Regional Emerging Technology Advisory Committee (RETAC)

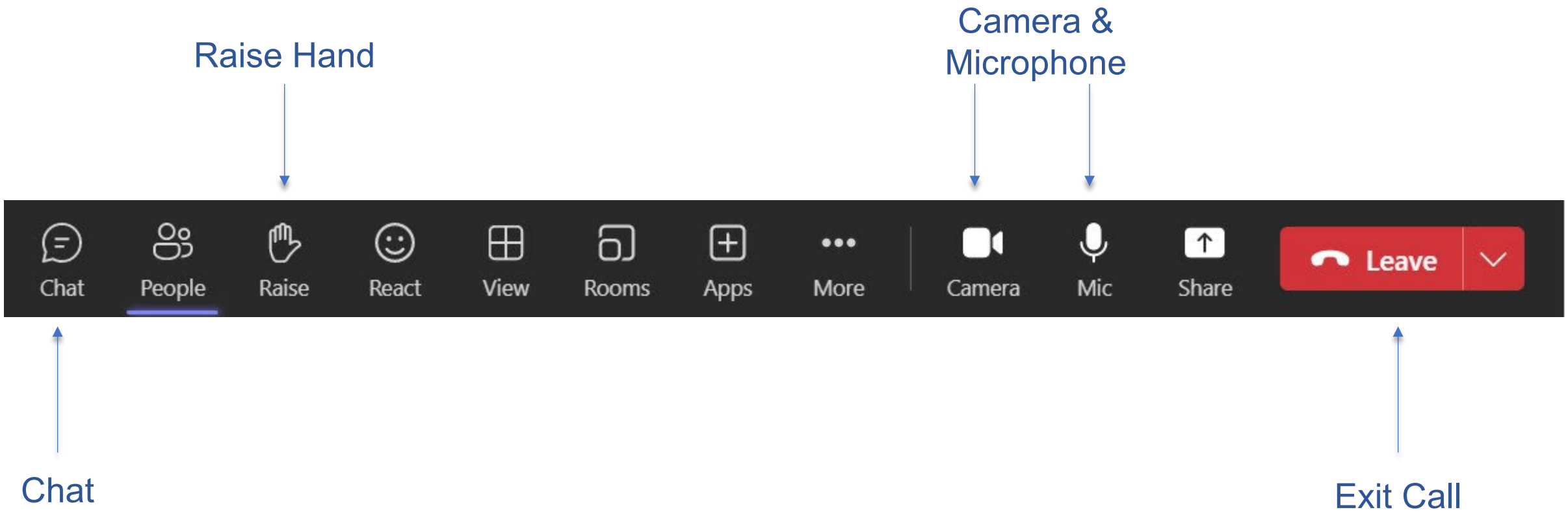
Northwest Energy Efficiency Alliance

Q3 2024 Meeting

September 25, 2024

8:30 a.m. – 12:00 p.m.

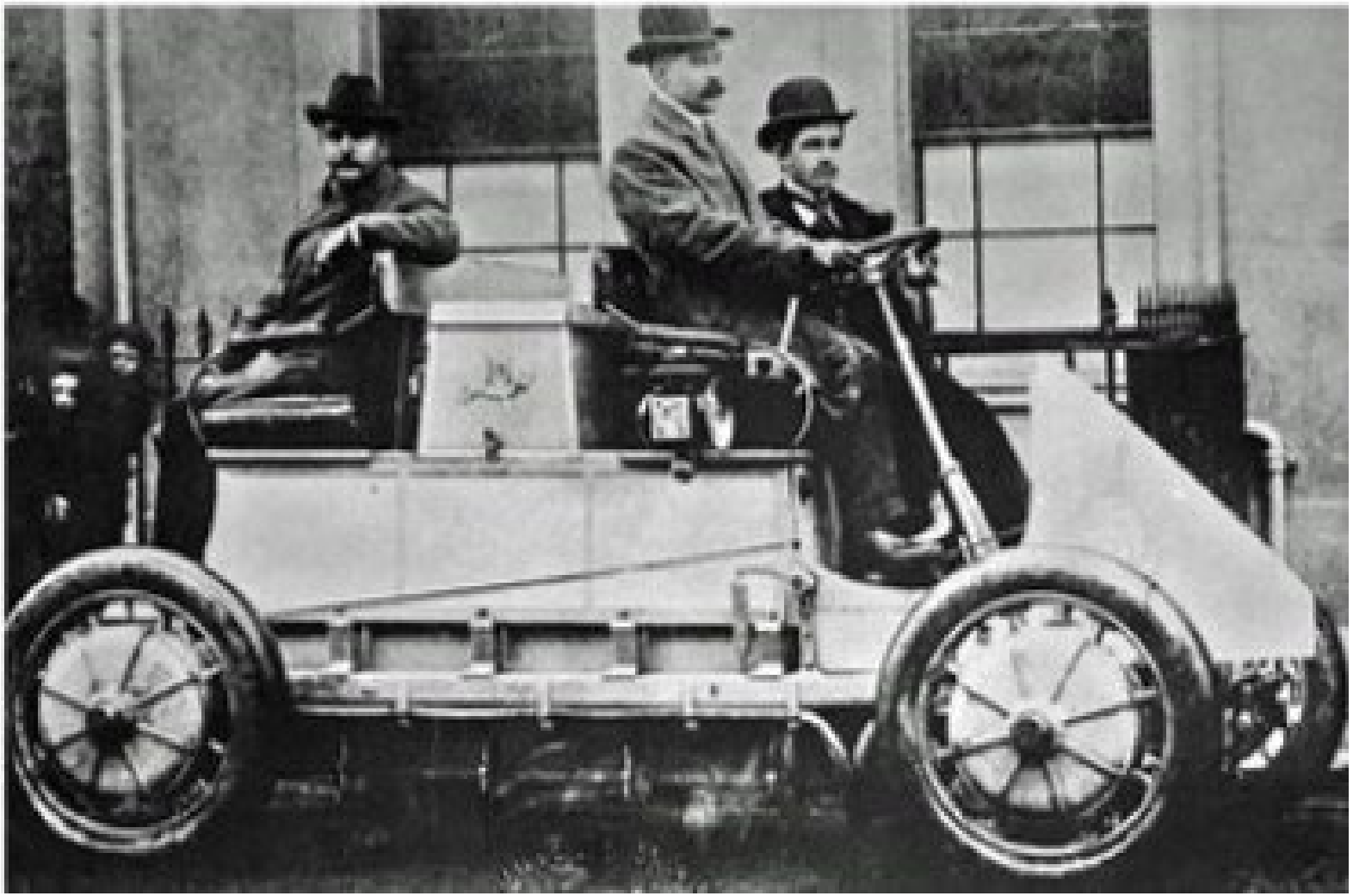
Navigating MS Teams Layout



Note: These options may vary, depending on which version you're using.

Name, Title, Organization and…

What inventor or scientist (past or present) most sparked your imagination?



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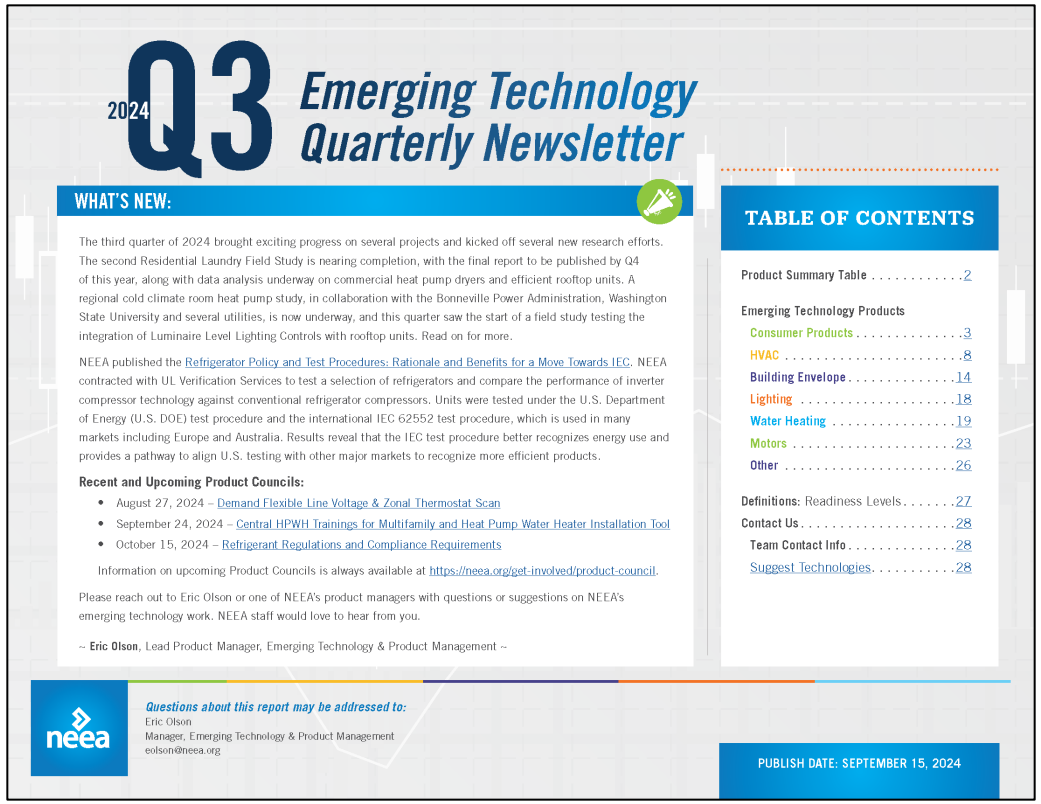
Agenda

8:30 am	Welcome and Announcements
9:00 am	NW Power & Conservation Council Regional Technical Forum Updates
10:00 am	*Break*
10:15 am	ResHVAC HP Research
11:15 am	ACEEE Summer Study Round Table
11:45 am	Wrap-Up

Q3 2024 Emerging Tech Newsletter



2024 Q3 Emerging Technology Quarterly Newsletter

WHAT'S NEW:

The third quarter of 2024 brought exciting progress on several projects and kicked off several new research efforts. The second Residential Laundry Field Study is nearing completion, with the final report to be published by Q4 of this year, along with data analysis underway on commercial heat pump dryers and efficient rooftop units. A regional cold climate room heat pump study, in collaboration with the Bonneville Power Administration, Washington State University and several utilities, is now underway, and this quarter saw the start of a field study testing the integration of Luminaire Level Lighting Controls with rooftop units. Read on for more.

NEEA published the Refrigerator Policy and Test Procedures: Rationale and Benefits for a Move Towards IEC. NEEA contracted with UL Verification Services to test a selection of refrigerators and compare the performance of inverter compressor technology against conventional refrigerator compressors. Units were tested under the U.S. Department of Energy (U.S. DOE) test procedure and the international IEC 62552 test procedure, which is used in many markets including Europe and Australia. Results reveal that the IEC test procedure better recognizes energy use and provides a pathway to align U.S. testing with other major markets to recognize more efficient products.

Recent and Upcoming Product Councils:

- August 27, 2024 – Demand Flexible Line Voltage & Zonal Thermostat Scan
- September 24, 2024 – Central HPWH Trainings for Multifamily and Heat Pump Water Heater Installation Tool
- October 15, 2024 – Refrigerant Regulations and Compliance Requirements

Information on upcoming Product Councils is always available at https://neea.org/get-involved/product-council.

Please reach out to Eric Olson or one of NEEA's product managers with questions or suggestions on NEEA's emerging technology work. NEEA staff would love to hear from you.

– **Eric Olson**, Lead Product Manager, Emerging Technology & Product Management –

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neea

Questions about this report may be addressed to:
Eric Olson
Manager, Emerging Technology & Product Management
eolson@neea.org

PUBLISH DATE: SEPTEMBER 15, 2024

https://neea.org/resources-reports

- Selected Q3 Highlights
  - Published Refrigerator Policy and Test Procedures report based on our testing of residential refrigerators.
  - Recent & Upcoming Product Councils
    - Demand Flexible Line Voltage & Zonal Thermostat Scan
    - Central HPWH Trainings for Multifamily and HPWH Installation Tool
    - Refrigerant Regulation and Compliance Requirements

RETAC Charter Review

Current (Cycle 6) Committee Charter

The purpose of the Regional Emerging Technology Advisory Committee (Committee) is to track and coordinate the progression of individual energy efficiency technologies through a regional pipeline to higher levels of readiness and higher levels of market adoption in the Northwest. The regional pipeline goals adopted by the Committee will help focus attention on technologies that can help improve the overall flow of the pipeline. The Committee's guidance will be used to inform NEEA staff's work toward achievement of the organization's strategic goals. This guidance will also be used by Committee members to influence their work toward achievement of their organization's goals and optimize regional collaboration on emerging technologies.

As a management advisory committee resourced by NEEA staff and providing support to the work of NEEA managers and other staff in its evaluation and promotion of energy-efficient emerging technologies, the Committee ultimately reports to NEEA's Executive Director.

Proposed Cycle 7 Committee Charter

NEEA's Regional Emerging Technology Advisory Committee's ("Committee") purpose is to track and coordinate the progression of technologies that enable energy efficiency, grid-enabled end-use capabilities, reduce greenhouse gas emissions, and accelerate the equitable delivery of energy efficiency benefits (emerging technology or technology) in the Northwest. Also, this Committee tracks higher levels of emerging technology readiness and market adoption in the Northwest. The regional pipeline goals adopted by the Committee help focus attention on technologies that can help improve the overall flow of the pipeline. Committee's guidance is used to inform NEEA staff's work toward achievement of NEEA's strategic goals and also used by Committee members to influence Committee work towards achievement of Committee members' host organization's goals to optimize Northwest collaboration on emerging technologies.

Summary of RETAC Charter Proposed Revisions

- General formatting change to align with other committee charters
- Addition of “Committee Authority” section to align with other committee charters. Replaces second paragraph of “Purpose” statement in Cycle 6 Charter
- Addition of 2 Committee Responsibilities, “Engagement in activities…” and “Committee members and NEEA share a commitment to communicate and coordinate as part of this committee with the intent of operating with transparency and clarity.”
- Clarifications and verbiage updates to other sections

Proposed Cycle 7 Committee Charter Next Steps

- Full proposed edits are included in the Meeting Packet (pages 5-8)
  - Full redlines and comments are included
- If you have concerns or suggested edits, please respond by email no later than 9/30 EOD
- Responses should be sent to lmosley@neea.org

2024

RETAC Meeting Dates

Q1	Thursday, March 28
Q2	Thursday, June 27
Q3	Wednesday, September 25
Q4	Thursday, December 12

2025

PROPOSED Meeting Dates

Q1	Thursday, March 13
Q2	Wednesday, June 18
Q3	Wednesday, September 24
Q4	Thursday, December 4

EFX25: Call for Session Topics Opens Sept. 16

Submit your ideas for conference sessions and keynote speakers

September 16 – October 25

www.neea.org/EFX

Conferences & Product Councils

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Conferences

Past Conferences

- 2024 ACEEE Summer Study – August 2024
- IES 24 National Conference – August 2024
- Smart Buildings Exchange – August 2024
- BOMA Seattle – August 2024
- CEE Industry Partners Meeting – September 2024
- ENERGY STAR Partners Meeting – September 2024
- BOMA PNW Regional Conference – September 2024
- Street and Area Lighting Conference – September 2024

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Conferences

Upcoming Conferences

- Grid Forward – October
- California Emerging Technologies Summit – October
- BOMA Oregon Products and Services Expo – October
- American Society of Plumbing Engineers (ASPE) Convention & Expo – October
- ASHRAE Decarbonization Conference – October
- AMCA 2024 Annual Meeting – October
- GTI Emerging Technology Meeting – October
- Montana Joint Engineers Conference – November
- Peak Load Management Association 2025 Fall Conference – November

Q3 2024 Product Council Presentations

Presenter	Topic	Date Scheduled	Webinar Recording
Cadeo Group, City of Seattle	Demand Flexible Line Voltage & Zonal Thermostat Market Scan	8/27/2024	Northwest Energy Efficiency Alliance (NEEA) | Demand Flexible Line…
D+R Int'l.	Central HPWH Trainings for Multifamily	9/24/2024	Available Soon!

