



# Q3 2024 AGENDA

## Regional Emerging Technologies Advisory Committee

**DATE:** September 25, 2024  
**TIME:** 8:30 a.m. – 12:00 p.m.  
**WEBINAR:** MS Teams – See link in calendar invite or register [here](#)  
**AUDIO:** Web audio or telephone 971-323-0535, code 715 683 694#

**MEETING OBJECTIVES:**

- RETAC members receive an update from the Regional Technical Forum on research gaps.
- Participants receive an update on the regional room heat pump study.
- RETAC members receive the preliminary findings on residential heat pump low load efficiency research, and a regional heat pump study to establish an improved base level of performance.
- RETAC participants hear highlights from the 2024 ACEEE Summer Study and are invited to share their impressions with the Committee.

**AGENDA**

Time	Topic	Lead	Packet Page #
8:30 a.m. (30 min)	<b>Welcome &amp; Announcements</b> <ul style="list-style-type: none"> <li>• Introductions and agenda review</li> <li>• Regional conferences and Product Council Updates</li> <li>• Key announcements and highlights from ET newsletter</li> </ul>	Eric Olson, Mark Rehley, NEEA  All	Agenda pp. 1-2
9:00 a.m. (60 min)	<b>NW Power &amp; Conservation Council – Regional Technology Forum Updates</b> <ul style="list-style-type: none"> <li>• 2023 Regional Conservation Progress Survey Results</li> <li>• Research Gaps.</li> </ul> <p><b>Outcome:</b> RETAC members receive an update from the Regional Technical Forum and updated research gaps for key products and technologies.</p>	Laura Thomas, NWPC	Memo p. 3

Time	Topic	Lead	Packet Page #
10:00 (15 min)	<b>Break</b>		
10:15 a.m. (60 min)	<p><b>ResHVAC HP Research</b></p> <ul style="list-style-type: none"> <li>• Cold Climate Room HP Research</li> <li>• Preliminary findings – LLE Investigation</li> <li>• Heat Pump Regional Base Case Study</li> </ul> <p><b>Outcome:</b> RETAC members receive an update on the regional cold climate room heat pump field study. Additionally, preliminary findings on residential heat pump low load efficiency investigation will be presented, as well as an update on a regional heat pump study.</p>	Christopher Dymond, NEEA	Memo p. 4
11:15 a.m. (30 min)	<p><b>ACEEE Summer Study Round Table</b></p> <ul style="list-style-type: none"> <li>• Participants will have the opportunity to share their impressions on the 2024 ACEEE Summer Study and highlight any research they found interesting</li> </ul> <p><b>Outcome:</b> RETAC members hear highlights of the 2024 ACEEE Summer Study.</p>	Eric/Mark	
11:45 p.m. (10 min)	<p><b>Wrap-Up</b></p> <ul style="list-style-type: none"> <li>• Final Q&amp;A, polling questions</li> </ul>	Eric Olson, NEEA	

# Memorandum – *Agenda Item (Tier 1)*



September 18, 2024

TO: Regional Emerging Technology Advisory Committee (RETAC)  
FROM: Eric Olson, Lead Product Manager  
SUBJECT: Northwest Power and Conservation Council Survey Results & Research Gaps

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**Our Ask of You:**

Please come prepared to ask questions about energy efficiency programs’ success, regional pilots’ success, and programs that may need to be adjusted to improve their impact. Also, please provide insights into research gaps that RETAC may be able to assist in addressing in the future.

**Brief Overview/ Context:**

Laura Thomas from the Northwest Power and Conservation Council will present on the 2023 Regional Conservation Progress Survey Results. The Regional Technical Forum (RTF) conducts an annual data collection of the region’s energy efficiency programs to understand the savings from energy efficiency and associated expenditures from the prior year.

Also, Laura will present on RTF Planning Measures and investigating ways to support the region in more easily identifying the RTF strategy and objectives. The RTF Policy Advisory Committee (PAC) has determined that for the 2025-20229 RTF Funding Cycle to expand the scope to include Planning Measure Research.

