August 24, 2023

Why did NEEA request this assessment?

To document transparently NEEA's approach to the evaluation of market transformation programs in order to identify strengths and areas of improvement.

Three questions guided the assessment.

Question 1

How do MRE MT evaluation practices compare to industry best practices as framed by NMR?

Question 2

How do MRE MT evaluation practices score on the PrgES checklist?

Question 3

What recommendations emerge from the comparison to NMR's "best practices" and the PrgES checklist?

The assessment included three research tasks and two evaluation tools.

Tasks

01

Document review
A set of foundational documents for three MT programs.

02

Interviews
In-depth interviews with 11 NEEA staff.

03

Cross-resource synthesis
Analysis of MT evaluation as described in documents and interviews using NMR's "best practices" and the PrgES checklist.

Tools

01

NMR Group's List of10 "Best Practices" for the evaluation of MT programs. From "Effective practices for the evaluation of market transformation efforts," 2013

02

Program Evaluation Standards (PrgES)
A set of evaluation quality standards in the form of a scoring rubric and prescribed by the Joint Committee on Standards for Educational Evaluation.

Results of the Assessment

Standard	Score
Propriety	96% - Excellent
Utility	91% - Excellent
Accuracy	88% - Very good
Feasibility	88% - Very Good
Evaluation Accountability	67% - Very Good
Overall	86% - Very good

"…extremely laudatory practices"

Conclusions and Recommendations

Documenting and telling the MT story is a key element of NEEA's success.

01

Incorporate methods like contribution analysis to tell the MT story.

Leverage MRE's Research & Evaluation Plans.

Conclusions and Recommendations

NEEA lacks a statement about adherence to standards and ethical principles. This impacts evaluation propriety.

02

State a commitment to evaluation principles, such as The American Evaluation Association's standards.

Conclusions and Recommendations

NEEA's MT evaluations scored well on accuracy, but there are areas for improvement.

03

Incorporate a process to entertain "plausible alternative hypotheses" for observed outcomes.

Conclusions and Recommendations

The utility of NEEA's MT Evaluations could be improved with greater attention to stakeholders.

04

Include more diverse perspectives in all phases of evaluation by adding a process of critical review by external stakeholders.

Conclusions and Recommendations

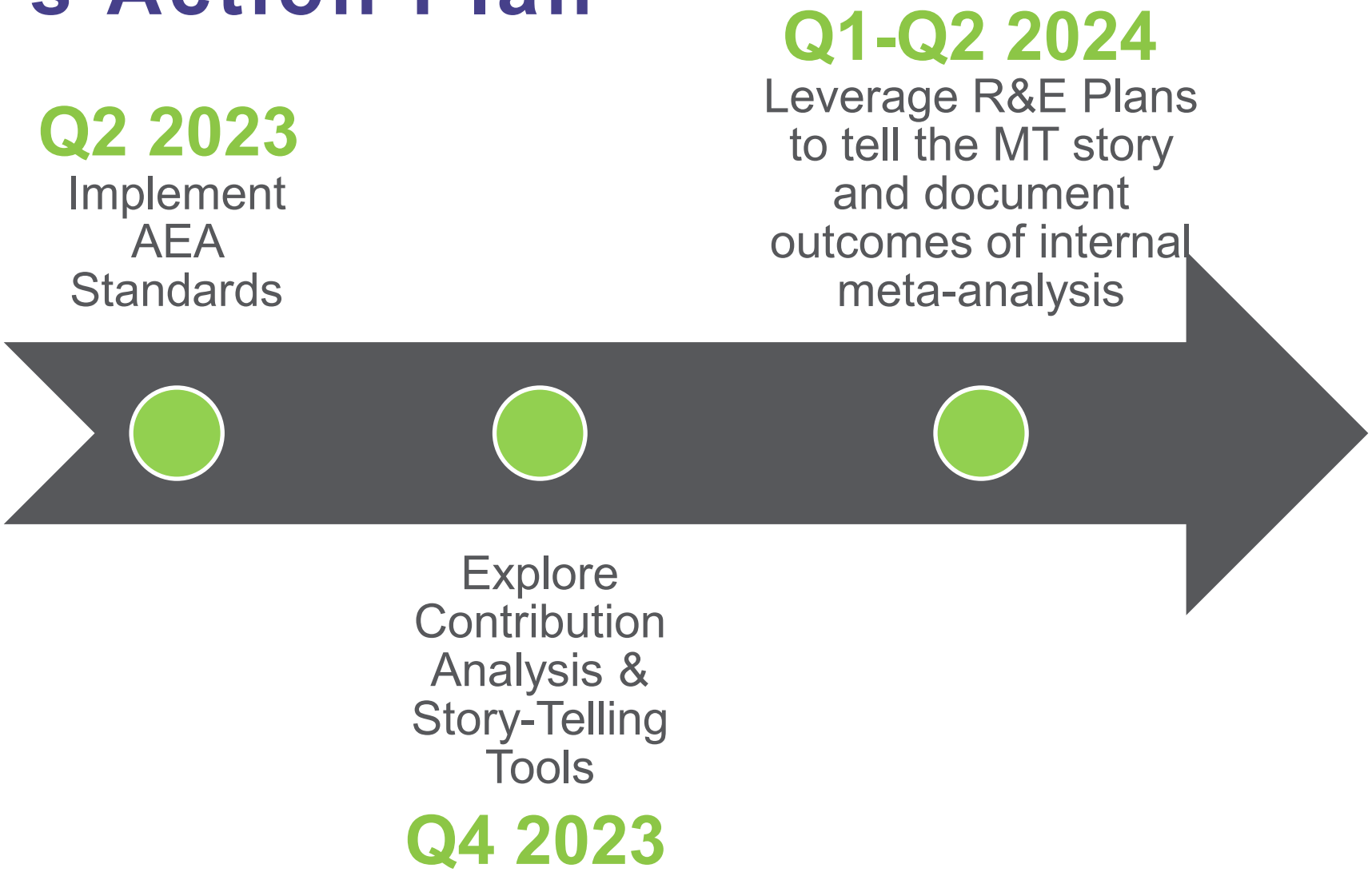
The assessment did not find evidence of internal metaevaluation, resulting in the lower PrgES score for evaluation accountability (67%).

05

Be more explicit about efforts to examine the accountability of the evaluation design.

Leverage MRE's Research & Evaluation Plans.

MRE's Action Plan



Questions?

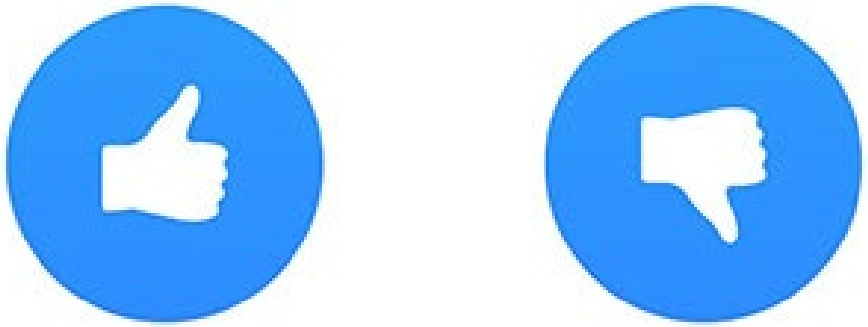
Upcoming Meeting Topics

Q4 – November 1, 2023

Topic Requests?

 |

How was your experience?



Meeting Wrap-up

- Public Comment?
- Upcoming Meetings:
  - November 1, 2023
- Feedback:
  - Overall
  - Agenda
  - Packet Materials
  - What went well?
  - What needs work?