Upcoming Product Council Presentations

Presenter	Topic	Date Scheduled	Registration Page
VEIC	Refrigerant Regulations & Compliance Requirements	10/15/2024	Session Registration

https://neea.org/get-involved/product-council

Regional Technical Forum Update

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Regional Technical Forum RCP, Research Strategies, and New Measures

Laura Thomas

RTF Manager

NEEA Q3 2024 Regional Emerging Technology Advisory Committee

Wednesday, September 25

Presentation Overview

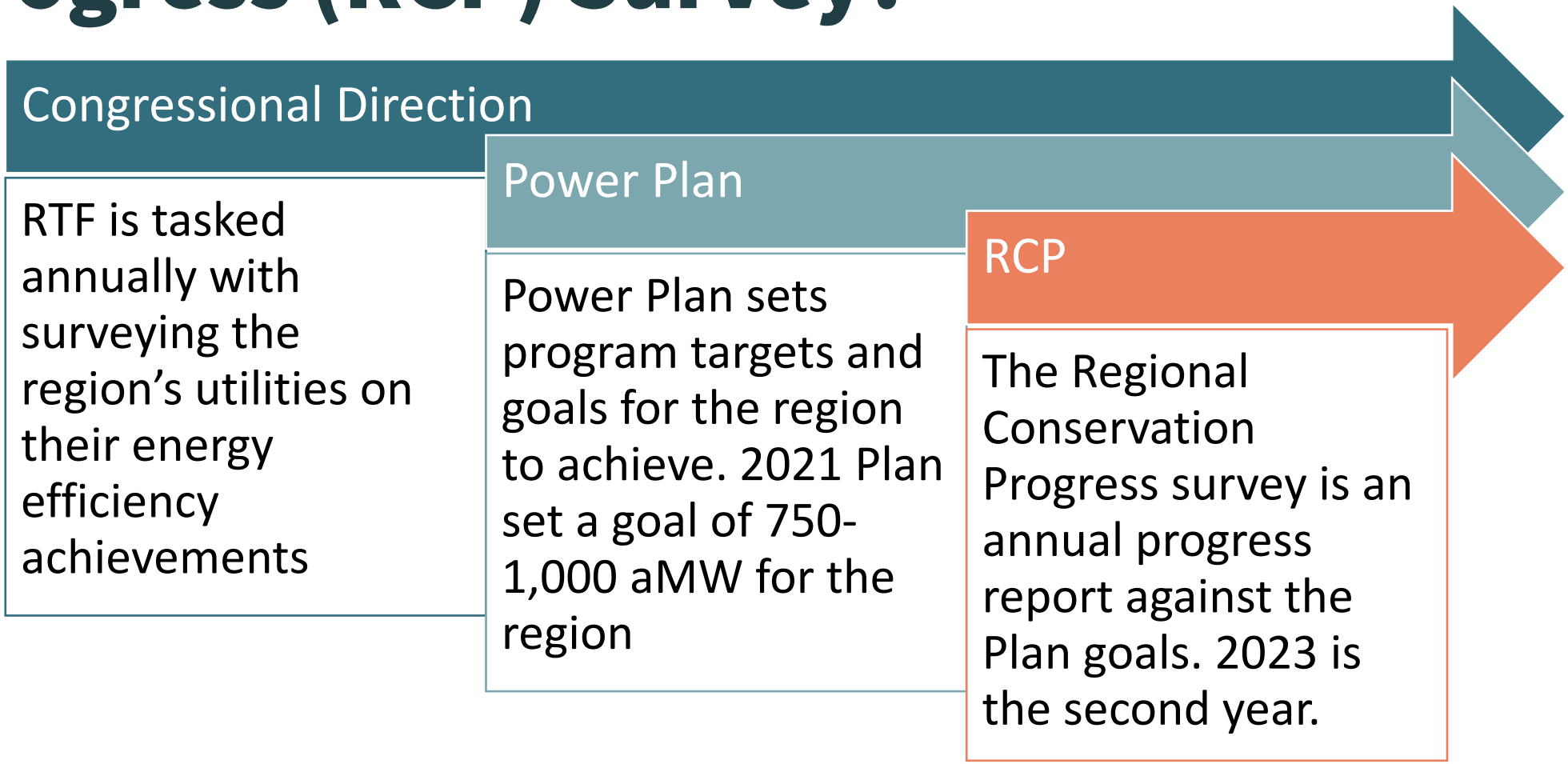
Today, sharing an update with NEEA's Emerging Technology Advisory Committee on two topics

- 2023 Regional Conservation Progress Survey Results
- Recent RTF work to support Planning measure research strategies
- Results of recent new measure scan

2023 RCP Results

Regional Technical Forum

What is the Regional Conservation Progress (RCP) Survey?



Acknowledgements

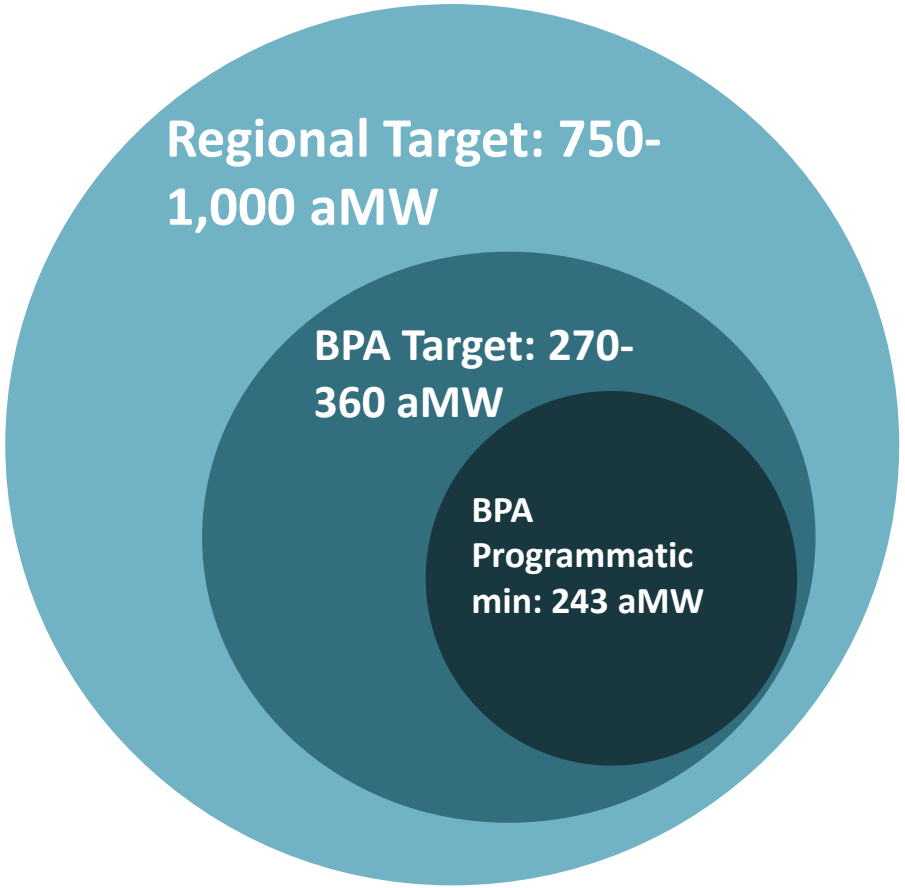
- Jennifer Light
- Kevin Smit
- Consultants (Apex)
- Responding Utilities

Thank you to the Regional Utilities who provided data:

- Bonneville Power Administration
- Puget Sound Energy
- NorthWestern Energy
- Avista
- Idaho Power
- Energy Trust of Oregon
- PacifiCorp
- Chelan County PUD
- Grant PUD
- Douglas PUD
- Northwest Energy Efficiency Alliance
- BPA Utilities:
  - Seattle City Light
  - Snohomish County PUD
  - Franklin PUD
  - Tacoma Power
  - Cowlitz PUD
  - Grays Harbor PUD
  - Clark PUD
  - United Electric Coop
  - Emerald PUD

2021 Plan 6-Year Conservation Target

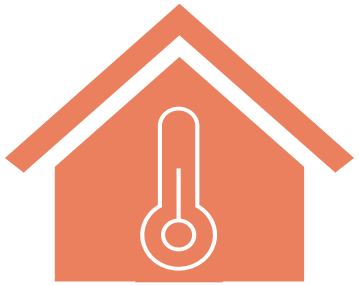
- Target represents the cost-effective conservation found in the 2021 Plan
- Bonneville's target sets a programmatic minimum which is intended to represent 90% of the savings achieved by BPA in the plan period. This percentage is consistent with where the majority of Bonneville savings have come from in past plan periods.



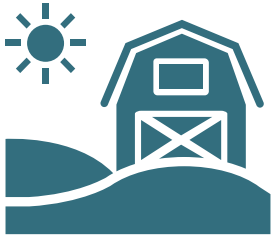
*The BPA targets were developed based on the portion of cost-effective energy efficiency in the Bonneville utility footprint

Additional Program Element Savings

- The Conservation Program recommends the region pursue efficiency beyond what is just cost-effective
- Successful implementation of the Conservation Program requires that the region achieve more than just the target amount of conservation