Please contact [Eric Olson \(eolson@neea.org\)](mailto:eolson@neea.org) if you have questions about the **NW Power and Conservation Council** presentation.

# Memorandum – *Agenda Item (Tier 1)*



September 18, 2024

TO: Regional Emerging Technology Advisory Committee (RETAC)

FROM: Christopher Dymond, Sr. Product Manager

SUBJECT: ResHVAC NEEA Topics

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## **Our Ask of You:**

Please come prepared to ask questions about energy efficiency programs' success, regional pilots' success, and programs that may need to be adjusted to improve their impact. Also, please provide insights into research gaps that RETAC may be able to assist in addressing in the future.

## **Brief Overview/ Context:**

Christopher Dymond will present an update on ResHVAC technology research findings and plans for the following topics:

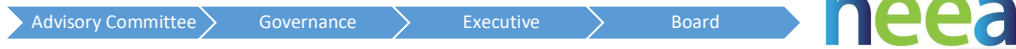
- Cold Climate Room HP research
- Low-Load Efficient Heat Pump Investigations
  - Field data
  - Lab data
  - Physical tear-down workshop
- Field Data Analysis Planned for 2025
- Tri-Mode Heat Pump Study

The work in these areas supports NEEA's Advanced Heat Pump program, which seeks to differentiate heat pump performance improvements and opportunities to influence manufacturers and industry partners.

Please contact [Christopher Dymond \(cdymond@neea.org\)](mailto:cdymond@neea.org) if you have questions about NEEA's residential heat pump work.

**REGIONAL EMERGING TECHNOLOGY ADVISORY COMMITTEE CHARTER**

**Review process:**



<b>HISTORY</b>			
Source	Date	Action/Notes	Next Review Date
RETAC	Q1-Q2 2020	Proposed Draft	Q1 2021
Governance Committee	July 8, 2020	Recommended for Board consideration	Q2 2025
Executive Committee	August 27, 2020	Recommended for Board consideration	Q2 2025
Board Decision	September 15, 2020	Board Approval	Q2 2025

**Commented [JU1]:** Jane, can you please move table as we have with others to end?

**Committee Purpose**

NEEA's ~~The purpose of the~~ 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 Ceommittee tracks higher levels of emerging technology readiness and market adoption in the Northwest.~~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 is will be used to inform NEEA staff's work toward achievement of NEEA's the organization's strategic goals and . This guidance will also be used by Committee members to influence Committee their work towards achievement of Committee members' host their organization's goals to and optimize Northwest regional-collaboration on emerging technologies.~~

**Commented [EO2]:** Suggest expanding this for C7 and our additional metrics. "The purpose of the Regional Emerging Technology Advisory Committee (Committee) 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). The committee tracks higher levels of emerging technology readiness and market adoption in the northwest."

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.

**Commented [MR3R2]:** Good add. Please have the language reviewed by Veronica's team.

**Commented [JU4]:** Moved to Authority Section.

**Committee Authority**

The Committee is authorized to take actions and make recommendations necessary to fulfill the Responsibilities delegated to it pursuant to this Charter by NEEA's Board of Directors ("Board") as provided by NEEA's Bylaws. The Committee is a management-advisory committee, providing support to the work of NEEA's managers and other staff in its promotion of energy efficient emerging technologies. The Committee reports to NEEA's Executive Director, and NEEA's Executive Director is given related authority pursuant to this Charter.

**Commented [JU5]:** Add Section re: Authority for creation per Bylaws

**Commented [EO6R5]:** Assume these edits are universal for committees.

**Commented [JU7]:** Add Section re: Authority for creation per Bylaws and moved reporting to Executive Director here for logical flow. Also clarified related authorities.