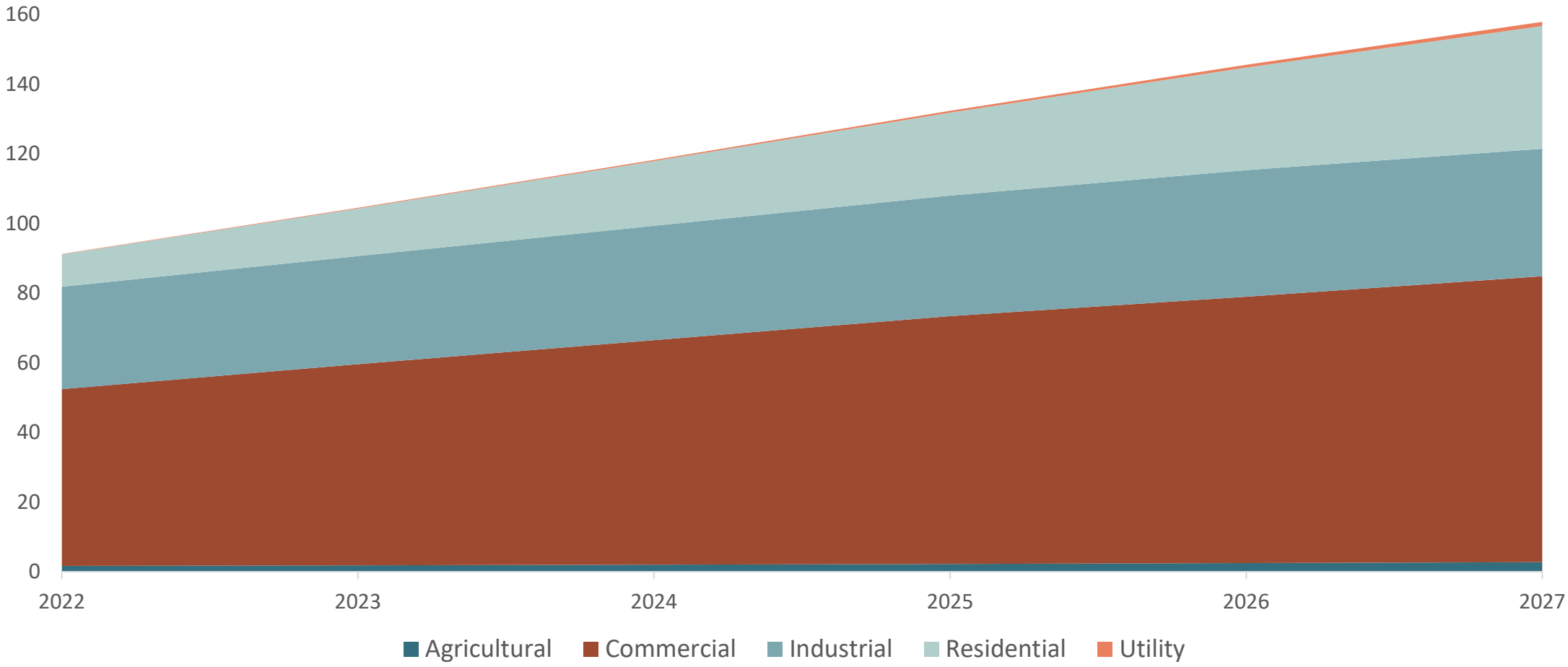
Weatherization



Small and Rural Utility Programs

Decarbonization

Annual Cost-effective Conservation Potential in 2021 Plan by Sector



Types of Conservation Savings in the 2023 RCP

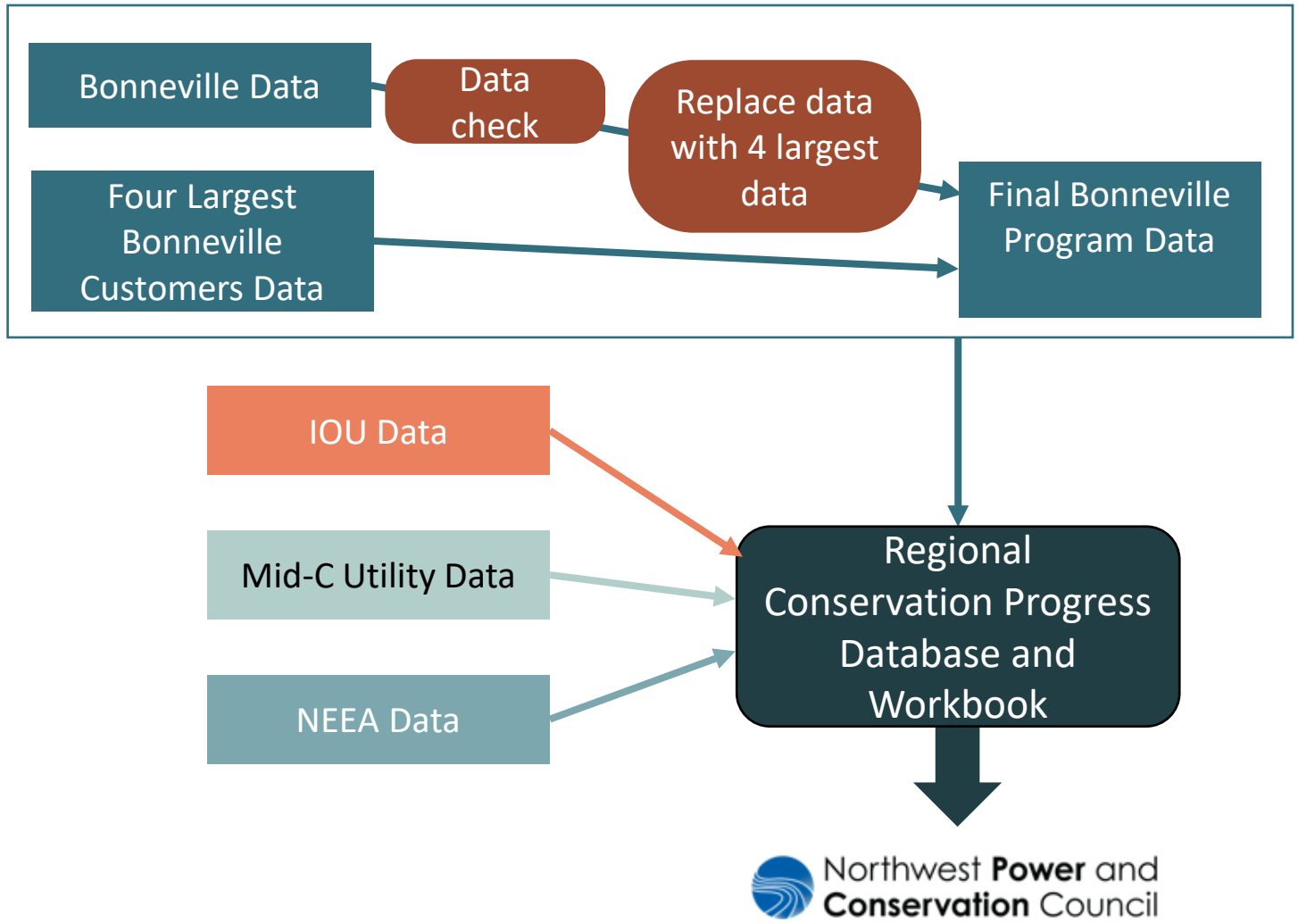
Program Savings

NEEA Initiative Savings

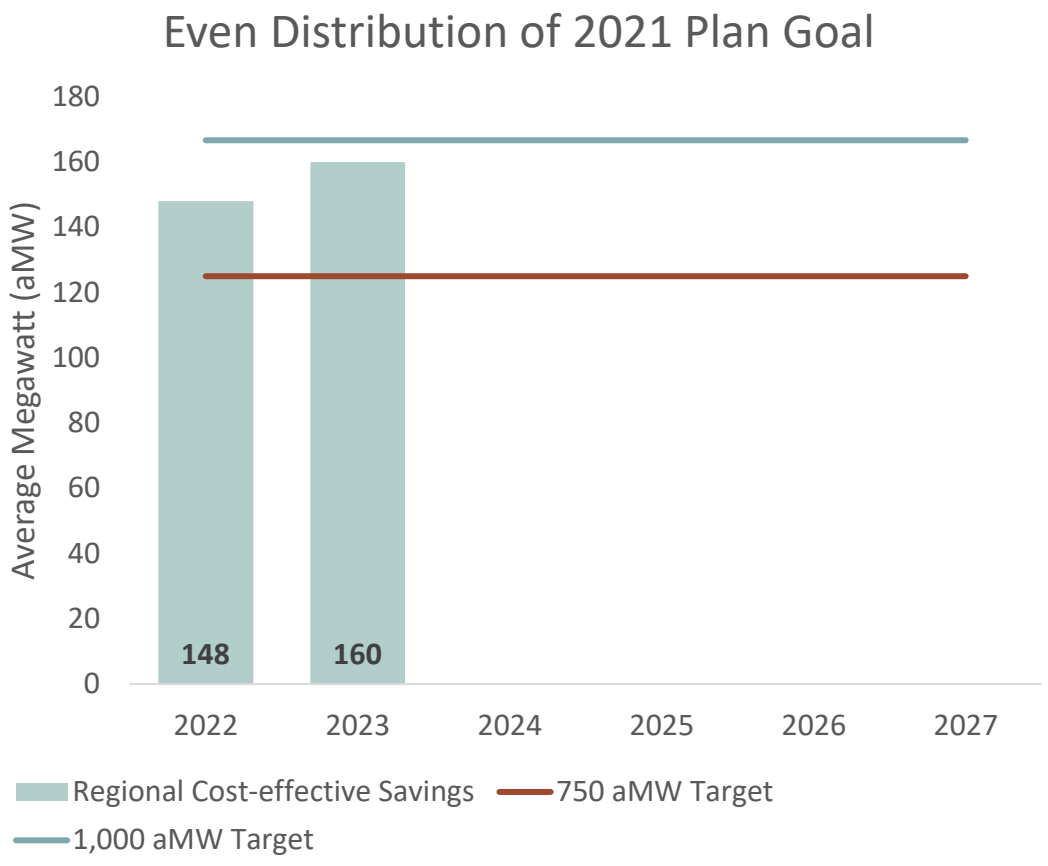
Codes and Standards

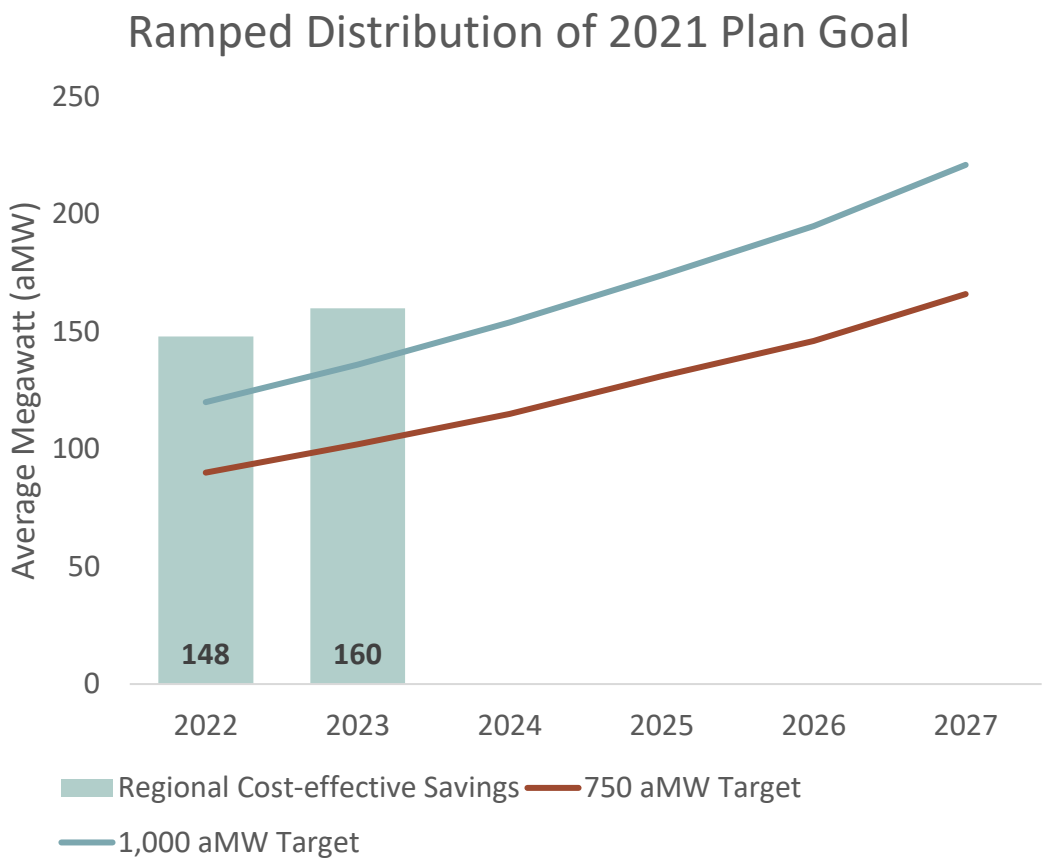
RCP Data Collection

- 2023 Savings
  - As much detail as possible
- 2023 Expenditures
  - Aiming for total expenditures
- 2024-2025 Projections
  - Forecasted savings and expenditures where available

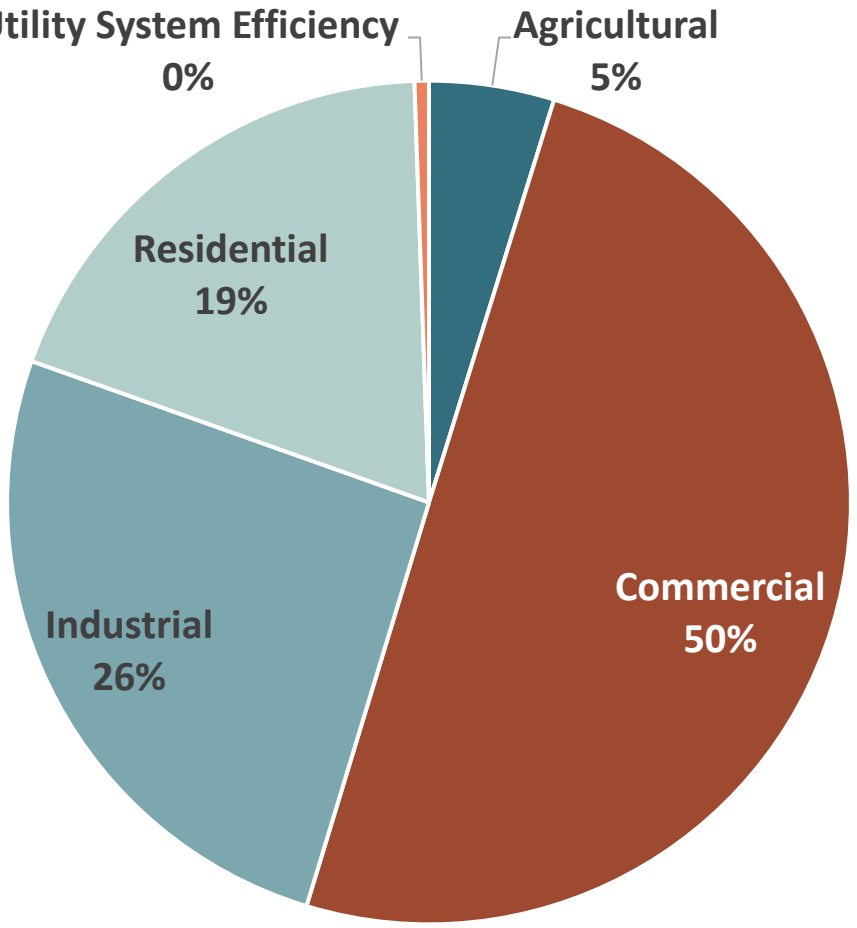


Total Regional Cost-Effective Savings Achieved in 2023 = 160 aMW

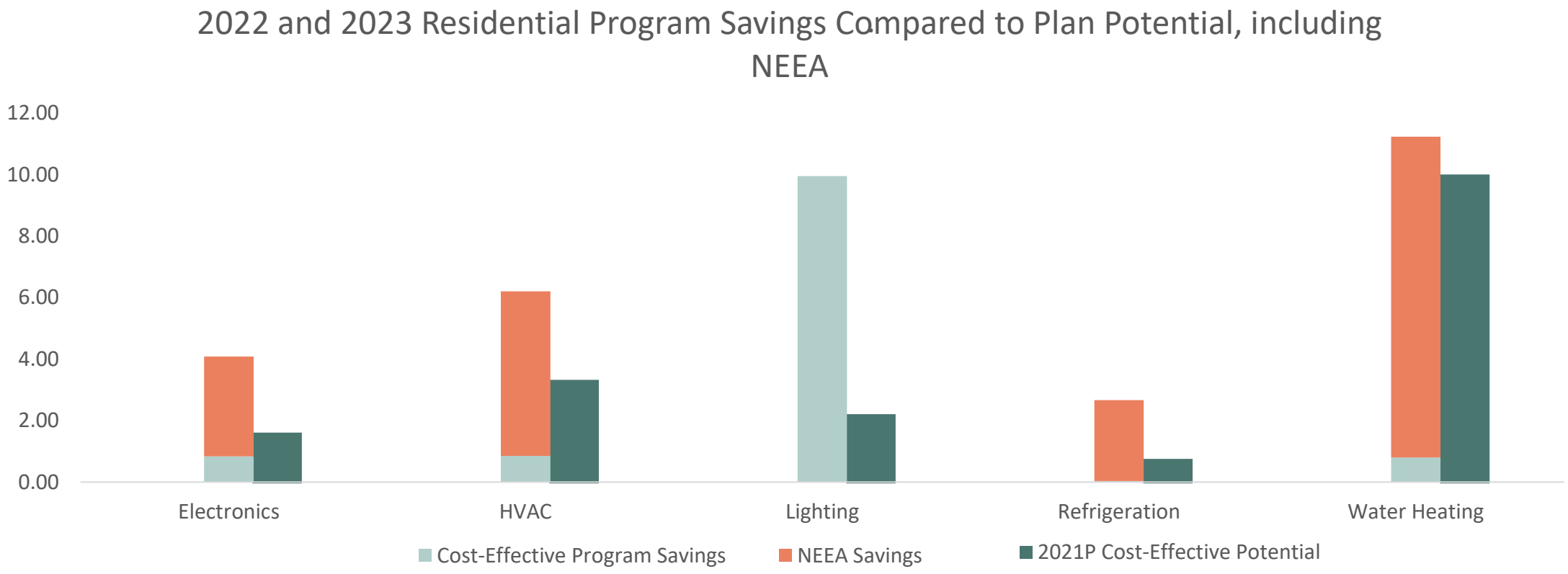




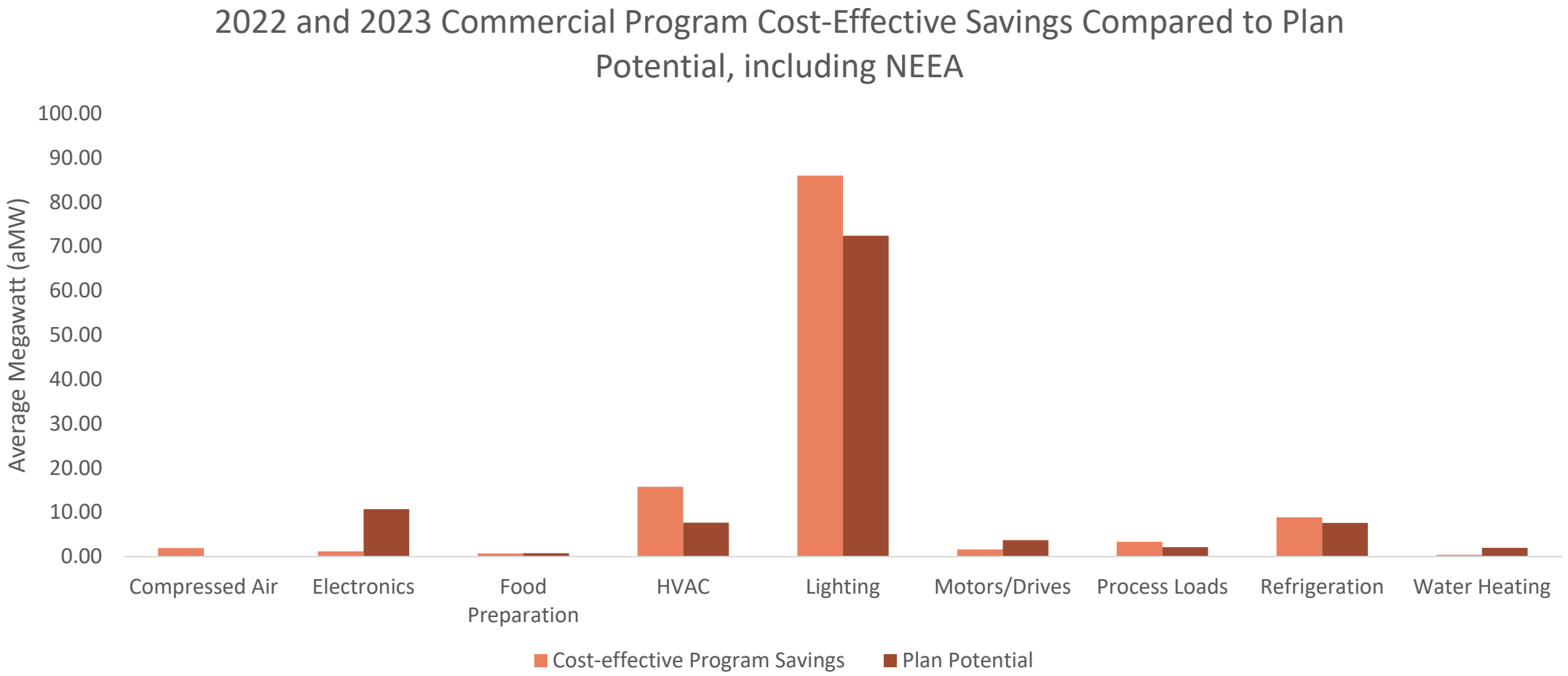
Regional Cost-effective Savings in 2023 by Sector



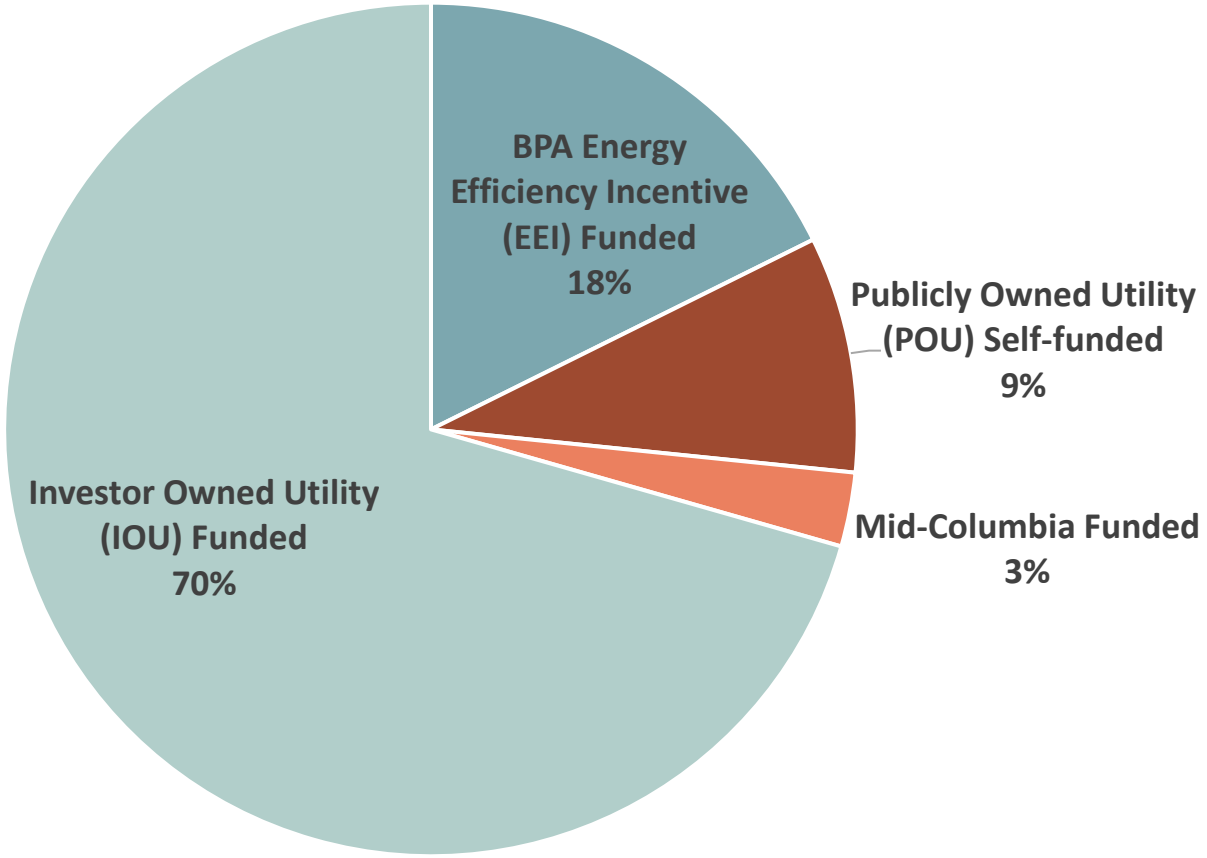
NEEA Program Ensuring Comprehensive Saving for Residential Sector in the Region



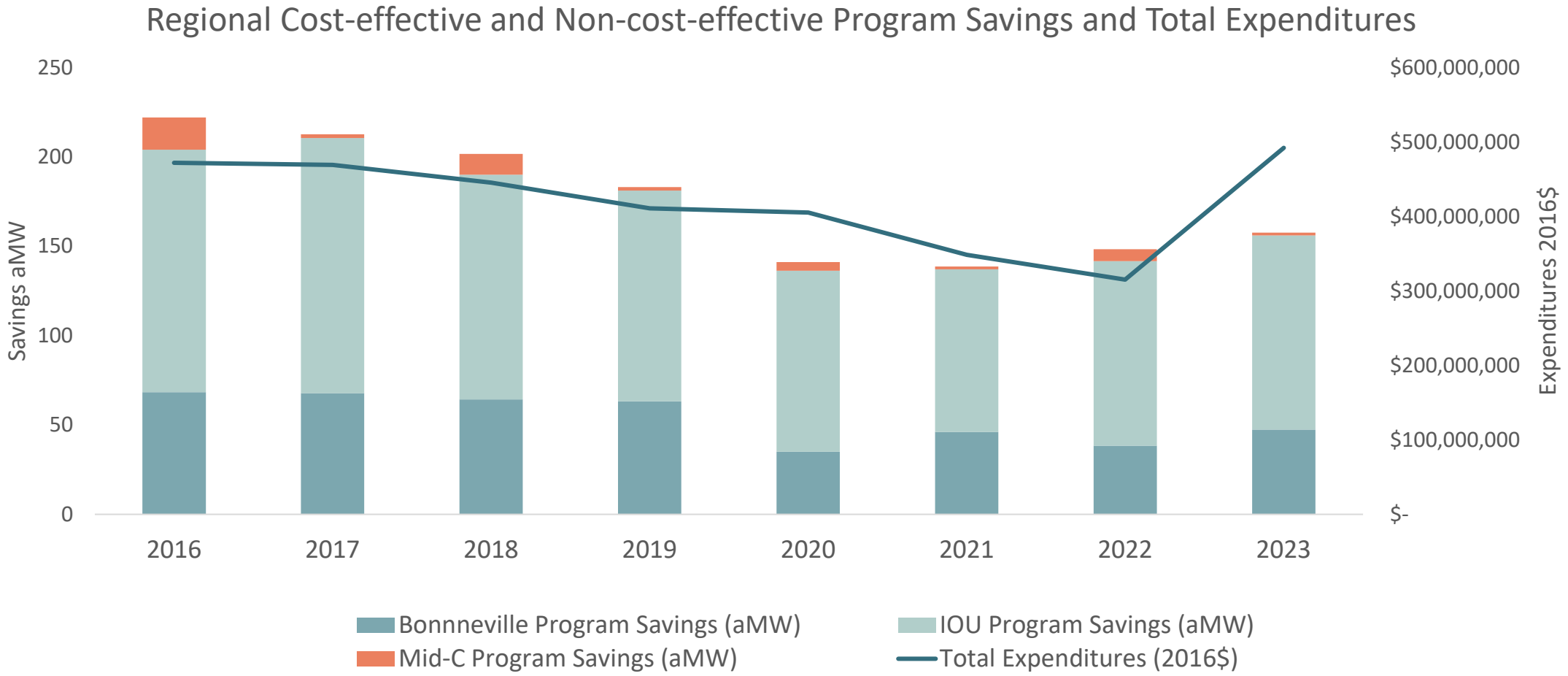
Commercial Programs Exceeding Expectations



Cost-effective Program Savings from 2022-2023 by Funding Type



Increase in Both Total Program Savings and Expenditures in 2023

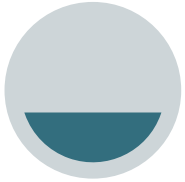


In 2023 the Region Accomplished Other Elements of the Conservation Program

- Of the savings reported to the RCP, 8% were not cost-effective and instead support other elements of conservation program goals. This amount is consistent with the 2022 RCP.
- 93% of these additional savings were primarily for residential HVAC measures.

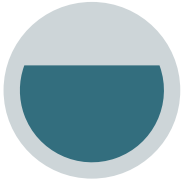
Weatherization in Plan Conservation Program

- The 2021 Power Plan “recommend(s) the region continue to invest in weatherization programs, targeting those homes that are leaky (in need of duct or air sealing) and/or have zero or limited insulation.” Plan assumes the potential for weatherization measures includes:



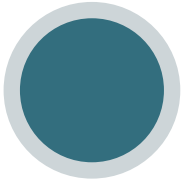
14 aMW

For 2022-2023



61 aMW

For 2022-2026



135 aMW

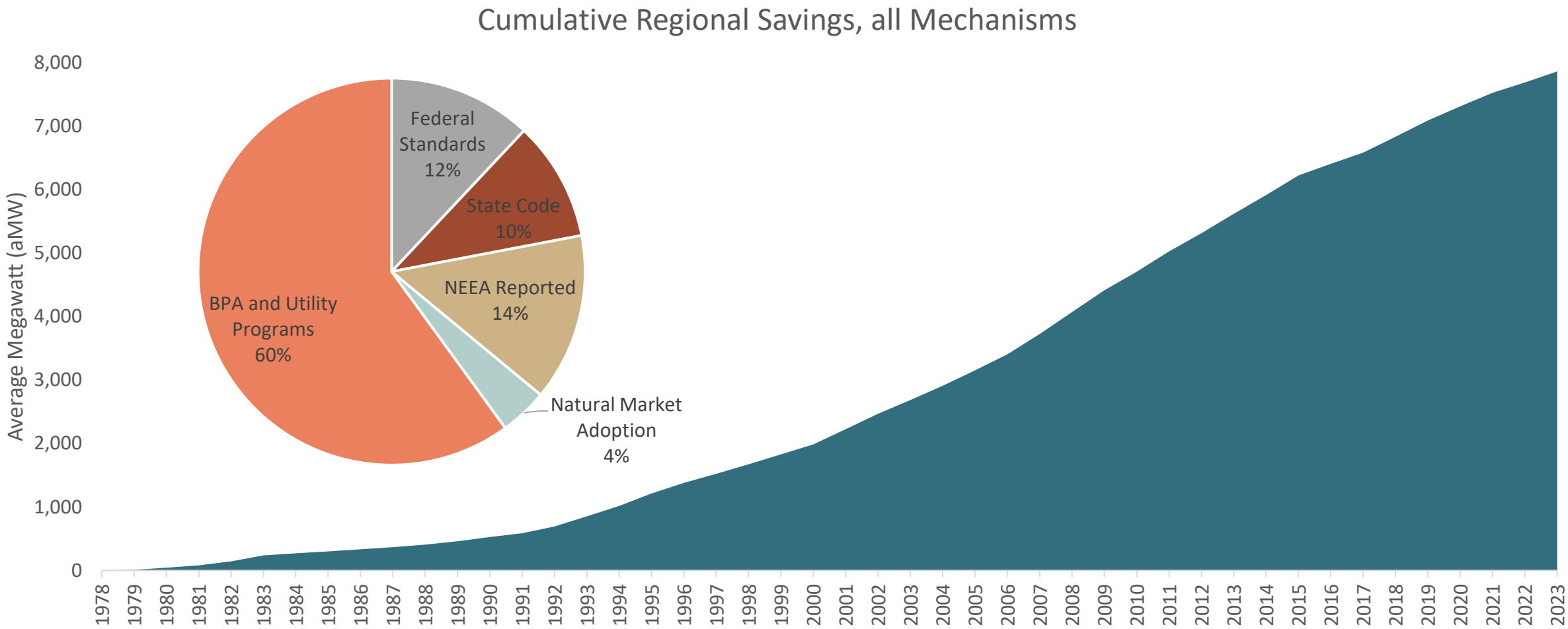
For 2022-2042

Region's Progress Toward Weatherization Goals

In 2022-2023, savings for weatherization measures total **3.1 aMW**. There continues to be significant weatherization potential in the region.

Photo by Erik Mclean on Unsplash

Region has achieved 7,865 aMW



Fun Facts: What does 7,865 aMW represent?

Equivalent to the annual energy consumption of around 6.3 million homes

Almost 2.9 times the generation of Grand Coulee

Avoided more than 25 million metric tons of CO2

or the amount of CO_2 sequestered by 29 million acres of US forests in one year

RTF Planning Measure Research

Regional Technical Forum

Role of the RTF

What the RTF **Does**

- Provides open, centralized, independent technical review of measures
- Relies on empirical data and professional judgment
- Follows a process for updating measures, including an appeals process
- Provides guidance for estimating savings from custom measures and program-level savings
- Tracks regional progress towards efficiency goals
- Assists Council in assessing new efficiency opportunities

What the RTF **Does Not** Do

- Perform direct regulatory function
- Require use of specific savings estimates or restrict which measures utilities can install
- Require use of specific program design
- Establish utility program reporting requirements
- Evaluate savings for ALL measures
- Establish rebate, incentive or willingness to pay levels
- *Execute primary research (RTF relies on others for research)*

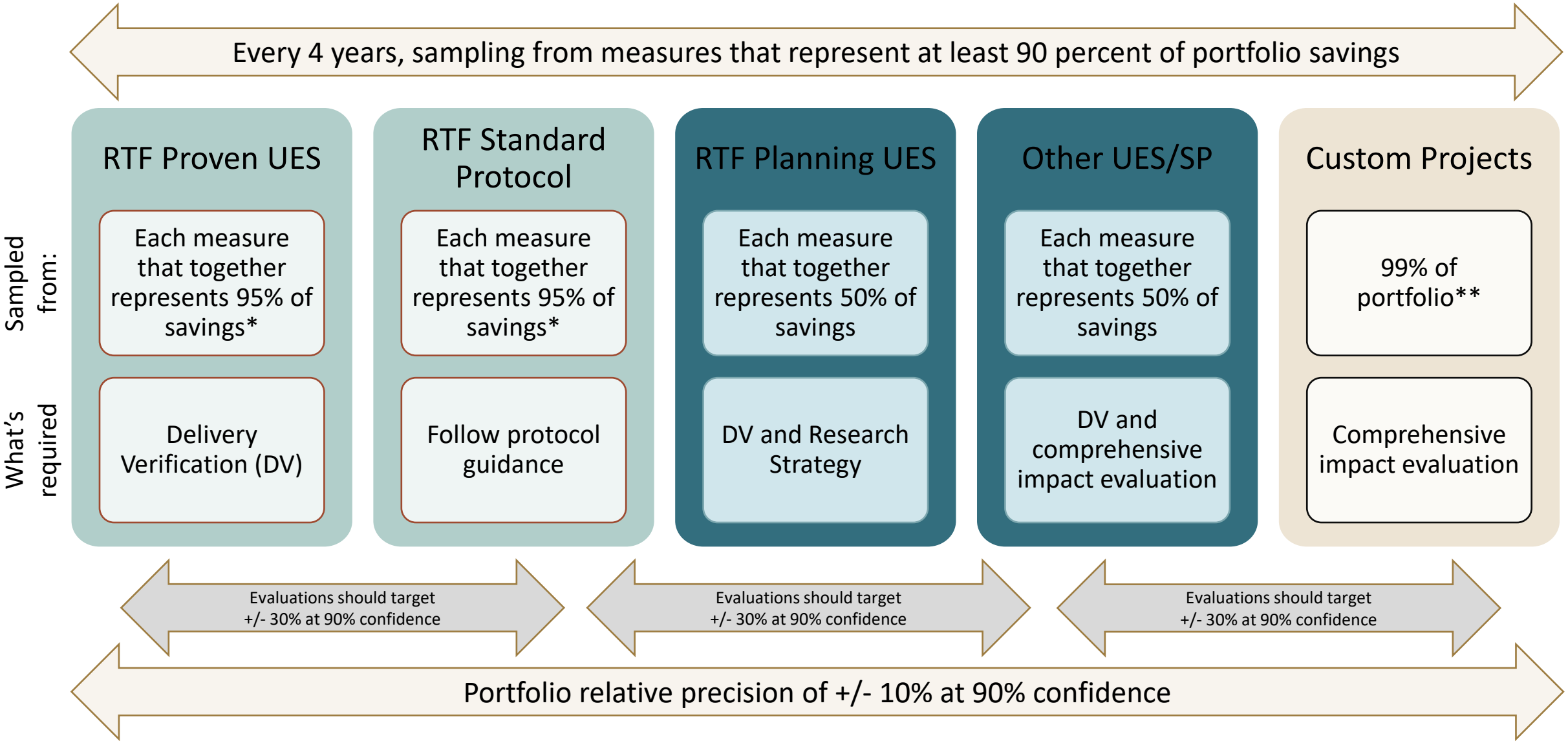
RTF Scope Expanded in 2025-2029 to include Planning Measure Research

- This year, the RTF Policy Advisory Committee (PAC) decided to expand the RTF's scope to include performing research on the identified research objectives of RTF Planning measures with the intention of reducing all or a portion of the uncertainty of these measures.
- Budget set for this work over the five-year funding period is a total of $268,000 with the option to use unallocated and unspent funds from previous years to take on larger projects.
- The RTF PAC is still in the process of determining the role and work for the RTF in this area for 2025.

RTF Categories

	Proven	Planning	Small Saver
RTF Approval	Estimation method and savings values based on reliable data and analysis and considered reliable	Sound engineering or statistical methods / savings values, but not considered reliable	Sound engineering or statistical methods / savings values , but not considered reliable
Technical Potential	Sufficient usefulness and applicability in the region	Sufficient usefulness and applicability in the region	Regional potential savings small <3 aMW or 1 million therms
Evaluation	Delivery verification (i.e., count of units) for a reliable random sample	1) Comprehensive impact evaluation, includes data collection and analysis OR complete Research Strategy, 2) Delivery verification	Comprehensive impact evaluation, includes data collection and analysis in addition to delivery verification
Additional Research	No additional research needed by the region	Research strategy required	Savings potential too small to warrant additional research

RTF Categories Evaluation Guidance



* For each RTF Proven UES and RTF SP, if a measure is not sampled in 2 cycles of evaluation (8 years), it should either be evaluated in the next cycle or removed from portfolio

** For Custom Projects, the savings from sampled projects must sum up to 20% of custom savings and represent a mix of projects (e.g., small and large)

Why is it Important for Measures to Move from Planning to Proven?