**Committee Responsibilities**

The Committee is authorized by the Board under this Charter to carry out the following Responsibilities:

The primary responsibilities of the Committee will be the coordination of:

1. Identifying and tracking emerging technologies,
2. Planning and conducting research, and
3. Developing, implementing and assessing pilots and field demonstrations.
4. Engagement in activities including:

Specifically, the activities include:

- a) Tracking adoption of new measures,
- b) Identifying actions to advance promising technologies and design strategies,
- c) Coordinating with the Regional Portfolio Advisory Committee (“RPAC”) to increase adoption of existing technologies with low market shares,
- d) Scanning for new technologies, and practices, and services.
- e) Sharing knowledge, expertise and resources to support development and maintenance of the region’s emerging technology pipeline.
- f) Providing a forum for information exchange within the region on emerging technology and opportunities for collaboration.
5. 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.

**Commented [E08]:** Is this referring to the RTF?

**Commented [MR9R8]:** This isn't defined. The intent is to try to measure the performance of technologies that have moved into programs. The RTF is a source, NEEA's portfolio is another, the power plan is another.

**Commented [JU10]:** Suggest change from “no surprises” to “transparency and clarity” from prior Shared Commitment language below.

### Committee Membership

NEEA’s The Executive Director has the authority pursuant to this Charter will delegate the option to appoint a Committee member to the Committee as designated by and from to each NEEA direct funder<sup>1</sup>. In addition, NEEA’s the Executive Director may appoint other Committee member(s), such as Northwest Power and Conservation Council staff, public utility commission staff, and state energy office staff.

**Commented [E011]:** @Jim, should this be “designated by each NEEA...”

### Open Committee Meetings and Closed Sessions

All Committee meetings are shall be open to in-person participation by members of the public. With the exception of sensitive information or confidential information not appropriate for public dissemination as determined by the Committee or NEEA’s Executive Director, Committee meeting materials (including but not limited to Committee meeting packets, slide presentations, and summary notes) are will be posted for public access. -A closed, non-public session for part or all of any Committee meeting may be called at any time by any Committee member or NEEA’s Executive Director to discuss sensitive or confidential information not deemed appropriate by the same for public dissemination, including but not limited to such as-competitive or proprietary

**Commented [JU12]:** Discretion proposed here to make this determination to close session by either Committee or NEEA’s Executive Director.

**Commented [E013R12]:** I support these additions.

<sup>1</sup> Pursuant to NEEA’s Bylaws, a “direct funder” refers to electric and gas, public or investor-owned utilities, Bonneville Power Administration, energy efficiency administrators, and the like that have committed to fully fund their share of NEEA’s 5-year Business Plan’s Cycle Core Funding activities, consistent with Board approved NEEA Funding Mechanism Policies, which determine the financial contribution required by each Direct Funder; not including funders paying such funds exclusively through other Direct Funders. See NEEA Bylaws, Art. II, Section (b)-(d).

information that should not be publicly shared. ~~Any member of the Committee can request a closed session.~~

**Committee Meeting Schedule**

~~The Committee meets on a quarterly basis and conducts additional meetings and/or webinars as needed in its determination, or as requested by NEEA’s Executive Director, or Board.~~

**Commented [JU14]:** Propose additional ability to call.

**Commented [JU15]:** Propose additional ability to call.

~~This Committee will meet on a quarterly basis and conduct additional meetings and/or webinars as needed.~~

**Shared Commitment**

~~Committee members and NEEA Staff share a commitment to communicate and coordinate with the intent of operating with no surprises.~~

**Commented [JU16]:** Moved into new #5 Responsibilities for logical flow.

**Review Schedule**

~~The NEEA’s Board will reviews this Charter during the first year of NEEA’s then current the funding cycle, or at other times as needed as determined by the Board.~~