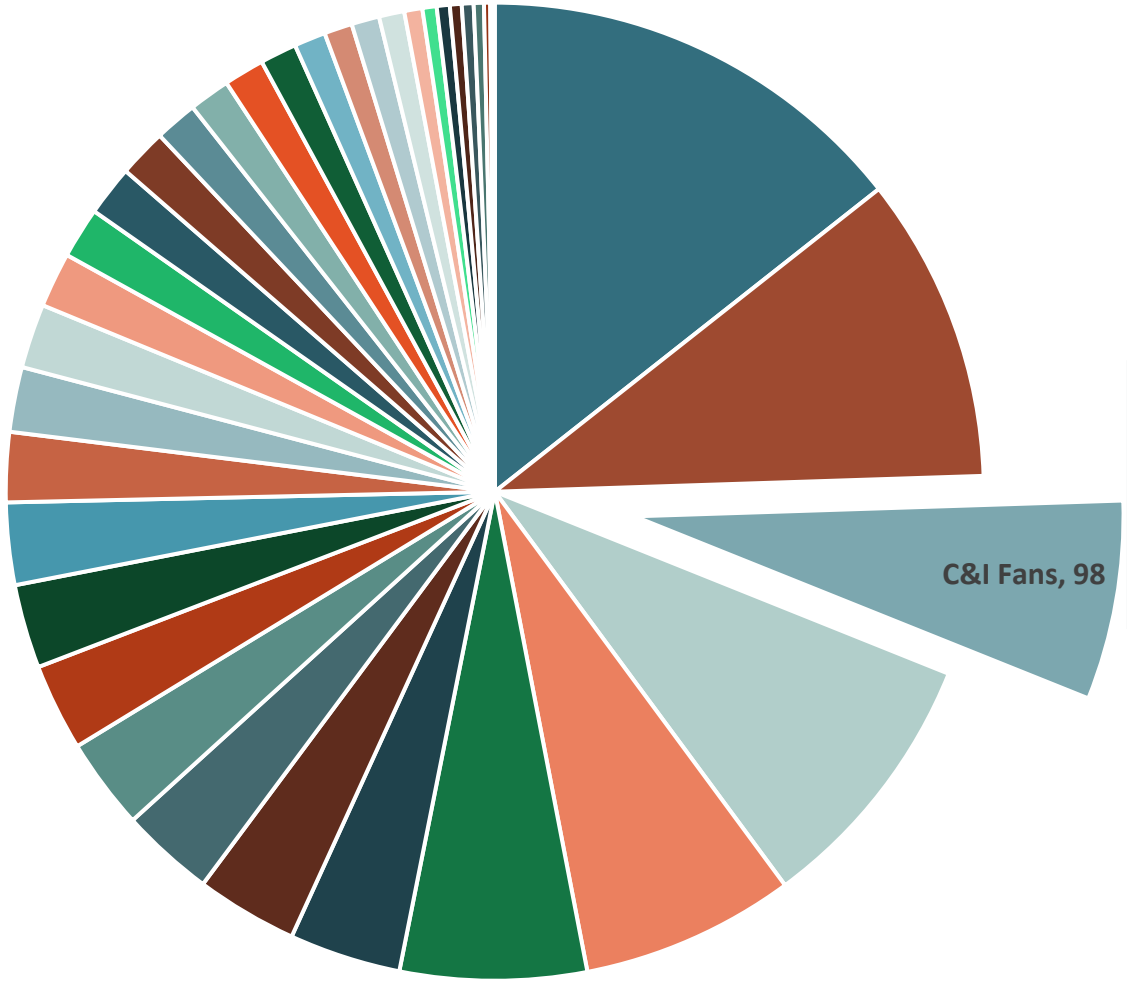
For Regional Programs

- Reliability of savings estimates for achieving program goals.
- Once proven, reduction of evaluation costs.

For Power Planners

- Efficiency is a resource, and that resource needs to be available and show up when expected.

RTF Planning Measures Represent 1.5 aGW of Potential in 2021 Power Plan



Uncertainty for this measures is +/- 50%, which is equivalent to…

John C. Boyle 1 & 2 Dam in Oregon, which has a nameplate capacity of 98.7MW

Photo Credit: Bobjgalindo, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons

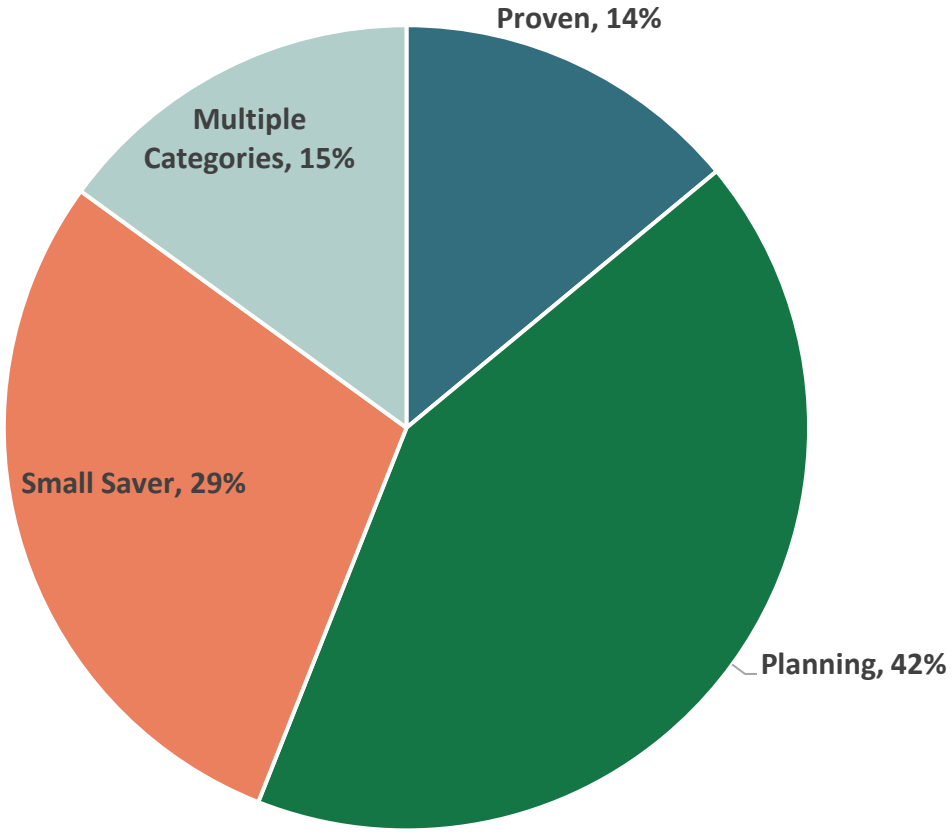
Overview of RTF Measures and Categories

RTF currently maintains 72 UES measures

RTF Category	Number of UES Measures
Proven	10
Planning	30
Small Saver	21
Multiple Categories*	11

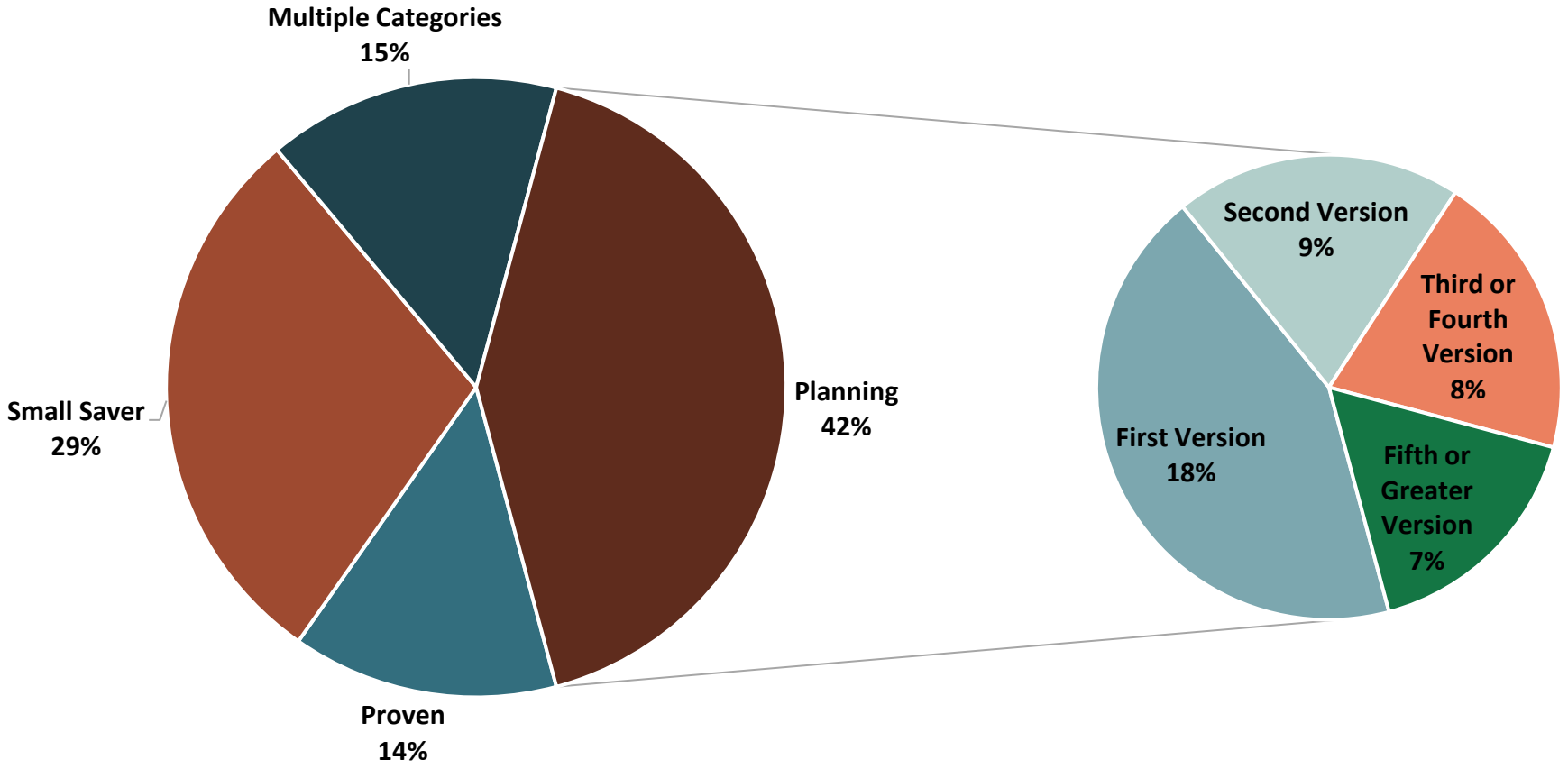
*Means that portions of the measure have different categories. For example, the Residential HPWH measure is Planning, Proven with split system applications being Planning and all other applications being Proven

Percent of RTF Active and Under Review Measures by Category

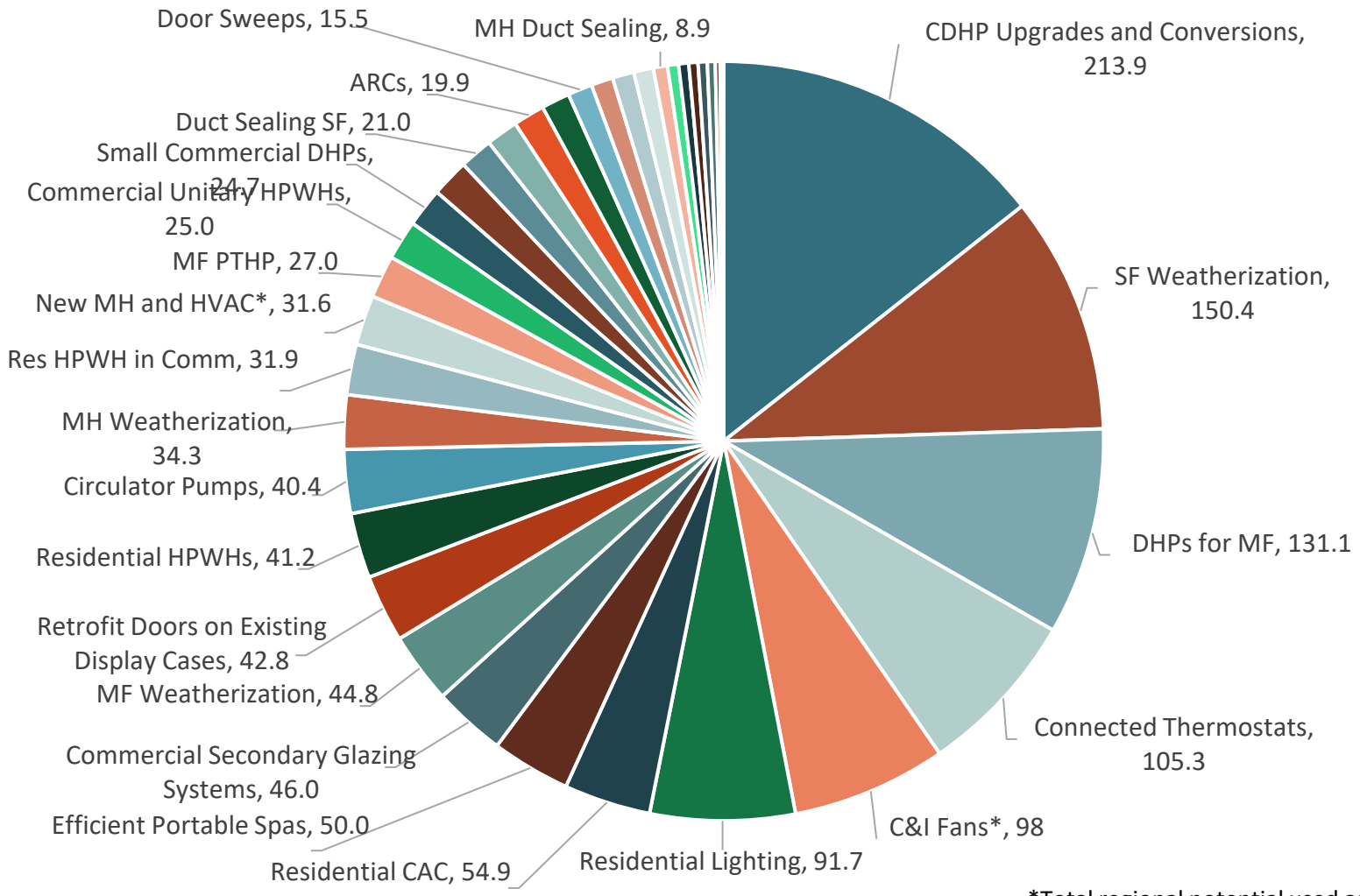


Number of Versions of RTF Planning Measures

Current RTF Active and Under Review Measures by Category and Planning Measure Version Number



RTF Planning Measures Savings Potential Affected by Research Strategy Objectives Represent 1.5 aGW of Potential in 2021 Power Plan

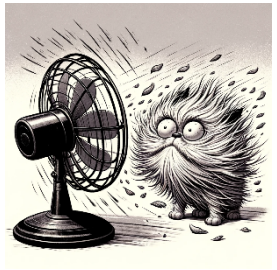


Heat Pumps
374.8 aMW

Water Measures
20 aMW,
Plus Deactivated,
Plus Gas

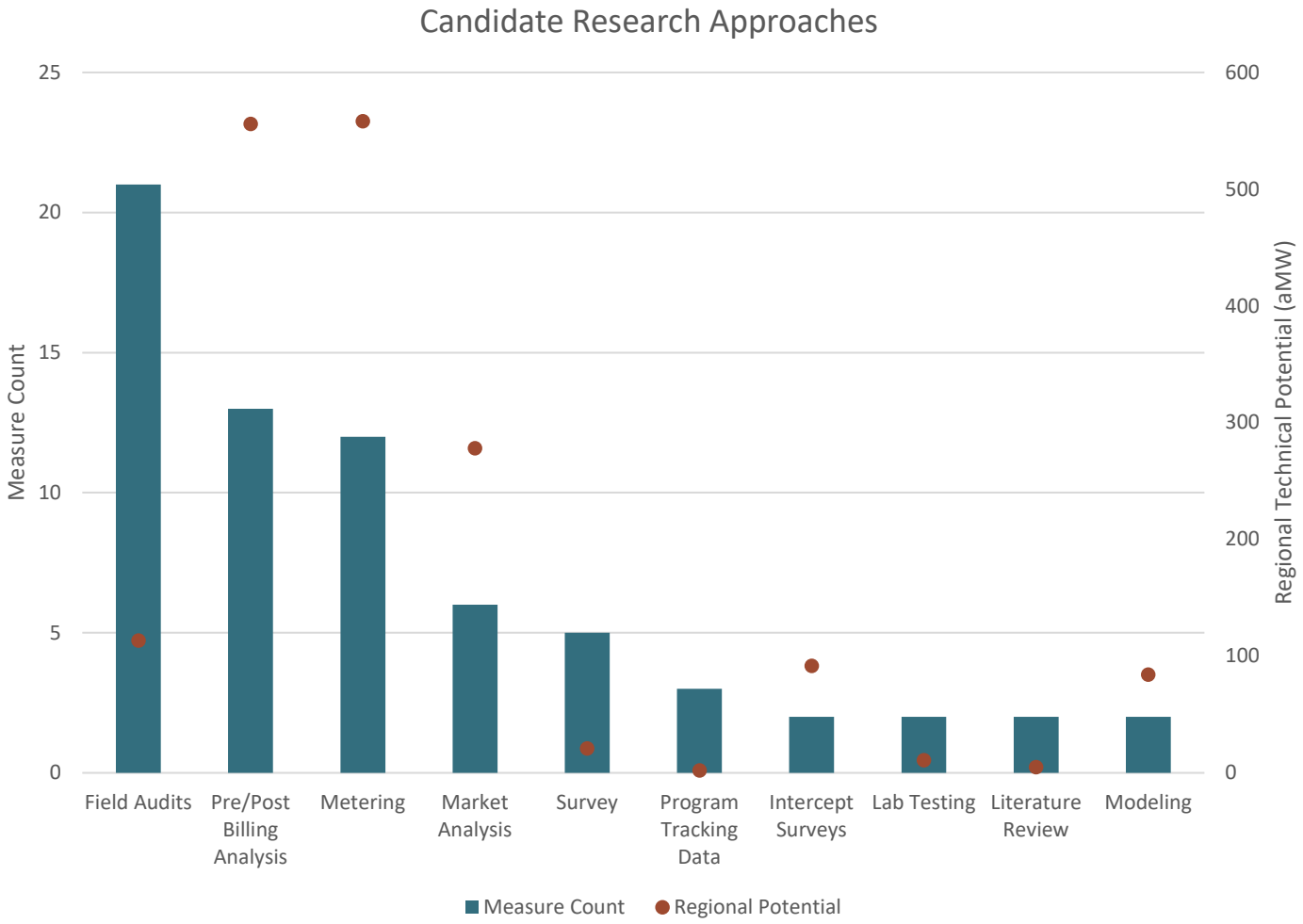
Weatherization
260 aMW,
Plus Gas

Fans
98 aMW



*Total regional potential used as still determining exact amount of potential impacted by research strategy