**Reference Chart**

<b>NEEA Governance/ Management/ Advisory Roles and Responsibilities</b>	
NEEA Board	<ul style="list-style-type: none"> <li>• All corporate governance and fiduciary duties, including ensuring the system of rules, practices and processes by which NEEA is directed to balance the interests of the alliance’s stakeholders, to support the achievement of the organization’s purpose</li> <li>• Strategic and Business Plan development and approval</li> <li>• Operations Plan and budget approval</li> </ul>
NEEA Executive Director	<ul style="list-style-type: none"> <li>• Manage the business of NEEA according to Strategic, Business and Operations Plans, set forth by Board</li> <li>• Oversee business operations and staff</li> </ul>
Regional Portfolio Advisory Committee (“RPAC”)	<ul style="list-style-type: none"> <li>• Advise NEEA’s Executive Director on portfolio performance and program advancement; “challenge flag” process; RPAC+ downstream marketing elections</li> <li>• Monitor developments from other advisory committees with regard to regional coordination, market progress, and emerging technology</li> </ul>
Coordinating Committees (“CCs”)	<ul style="list-style-type: none"> <li>• Collaborate with NEEA Staff and report to RPAC on coordination and optimization of NEEA programs and related activities, to identify and manage through potential implementation challenges between NEEA and local utility activities, and seize opportunities for amplified market influence</li> </ul>
Cost-Effectiveness and Evaluation Advisory Committee (“CEAC”)	<ul style="list-style-type: none"> <li>• Advise NEEA’s Executive Director on methods, data sources and inputs for use in NEEA’s cost-benefit analysis and energy savings reporting</li> <li>• Advise NEEA’s Executive Director on market research and evaluation methodologies</li> </ul>
Regional Emerging Technology Advisory Committee (“RETAC”)	<ul style="list-style-type: none"> <li>• Advise NEEA’s Executive Director on NEEA’s work toward achieving its strategic pipeline goals</li> <li>• Track and coordinate the progression of energy efficiency technologies to improve technology readiness and market adoption in the Northwest</li> </ul>

Natural Gas Advisory Committee (“NGAC”)	<ul style="list-style-type: none"><li>• Advise NEEA’s Executive Director on gas portfolio performance and program advancement; “challenge flag” process; RPAC+ downstream marketing elections</li><li>• Monitor developments from other advisory committees with regard to market progress and emerging technology</li></ul>
Work Groups	<ul style="list-style-type: none"><li>• Formed by RPAC on an as-needed basis and staffed with as-needed expertise, for a limited term and specific purpose that is distinct from that of RPAC, the CCs, and other Advisory Committees or Work Groups</li></ul>



# 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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### Questions about this report may be addressed to:

Eric Olson  
Lead Product Manager, Emerging Technology & Product  
Management [eolson@neea.org](mailto:eolson@neea.org)

# Product Summary & Readiness Levels

	PRODUCT OR PROJECT	PROGRAM*	FUEL TYPE	SECTOR	ELECTRIC SAVINGS POTENTIAL <sup>1</sup>	GAS SAVINGS POTENTIAL <sup>2</sup>	PRODUCT PERFORMANCE <sup>3</sup>	MARKET/COMMERCIAL <sup>3</sup>	PROGRAM READINESS <sup>3</sup>
<b>Consumer Products</b>	Ultra-High Definition TVs	RPP			57	N/A	4	5	5
	Residential Laundry Field Study	RPP			N/A	N/A	5	5	5
	Monitors and Commercial Displays	TBD			TBD	N/A	3	5	1
	Laundry Centers & All-in-One Washer-Dryers	RPP			TBD	TBD	4	5	5
	Commercial Heat Pump Dryers	TBD			TBD	TBD	1	3	1
<b>HVAC</b>	Very High Efficiency Dedicated Outside Air Systems	VHE DOAS			85	20+	4	3	2
	Efficient Rooftop Units	ERTU			N/A	9	4	3	4
	Heat Pump Rating Representativeness	AHP			TBD	N/A	3	5	4
	Heat Pump Advanced Features and Capabilities	AHP			35+	N/A	3	5	4
	Room Heat Pumps	TBD			TBD	N/A	2	3	1
	Dual Fuel Gas-Electric Heat Pump	DFHP			TBD	TBD	3	5	1
<b>Building Envelope</b>	High-Performance Windows	HPW			60	30	4	3	4
	Secondary Windows	Window Attachments			35	23+	4	5	4
	Skinny Wall Retrofit Panels	TBD			TBD	TBD	2	1	1
	Advanced Prefabricated Zero Carbon Homes	TBD			TBD	TBD	2	2	1
<b>Lighting</b>	Luminaire Level Lighting Controls	LLLC			75	N/A	4	4	3
	LLLC with HVAC Control	LLLC			358	TBD	3	2	3
	Parking Lot Lighting with LLLC	TBD			TBD	N/A	3	3	1
<b>Water Heating</b>	Combination Hot Water and Space Heat	N/A			130	N/A	1-4	1-3	2
	Heat Pump Water Heaters	HPWH			TBD	N/A	2-5	3-4	2-5
	Integrated Residential GHPWH	GHPWH			N/A	200	3	1	2
	Central Commercial Heat Pump Water Heater	HPWH			50	N/A	3	3	3
	Advanced Commercial Gas Water Heating	TBD			N/A	64	3	3	2
	Split System Heat Pump Water Heater	HPWH			50	N/A	3	3	3
	Industrial Heat Pumps	N/A			TBD	TBD	2	2	1
<b>Motors</b>	Commercial & Industrial Fans	Fans			176	N/A	5	4	2
	Power Drive System Technology Assessment	N/A			292	N/A	5	4	1
	Extended Motor Products (Pumps)	XMP			246	N/A	5	5	5
	Heat Pump Engine Block Heaters	N/A			TBD	TBD	1	3	1