Billing Analysis and Metering Account are the Most Potentially Impactful Research



- Our Research Strategies contain an array of Candidate Methods
  - Remember that these are just one potential way of addressing the main Research Questions needed to address uncertainty
- The plurality of Strategies require some in situ data regarding operating conditions
- However, Billing Analysis and Metering have the largest aggregate impact on reducing uncertainty for potential regional savings
- Nonetheless, some “low hanging fruits” have a meaningful amount of associated regional potential
  - Market Analysis
  - Surveys
  - Modeling

Active Research Strategies

- The RTF currently has 36 active Research Strategies for 45 measures
  - 26 measures could be addressed with Candidate Research Approaches estimated to cost under $250,000 each

Estimated Cost Range	# of Measures	# of Research Strategies	Maximum Technical Potential (aMW from '21 Power Plan)	Uncertainty (of 24 that are quantified by CAT)		
				20-40%	41%-75%	76%+
< $25,000	1	1	14	0	0	0
$25,000 - $100,000	15	15	534	2	3	2
$100,000 - $250,000	10	9	311	1	2	2
$250,000 - $500,000	12	6	535	2	4	2
$500,000 - $1,000,000	4	3	325	0	2	0
$1,000,000 - $2,000,000	1	1	40	0	1	0
> $2,000,000	1	1	1	0	1	0

What is in an RTF Research Strategy?

- Typically research strategies include:
  - Introduction
  - Research objectives
  - Data collection and analysis
    - Suggestion on potential data collection and analysis approach to complete research objectives. Not the only way the research objectives could be completed, but an example to support the region in understanding the objectives and to help develop an estimated cost range. If someone does pick up a research strategy and wants support providing input to ensure their works will inform the RTF research objectives, please reach out to the RTF Manager or admin.
  - Estimated Cost Range

RESEARCH STRATEGY FOR COMMERCIAL FOODSERVICE MEASURES: GRIDDLES, FRYERS, COMBINATION OVENS AND HOT FOOD HOLDING CABINETS

RTF APPROVAL DATE: JULY 20, 2021

1. INTRODUCTION

This document describes the anticipated research needed to support RTF-Proven savings values for Commercial Griddles, Fryers, Combination Ovens, and Hot Food Holding Cabinets.

As proposed, these RTF measures apply to the installation of energy efficient griddles, fryers, combination ovens, and hot food holding cabinets in commercial cooking settings. These measures primarily save energy by reducing idle energy consumption through improved insulation and gaskets when the unit is on, but not being actively used. Additional energy is saved through the use of advanced burner and heat exchange design (in the case of fryers and griddles), the use of infrared burners (in the case of combination ovens), and the use of auto door closers (in the case of hot food holding cabinets).[1]

Some of the data inputs in the proposed UES analysis for these four measures are well known or are backed by robust datasets. However, additional research is needed because of several inputs with significant uncertainty or which are not well understood. The sources of uncertainty addressed in this Research Strategy include:

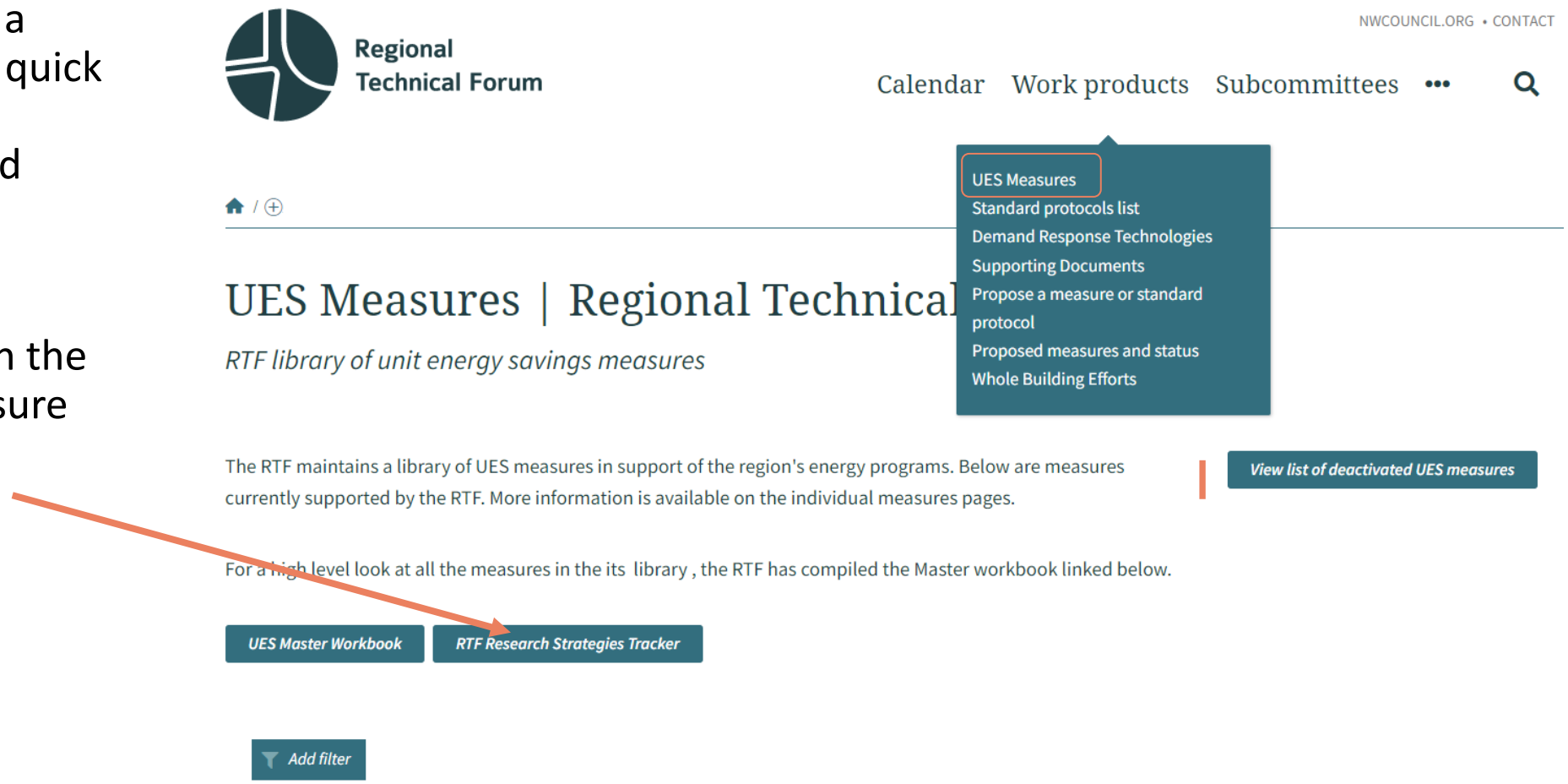
- Daily and annual hours of use
- Cooking setting and modes of operation utilized
- Amount of food cooked/processed per day
- Energy performance metrics for non-ENERGY STAR units

[1] Additional benefits available to the users include high production capacity, improved air circulation, faster and more uniform cooking, reduction in heat loss, efficient use of cooking oil, extended product lifetimes.

Research Strategies Overview Workbook

The CAT has compiled a workbook to facilitate quick comparisons among Planning Measures and Research Strategies.

Workbook is posted on the RTF website UES Measure page



Research Strategies Workbook Overview

Details all RTF measures, and for planning measure provides:

- information about the research strategy including link, estimated costs, research objectives, and savings potential impacted by research objectives

General measure characteristics									Anticipated research cost and uncerta		
Name	Type	Sector	Application	Fuel Type	Current Category	Status	Latest RTF Decision	Sunset Date	Research value proposition (aMW * Δuncertainty / research cost)	General notes	Savings potential (aMW) affected by research strategy
Advanced Rooftop Controls	UES	commercial	HVAC	dual fuel	planning	active	17-Oct-2023	31-Oct-2026	4.0E-06		
Air Source Heat Pump Upgrades and Conversions MH	UES	residential	HVAC	electric	planning, proven	active	6-Dec-2022	30-Sep-2024	2.0E-03		1
Air Source Heat Pump Upgrades and Conversions SF	UES	residential	HVAC	electric	planning, proven	active	6-Dec-2022	30-Sep-2024	1.4E-03		
Anti-Sweat Heater Controls	UES	commercial	grocery	electric	small saver	active	24-Jun-2020	30-Jun-2025			NA
Circulator Pumps	UES	commercial, re	pumps	dual fuel	planning	active	23-May-2023	31-Dec-2026	1.6E-05		
Clothes Dryers - SF, MH, and MF in-unit	UES	residential	appliances	dual fuel	proven	active	8-Dec-2020	31-Dec-2025		Proven	NA
Combination Ovens	UES	commercial	cooking equipr	dual fuel	planning	active	20-Aug-2024	31-May-2028			
Commercial and Industrial Fans	UES	commercial, in	Fans	electric	planning	active	19-May-2020	31-Jan-2025			Needs revie
Commercial Boilers	UES	commercial	HVAC	gas	small saver	active	18-Feb-2021	30-Nov-2025		Small saver	NA

New Measure Scan Results

RTF New Measure Scan Project

- The RTF allocated resources in the 2024 work plan to perform a new electric measure scan to compile a queue of potential new measures to develop in the future.

Process for the New Measure Scan

Identify Complete List of all RTF Measures

- Contractor collected a full list of all active, proposed, under development and deactivated measures at the RTF.

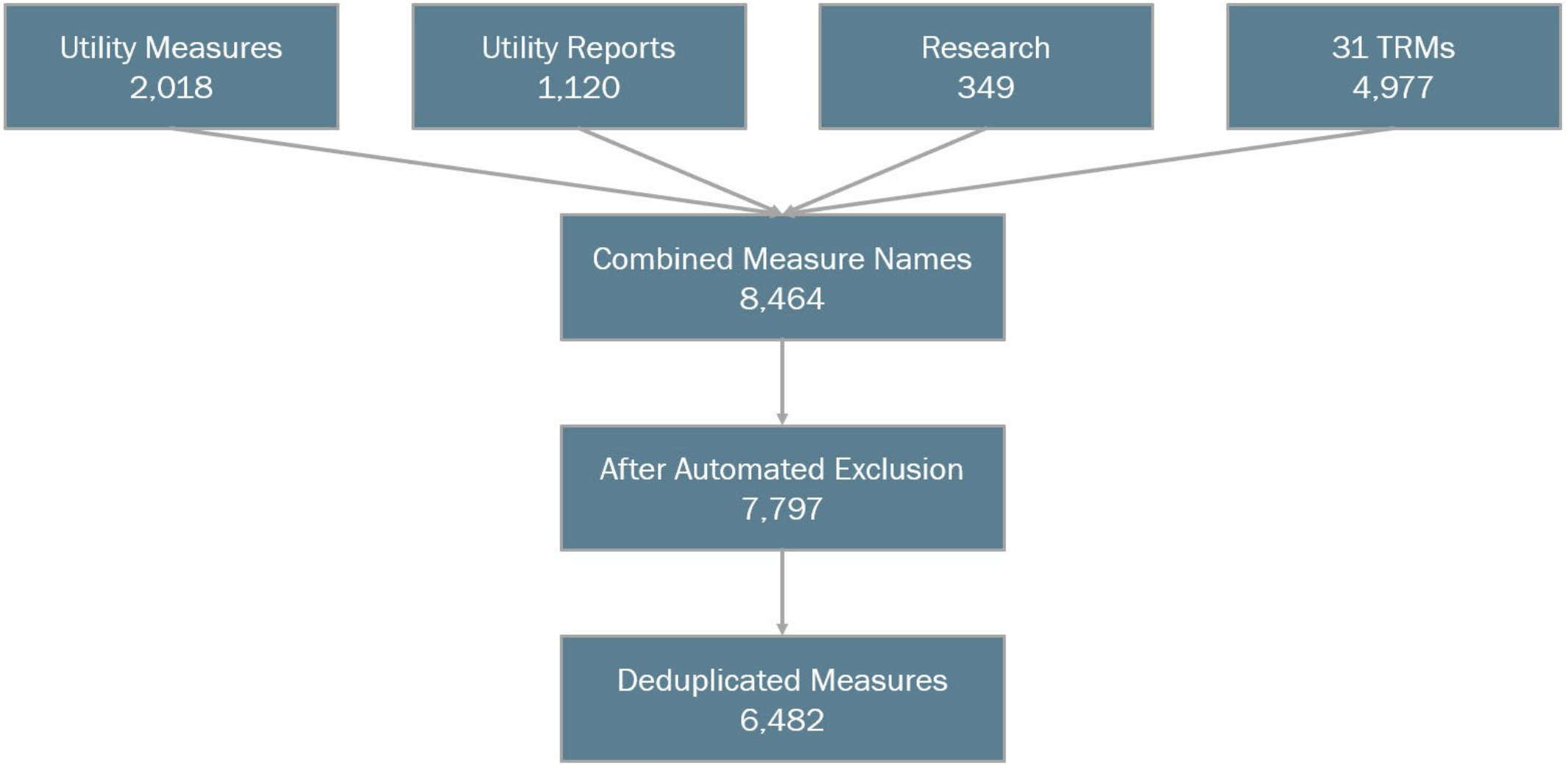
Conducted an expansive literature review

- Reviewed four buckets of sources: 1) PNW utility offerings, 2) PNW utility reports, 3) national technical reference manuals, and 4) relevant recent publications such as utility market potential assessments or integrated resource plans

Aggregated Datasets and Reviewed

- Contractor aggregated and grouped similar measures and excluded measures that are active RTF measures. Categorized and ranked measures to provide a list of potential priority measures.

Preliminary Measure Review Count



Identified 25 Most Relevant Potential Measures for RTF to Consider

Rank	Measure	Local Utility Count	Local Report Count	RTF Status
1	Chiller Optimization	2	4	
2	Demand Control Ventilation non-Kitchen Applications	4	3	
3	Variable Refrigerant Flow	3	1	
4	Heat Pump Variable Refrigerant Flow	1	0	
5	Server Virtualization	1	1	
6	Uninterruptible Power Supply	1	0	
7	Computer Server	1	4	
8	Computer Room Air Conditioner	2	0	
9	Server Room AC	2	0	
10	Server Room Temperature Setback	1	1	
11	Data Center Airflow Management	1	0	
12	Data Center Best Practice Measures	1	1	
13	Ozone Laundry	3	0	

Rank	Measure	Local Utility Count	Local Report Count	RTF Status
14	Whole House Fan	3	1	
15	Scientific Irrigation Scheduling	2	0	Deactivated
16	ENERGYSTAR Computer	2	4	Not Accepted
17	ENERGYSTAR Television	1	5	Not Accepted
18	ENERGYSTAR Monitor	1	3	
19	Automatic High-Speed Doors	1	1	
20	Efficient Transformer	1	1	
21	ENERGYSTAR Game Console	0	1	
22	Electric Cooktop (including induction)	1	0	
23	Dehumidifier	2	1	
24	Refrigeration Optimization	2	3	Not Accepted
25	Energy Audit	4	1	

Next Steps

- RTF staff and contract analysts are:
  - Sorting through the workbook and added details to support continued prioritization
  - Will use this list to bring new measure proposals to the RTF for consideration of allocating resources toward measure development
- Workbook is available on the RTF website on the Supporting Documents page: https://rtf.nwcouncil.org/other/new-electric-measure-scan/
- If you have comments or suggestions on how to make the workbook more useful for the region to use.