**\*Program Acronyms Defined:** Retail Product Portfolio (RPP); Ductless Heat Pumps (DHP); Advanced Heat Pumps, formerly Variable Speed Heat Pumps (AHP); Very High Efficiency Dedicated Outdoor Air Systems (VHE DOAS); Luminaire Level Lighting Controls (LLLC); Heat Pump Water Heater (HPWH); Efficient Gas Water Heaters (EGHW); Extended Motor Products (XMP); High-Performance Windows (HPW); Gas Heat Pump Water Heaters (GHPWH); Dual Fuel HVAC (DFHP)

1: Technical achievable **electric savings potential** in the region aMW  
 2: Technical achievable **gas savings potential** in the region in MM Therms  
 3: **Readiness Level Definitions** provided on page 27; **Rating Scale** 1=low 5=high  
 †: Preliminary estimate or technical potential from the RTF

**Fuel Type Symbols:** Electric Gas **Sector Symbols:** Residential Commercial Industrial



### *Ultra-High Definition (UHD) TVs*

**Project Status:** The ENERGY STAR® Qualified Products List (QPL) continues to grow, with 116 TVs representing at least two major brands. Energy use data from multiple manufacturers’ TV testing has been received and is informing negotiations on appropriate on-mode energy levels through the industry Voluntary Agreement.

**Product Description:** 4K UHD TVs with various forms of advanced display technologies.

**Project Objectives:**

- Update U.S. DOE TV test procedure and International Electrotechnical Commission (IEC) test clip to:
  - 1) adequately address existing features such as Automatic Brightness Control (ABC) and Motion Detection Dimming (MDD) to prevent gaming of test results by manufacturers; and
  - 2) incorporate emerging technologies such as UHD, true and upscaled high dynamic range (HDR), increasing panel brightness and stand-by power.
- Update ENERGY STAR specification to address issues with ABC/MDD, address new energy-consuming features such as UHD, and to account for the U.S. DOE test procedure and IEC test clip updates.
- Use data from TV manufacturers’ TV testing to review current television energy use, which will help to define efficiency standards for potential incentives in 2025.

**Product Manager:** Wendy Preiser  
 wpreiser@neea.org  
 503.688.5494

Product	4	Comm/Market	5	Program	5
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### Residential Laundry Field Study

**Project Status:** The field monitoring phase of the study is complete and data analysis is in final stages. Preliminary results have been used to inform comments on the ENERGY STAR Dryer Discussion Guide and Federal Trade Commission (FTC) Notice of Proposed Rulemaking (NOPR) on mandatory Energy Label changes. Due to the prioritization of responding to ENERGY STAR, the first results report is expected in Q4 2024.