Questions or Feedback

Please reach out to Laura Thomas, lthomas@nwcouncil.org, with any feedback on the resources presented today or to join the RTF mailing list for updates about upcoming RTF agendas.

Tell Us What You Think…

- What did you find most helpful in this segment?
- What would you like to learn more about?

Drop your thoughts into the chat with #RTF

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Break

Return at 10:15

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Agenda

8:30 am	Welcome and Announcements
9:00 am	NW Power & Conservation Council Regional Technical Forum Updates
10:00 am	*Break*
10:15 am	ResHVAC HP Research
11:15 am	ACEEE Summer Study Round Table
11:45 am	Wrap-Up

ResHVAC Updates

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Heat Pump ET

- Cold Climate Room Heat Pump research
- Low-Load Efficient Heat Pump Investigations
  - Field data
  - Lab data
  - Physical tear-down workshop
- Tri-Mode Heat Pump Study
- Future Field Data Analysis

Cold Climate Room HP Study

Energy Program
Washington State University

- Research Objectives
  - Collect consistent set of heat pump use data that can be used to calculate energy savings from window heat pumps compared to other heating and cooling systems.
  - Collect consistent set of customer experience data that can be used to develop program recommendations that increase customer value propositions and remove adoption barriers.
  - Help build market interest in window heat pumps through development of case studies and earned media coverage.
- Project Description
  - 30 systems installed in a mixture of single and multifamily homes
  - Power and SA temp collected for 12 months
  - 4 participant interviews
  - 10 participant activities

Cold Climate Room HP Study

- 2024
  - BPA Feasibility studies for Midea and Gradient Systems
  - Site screening and selection
  - Procurement and participant agreements
- 2025
  - Collect Data – Supply air temperature, Power
  - Conduct 4 Interviews – roughly every quarter
  - Participant Activities (clean coil, record Tstat settings, Prioritize Room HP, etc)
- 2026
  - Final Report and Product Council Presentation
  - RTF Measure?
  - Influence Tax Credit Criteria?

Low Load Efficient (LLE) Heat Pumps

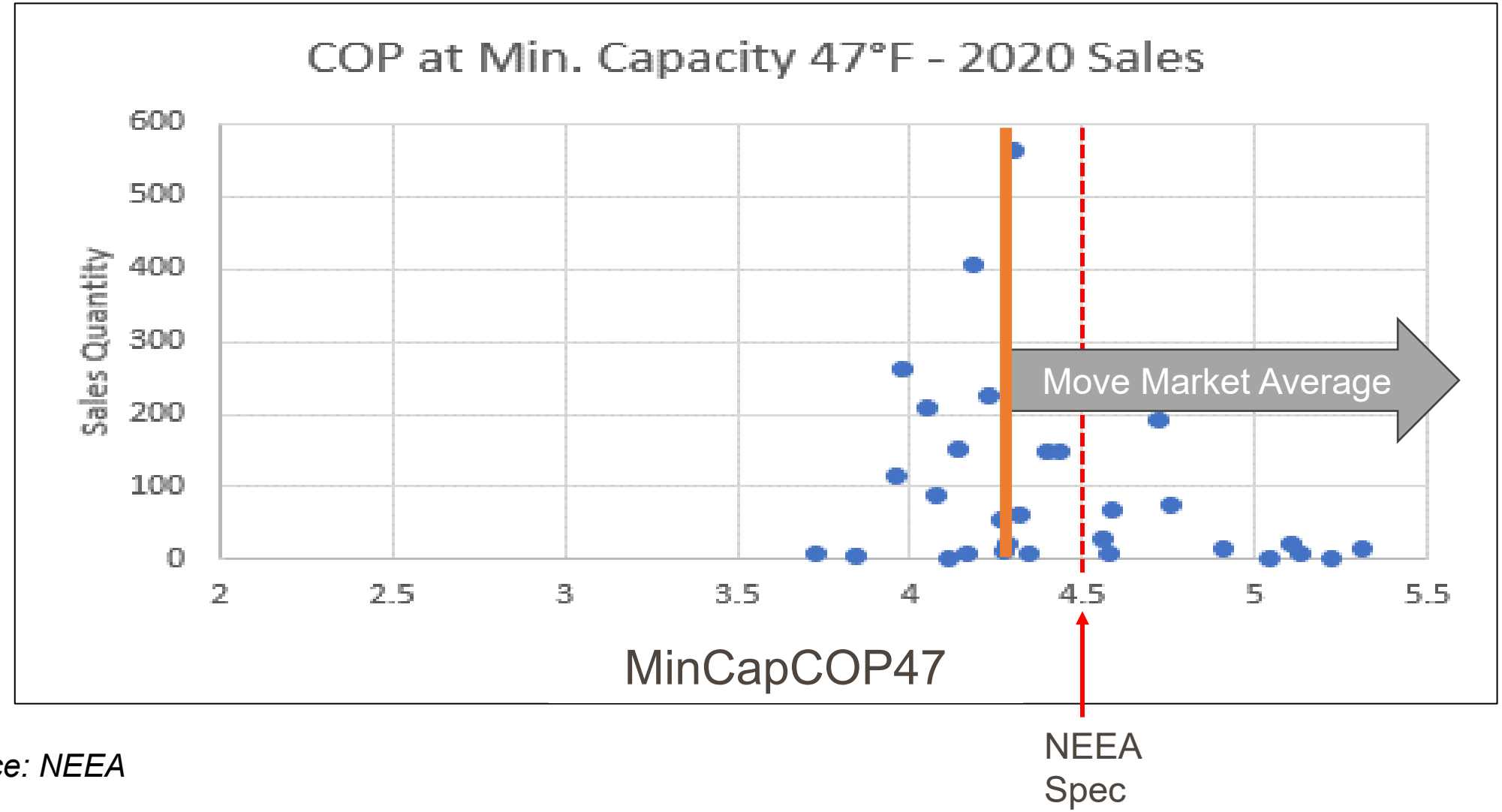
When sized right, a variable speed heat pump spends most of its time running at part load.

Good VSHPs are 40+% more efficient when running at minimum output than at full output.

Heat Pump Metrics – Quick Review

- SEER2 — weighted seasonal cooling efficiency
- HSPF2 — weighted seasonal heating efficiency
- EER2 — peak cooling efficiency at 95F
- COP 5F — peak heating efficiency at 5F
- Capacity Maintenance — 5F capacity ÷ 47F rated capacity
- DFUE — combined efficiency metric of dual fuel
- MinCapCOP47 — minimum capacity efficiency at 47F

Minimum Capacity COP at 47F



Source: NEEA

LLE – Good Confidence

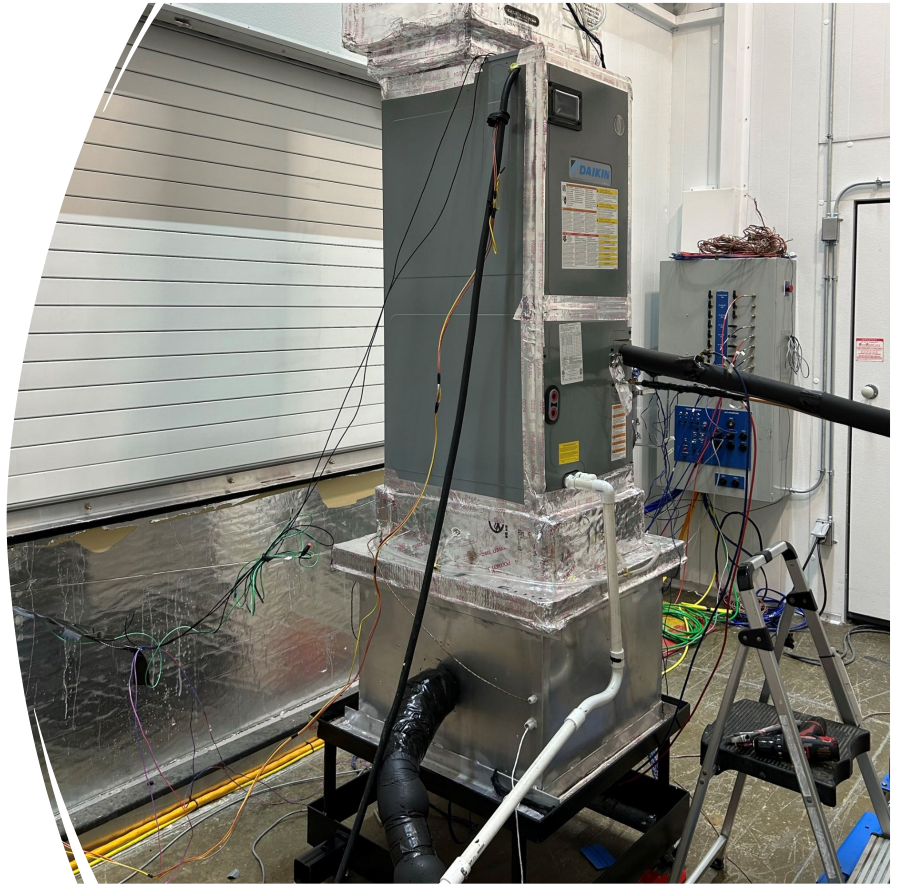
- MinCapCOP47 does not correlate to current HSPF2
- About 1/3 of current VSHPs are have MinCapCOP47 ≥ 4.5
- All climates benefit from LLE
  - Very cold climates have comparable hours at mild temps
- Performance Benefits
  - Reduces oversizing penalty
  - Improves Dual Fuel systems
- Incremental cost of LLE is low, perhaps even negligible
  - No clear physical component responsible for LLE performance

LLE – Concerns and Challenges

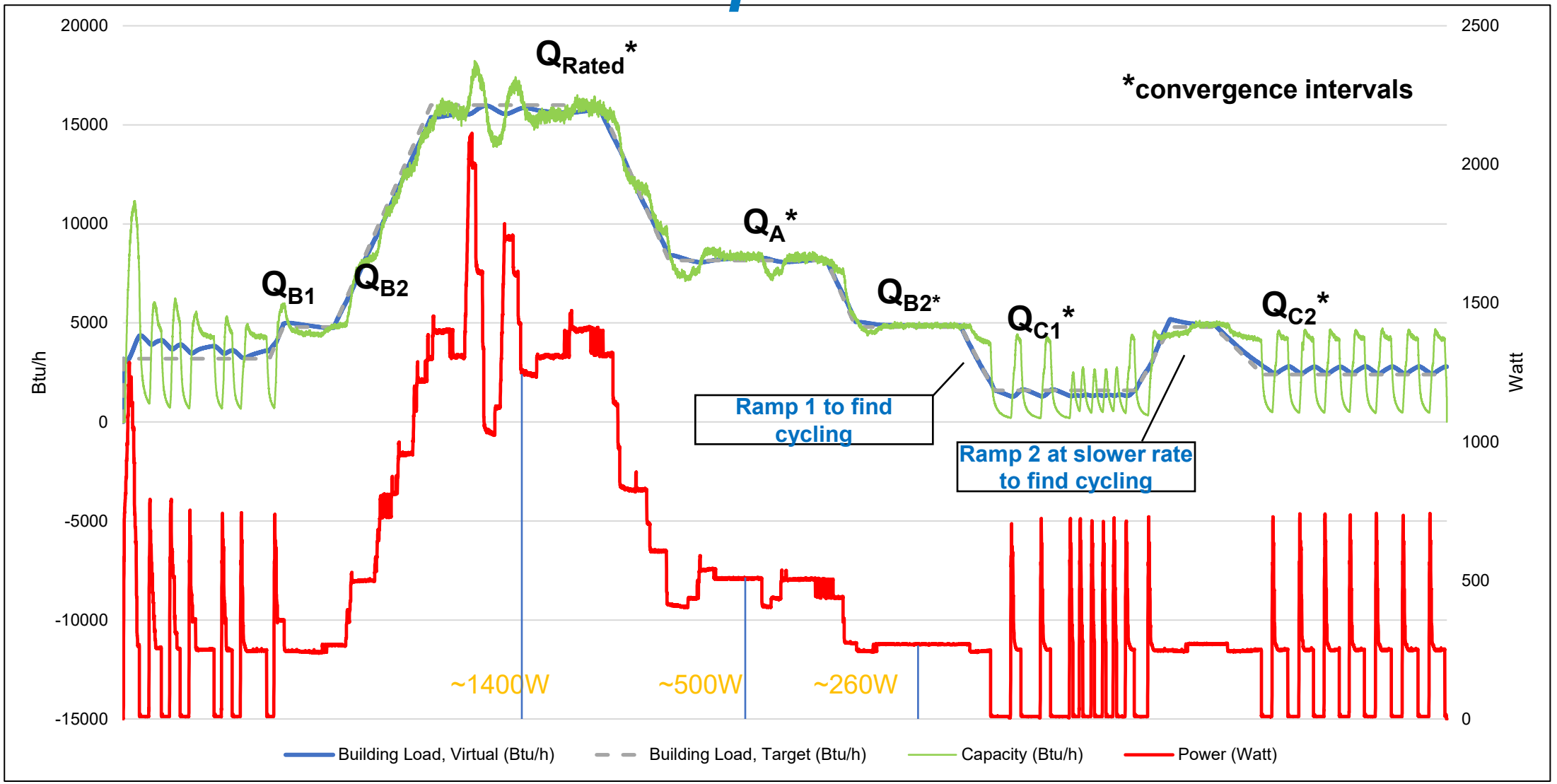
- Consumers are not going to care much if at all about LLE
- Manufacturers do not appear concerned about on LLE heating in their design engineering
- Programs are currently unaware of the value of LLE
- NEEP's MinCapCOP47 data is not AHRI certified and may not consistently represent $H1_{Low}$
- Savings is based on modeling
  - Does MinCapCOP47 reflect how HPs operate in the field?
  - How do we calibrate model based on MinCapCOP47?

LLE Lab Testing

- Load based testing of machines at part load
  - 47F
  - 62F
  - 17F
- 6 Systems
  - 3 ductless
  - 3 ducted

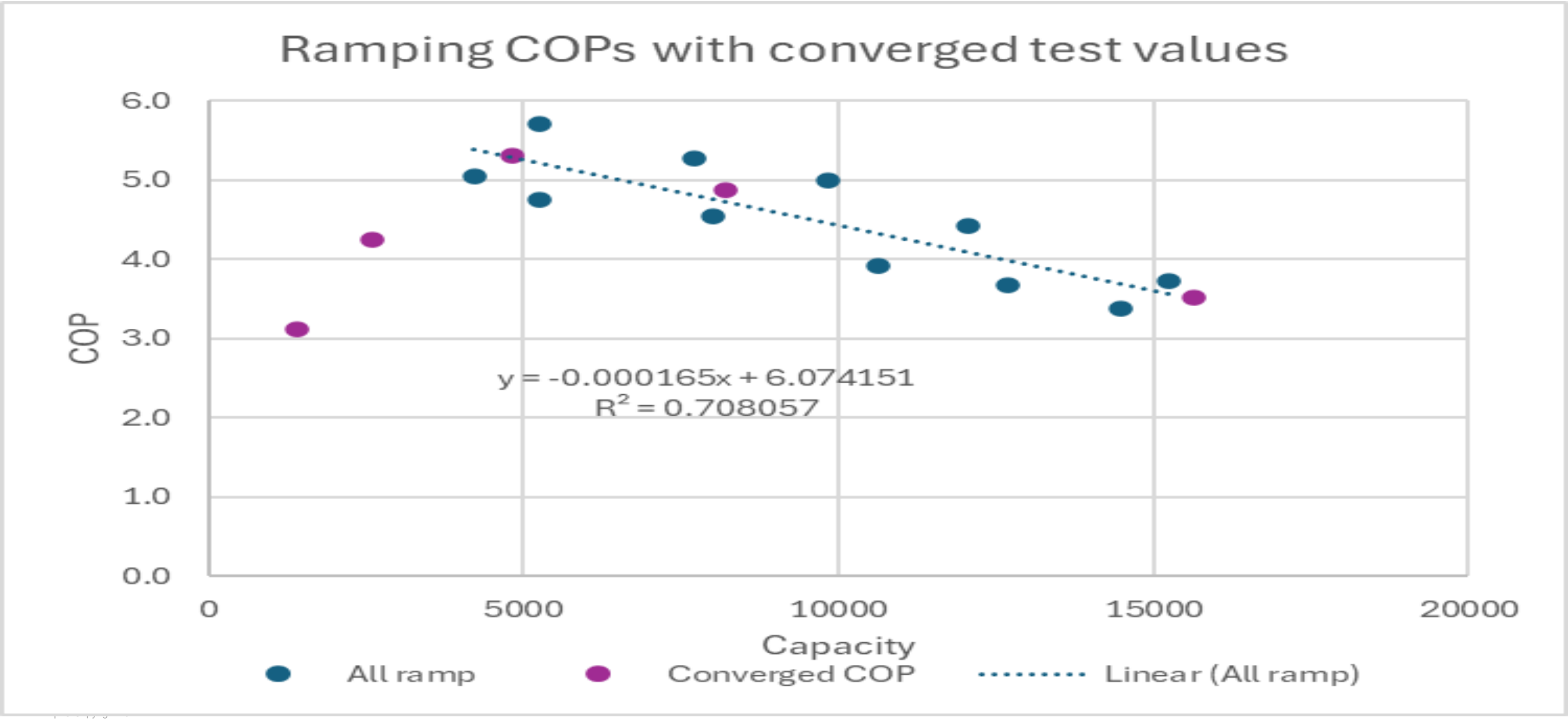


47F Part Load Test Sequence



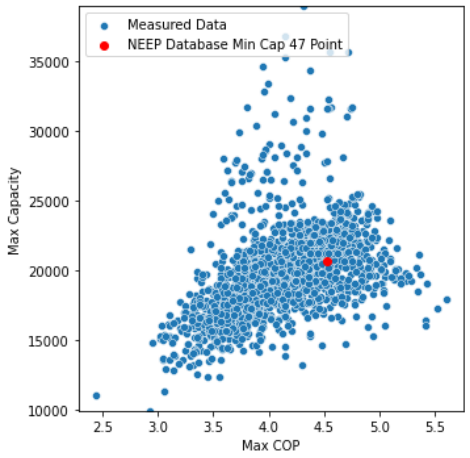
COP@ Rated	COP@ A	COP @ B2
16000/1400/3.412 = 3.4	8500/500/3.412 = 5.0	5000/260/3.412 = 5.6