**Product Description:** Residential appliances for washing and drying clothes.

**Project Objectives:** Conduct research to leverage NEEA's Residential Building Stock Assessment (RBSA) households by selecting a statistically representative sample of households and studying their laundry use patterns and equipment energy use. This study collects data on water usage, load sizes, textile mix, washer and dryer cycles selected, how efficiently washers remove water from the load, and how efficiently dryers dry clothes. These insights will allow updates to energy savings opportunities, inform current ENERGY STAR specification development, inform future U.S. DOE rulemakings, and facilitate collaboration with other partners to replicate the study in their territories.

**Product Manager:** Eric Olson  
eolson@neea.org  
503.688.5435

Product	5	Comm/Market	5	Program	5
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### Monitor and Commercial Display Testing

**Project Status:** The test procedure modification for monitors and commercial displays are complete. Testing is beginning on commercial displays to assess level setting. The potential for energy savings exploration continues.

**Product Description:** High-definition and UHD monitors and commercial displays with various advanced display technologies.

**Project Objectives:** The current monitor and display policy approach has several gaps. Most displays and monitors are similar in design and construction to TVs. For TVs, the U.S. DOE has adopted ANSI/CTA-2037D, developed by NEEA, which better represents true energy use than the current industry standard. This project has three objectives:

- Replace the current industry standard with the NEEA-developed test procedure adapted to monitors and displays;
- Achieve adoption by ENERGY STAR of the NEEA-developed test procedure and methodology for monitors and displays, with buy-in by industry stakeholders including major manufacturers and energy-efficiency advocates; and
- Succeed in having the new test procedure inform an update to the U.S. DOE federal energy test standard.

**Product Manager:** Wendy Preiser  
wpreiser@neea.org  
503.688.5494

Product	3	Comm/Market	5	Program	1
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### Laundry Centers and Washer-Dryer Combo Testing

**Project Status:** Three brands are currently in the market with all-in-one combination laundry units featuring heat pump dryer technology. Consumer adoption of all-in-one units continues to be strong in the first half of 2024, indicating customers’ acceptance of a single piece of equipment that runs a complete wash-and-dry cycle of a load of laundry. Formal outreach to manufacturers for input on a test procedure begins in Q3 2024. The process is expected to continue into 2025.

**Product Description:** Laundry centers are residential clothes washers and electric or gas clothes dryers that clean and dry clothes in separate, stacked drums. A combination all-in-one washer-dryer is a residential clothes washer and electric or gas clothes dryer that cleans and dries the clothes in a single tumble-type drum.

**Project Objectives:** Laundry centers and combination all-in-one washer-dryers with heat pump dryers are now available in the market. This research aims to:

- Test equipment to understand actual performance and energy consumption compared to U.S. DOE and ENERGY STAR estimates;
- Develop possible U.S. DOE test procedure updates for laundry centers and combination washer-dryers and potential implications for standard washer and dryer tests;
- Craft laundry center and single-drum washer-dryer ENERGY STAR program recommendations; and
- Identify relevant regional program opportunities for laundry centers and single-drum washer-dryers.

**Product Manager:** Wendy Preiser  
 wpreiser@neea.org  
 503.688.5494

Product	4	Comm/Market	5	Program	5
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### Commercial Heat Pump Dryers

**Project Status:** Testing is complete. The final analysis is in progress and is expected in Q4 2024.

**Product Description:** Commercial clothes dryers using electric heat pump technology in place of, or in addition to, electric resistance elements to dry textiles. Commercial heat pump dryers may be utilized in vended applications or as on-premises laundry.

**Project Objectives:** Commercial heat pump dryers are now available in the market. This research seeks to:

- Quantify the energy use of heat pump dryers compared to similar capacity (50 lb. ± 10 lbs.) electric resistance and gas commercial dryers;
- Develop a regional model of energy use and savings estimates looking at three locations in NEEA's territory and comparing them to a U.S. national average calculation;
- Understand the cycle time differences between conventional and commercial heat pump dryers by testing a variety of textiles, including Association of Home Appliance Manufacturers (AHAM) 100% cotton textiles, hotel linens and hotel towels;
- Quantify potential impacts in capital costs, operational and labor costs in using heat pump dryers versus conventional commercial dryers; and
- Utilize learning to inform future ENERGY STAR and U.S. DOE test procedure developments or rulemakings.

**Product Manager:** Wendy Preiser  
wpreiser@neea.org  
503.688.5494

Product	1	Comm/Market	3	Program	1
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### Efficient Rooftop Units (RTUs)

**Project Status:** Monitoring the units installed in Portland, OR is ongoing, and the final report is expected by the close of Q3 2024.

**Product Description:** Packaged, weatherized, commercial natural gas indirect air heating systems that may or may not include ventilation, air conditioning or both. Efficient rooftop units (RTUs) are mounted externally to a building and capture heat from the products of combustion (flue gases) to achieve a minimum thermal efficiency or annual fuel utilization efficiency (AFUE) of 90%. Also includes non-condensing products that use modulating gas valves.

**Project Objectives:** Evaluate the performance of efficient RTU products through field trials in multiple climates. The first test site in Winifred, MT, evaluated an AAON unit over a nine-month period that concluded in June 2022. The Montana State University (MSU) Integrated Design Lab managed this project.

The second site, in Portland, OR, is testing units from two manufacturers—a high-efficiency Daikin unit and a standard-efficiency Trane model. The units will be tested over nine months. Results will inform plans to promote and accelerate the adoption of efficient RTU products.

**Product Manager:** Chris Wolgamott  
cwolgamott@neea.org  
503.688.5484

Product	4	Comm/Market	3	Program	4
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### *Heat Pump Rating Representativeness*

**Project Status:** Field testing of the six heat pumps concluded in February 2023; lab testing with both [AHRI 210/240 M1](#) and [CSA SPE07:2023](#) test procedures was completed in late December 2023. The University of Nebraska is under contract for data analysis and coordinating with the prime contractor (DNV) on a final report. Preliminary test results are available from the [August 15, 2023 Product Council](#). The results of this project were presented during the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Unitary Small Equipment Test Procedure Committee meetings and helped redefine future federal test procedures.

**Product Description:** Variable Speed heat pumps and air conditioners.

**Project Description:** NEEA is working collaboratively with Northeast Energy Efficiency Partnerships (NEEP); Air-Conditioning, Heating, and Refrigeration Institute (AHRI); BC Hydro; NRCan; New York State Energy Research and Development Authority (NYSERDA); Southern California Edison; Xcel Energy; and U.S. DOE to determine the representativeness of different heat pump test procedures. The study will observe heat pump performance in a controlled field installation and compare those observations with corresponding laboratory test results. NEEA will investigate the heat pump test procedures prevalent in North America (CSA SPE07 and U.S. DOE Appendix M1) and identify which method more accurately represents energy use. Additionally, key conditions and sequences (e.g., defrost, variation of compressor speed at part load) affecting instantaneous power demand and overall energy use will be investigated.

**Project Objectives:**

- Identify how well U.S. DOE Appendix M1 represents field performance.
- Identify how well CSA SPE07 represents field performance.
- Identify essential pieces of information that must be captured by any heat pump test procedure to accurately represent heat pump performance (e.g., any controls sequences that are particularly impactful to performance).
- Determine critical performance indicators that could effectively be used to differentiate efficient equipment in a Qualified Products List (QPL) in advance of wide availability of modified test procedures.

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Product	3	Comm/Market	5	Program	4
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### Room Heat Pump Field Study

**Project Status:** This project is complete. On July 24, 2024, the Environmental Protection Agency (EPA) and U.S. DOE released the [final version](#) of the ENERGY STAR room heat pump test procedure as part of the room air conditioner specification.

**Product Description:** A small heat pump designed to condition a single room. The heat pump may be installed in a window, like a window air conditioner, or portable so it can easily be moved from room to room. It is plugged into a standard 15A 120V AC outlet.

**Project Objectives:** Conduct consumer research and field test micro heat pumps. This project consists of a small sample (16 total units) placed in a selected sample of homes. The principal research goal is to understand the customer experience and develop an assessment of the product’s market readiness. The secondary goal is to gather information to guide estimates of energy savings potential and to determine the units’ effectiveness at displacing energy used by the pre-existing heating system.