Analysis is not complete – this is preliminary

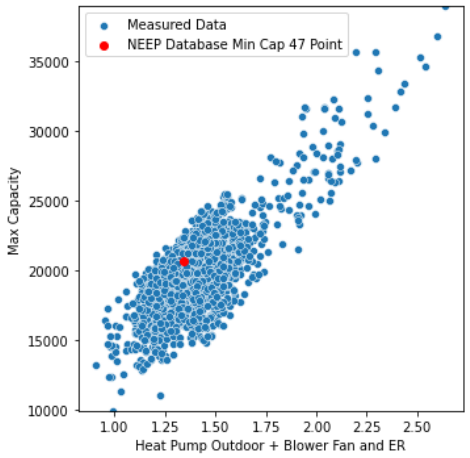


Field Data of Part Load

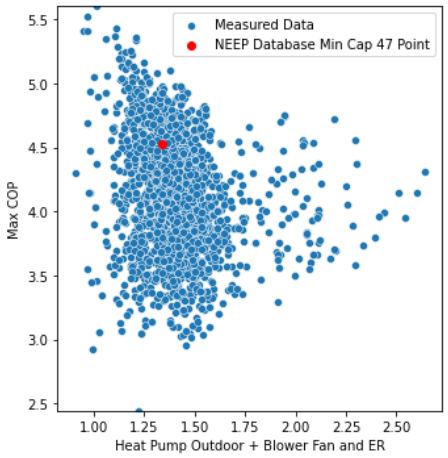
- BPA High Performance, High-Capacity Field Test
  - ~25 ducted “best of the best” systems
  - Detailed performance (COP) monitoring
- Site Data – filtered for ambient between 42F and 52F



MinCapCOP47



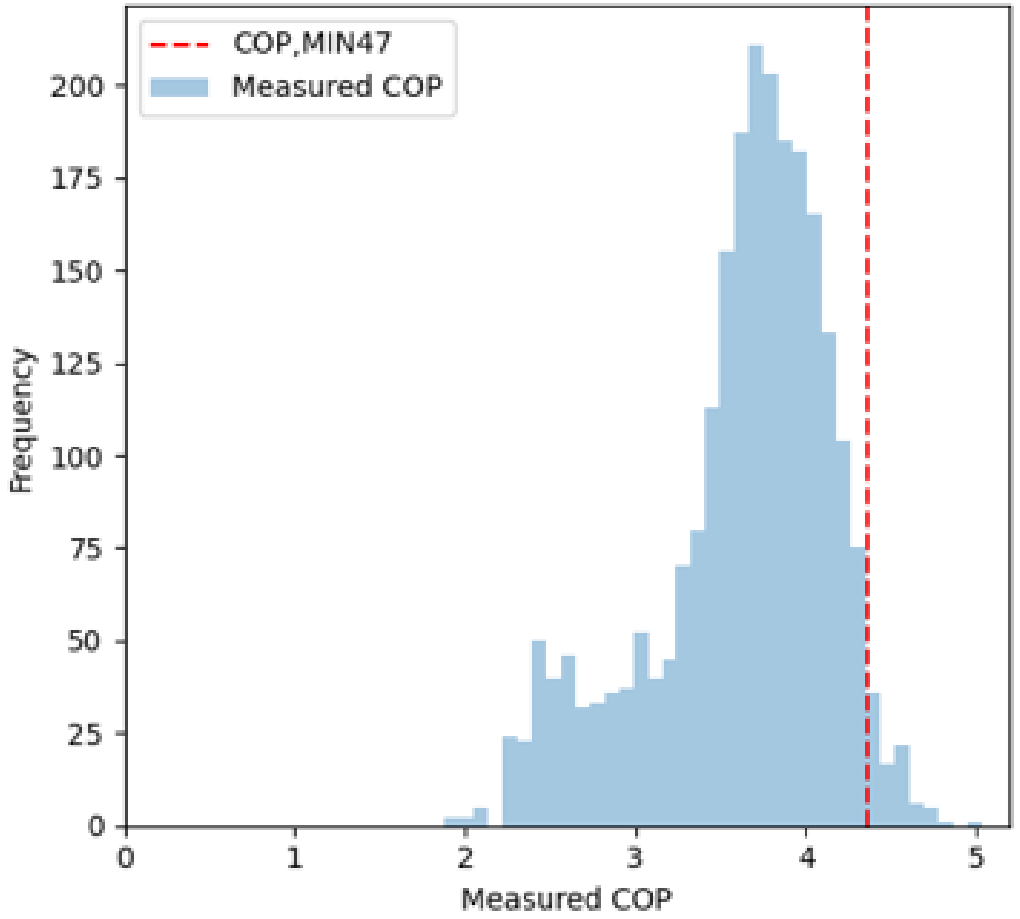
Total Power



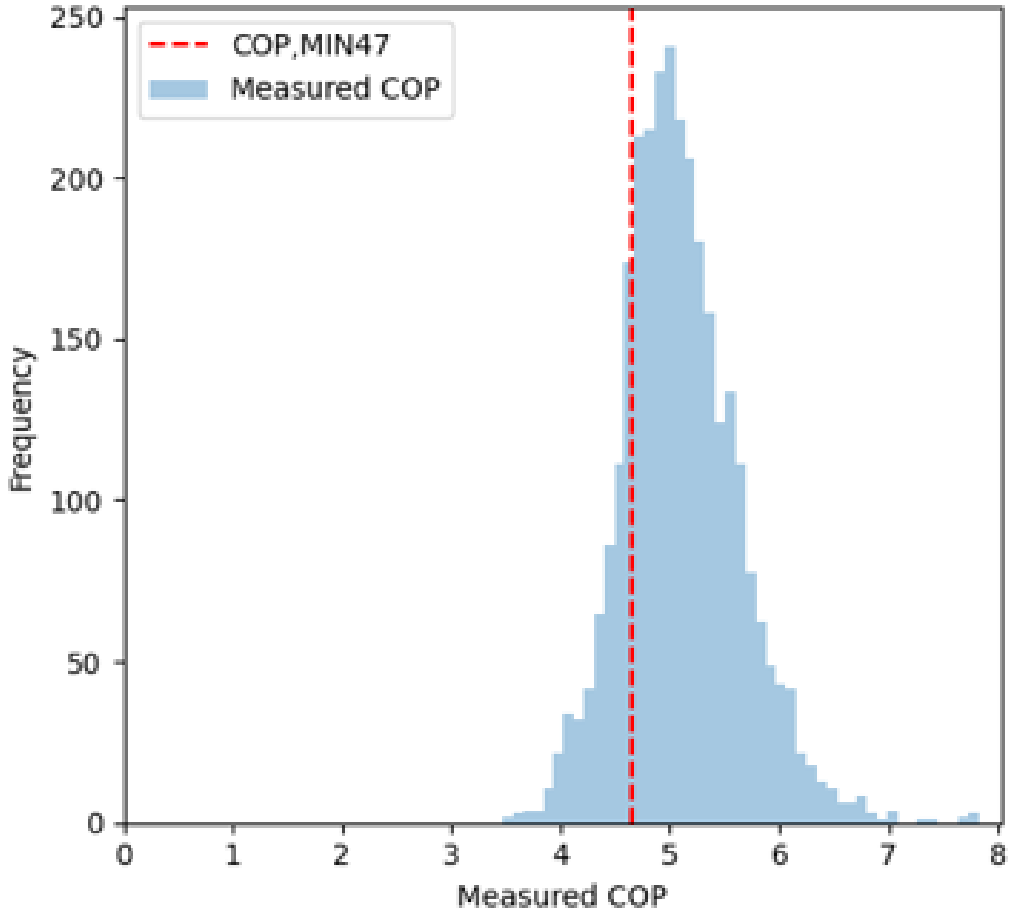
Total Power

LLE – BPA Field Data Analysis

Capable, but not often



Good most of the time



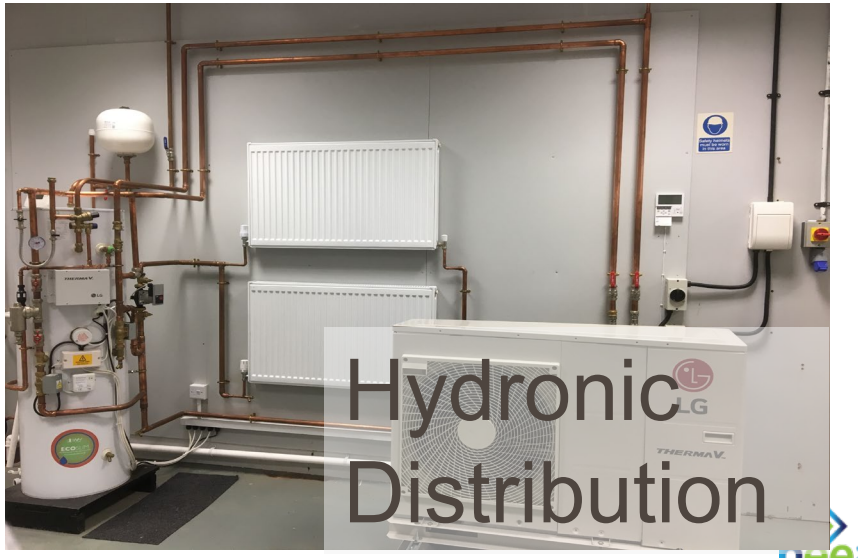
LLE Teardown Workshop

- Contracted Munro Associates to provide a 1-day teardown workshop on 2 low load efficient heat pumps
- Sometime in November – Auburn MI.
- Questions
  - What drives manufacturing cost?
  - What drives performance?

Sandy Munro – electric vehicle teardown comparison

TriMode Heat Pumps – Heat, Cool, and DHW

- What products are coming to the US?
- Is there an MT opportunity?
  - When should we pursue it?
  - What challenges must be overcome?



What is next for LLE Heat Pumps

• Do LLE HPs exist	**YES**
• Does MinCapCOP47 predict LLE	
- Is it a good proxy?	**Yes**, test procedure soon to include CVP
- Is it reported accurately?	Not always --- trying to get AHRI to include in directory
- Is it reflected in field data?	Unclear --- need better field data to understand why
• What is the savings rate from LLE	
- From Modeling?	4-8% improvement if sized right
- From Field data?	Unknown ---- need better field data to calibrate model
• What other factors affect LLE	
- Sizing?	important --- need to incorporate into contractor training
- Duct losses?	moderately --- bad ducts could undermine LLE
- System design?	negligible
- Crossover temperature & lockout?	negligible

2025 HP Research Ideas

- More field data analysis (BPA, TVA, RR, California, etc)
- Contractor interviews and focus groups
- Connected Commissioning
- Dual Fuel Load Flexibility
- Current practice field study --- basecase

Tell Us What You Think…

- What did you find most helpful in this segment?
- What would you like to learn more about?

Drop your thoughts into the chat with #ResHVAC

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ACEEE Summer Study Round Table

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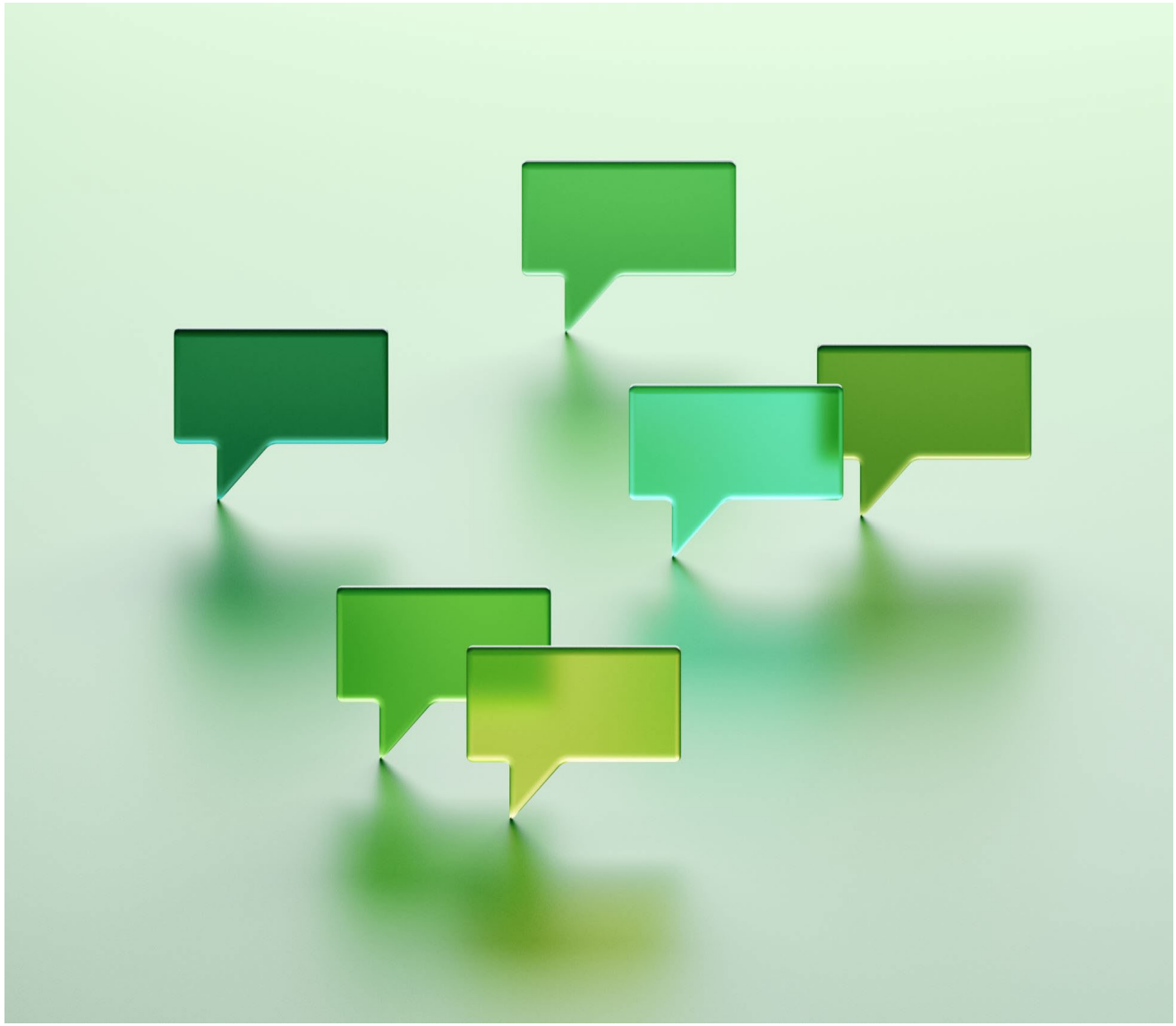
Closing

Open Discussion & Comments



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How would you rate the overall value of today's session?

If the poll didn't work for you, please let us know in the chat box what the problem was: if you used the app or browser, and the error message displayed.

Thank You!