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Product	2	Comm/Market	3	Program	1
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### *Low Load Efficient Heat Pump Investigation (Advanced Features & Capabilities)*

**Project Status:** Testing is underway for Phase 3 (lab testing to understand and validate how heat pumps work under part load conditions), and Phase 4 (physical teardown workshop) is planned for September 2024. Phases 1 and 2 are complete; findings were presented at the [April 2, 2024, Product Council](#).

**Product Description:** Variable speed heat pumps that are highly efficient when running under low loads.

**Project Objectives:** The core objectives are to determine the incremental cost and reasons why some variable speed heat pumps exhibit significantly better part load (low load conditions) operating performance.

- Phase 1 of the project will review existing publicly available data.
- Phase 2 will conduct a virtual teardown of equipment to compare a dozen different heat pumps based on technical service manuals.
- Phase 3 will consist of lab testing several variable speed heat pumps to validate and understand how heat pumps operate under part load conditions.
- Phase 4 will perform a physical teardown of subcomponents to provide insight on component differences, the manufacturing costs, and components that enable low load efficiency.

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Product	3	Comm/Market	5	Program	4
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### *Air-Conditioning, Heating, and Refrigeration Institute (AHRI) 1380 HVAC Connectivity Standard*

**Project Status:** This project is currently in its planning phase.

**Product Description:** Hardware and software to make HVAC grid flexible and controllable.

**Project Objective:** Support efforts to harmonize connectivity standards among several standards, including heat pumps, ENERGY STAR, OpenADR and others.

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**Product Readiness Levels:**

Product	3	Comm/Market	3	Program	1
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### *Dual Fuel Heat Pumps*

**Project Status:** AHRI released a revised version of [AHRI 210/240](#), “Performance Rating of Unitary Air-conditioning and Air-Source Heat Pump Equipment,” that includes several significant changes, including a new metric for dual-fuel systems, a new metric to help delineate heat pumps with good low-temperature performance and a controls verification procedure.

NEEA continues to work on modeling multiple dual-fuel configurations for three types of homes with multiple Northwest climate zones and demand response impacts. GTI Energy will lab test traditional dual-fuel units in the second half of 2024 and test a simultaneous dual-fuel system from iFLOW. The market landscape of dual-fuel units and controllers is complete, and NEEA continues to work with manufacturers to understand their respective differentiated value propositions and explore new equipment configurations.

**Product Description:** A forced air gas furnace or hydronic furnace combined with an electric air source heat pump (ASHP) with integrated controls.

**Project Objective:** Understand energy and cost savings from ASHPs as a centrally ducted air-conditioning replacement across various representative applications in the Northwest.

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Product	3	Comm/Market	5	Program	1
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### *Dual Fuel Heat Pump Field Study*

**Project Status:** The project is underway. Site identification is underway to recruit 10 demonstration participant sites to install the systems by the end of 2024. The system includes a variable speed cold climate air source heat pump, a natural gas condensing tankless water heater, a hydronic furnace, heat pump evaporator coils and a smart controller.

**Product Description:** A forced air gas furnace or hydronic furnace combined with an electric air source heat pump (ASHP) with integrated controls.

**Project Objectives:** Understand the efficiency and ability of residential dual-fuel systems to provide value through energy savings and grid flexibility by pairing highly efficient gas water and space heating with an electric heat pump and using a smart controller to increase fuel flexibility and dynamically control the system.

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**Product Readiness Levels:**

Product	3	Comm/Market	5	Program	1
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### *Cold Climate Room Heat Pump Field Testing*

**Project Status:** This project is underway. Washington State University is refining the scope of work and developing an implementation plan. NEEA is coordinating with multiple utilities in the territory to identify suitable test sites.

**Product Description:** A small heat pump designed to condition a single room and is plugged into a standard 15A 120V AC outlet. The heat pump may be installed in a window, like a window air conditioner, or portable so it can easily be moved from room to room. Cold climate-capable room heat pumps can actively defrost and provide 100% capacity down to 17°F.

**Project Objectives:**

- Conduct lab testing to characterize full range of equipment operation.
- Conduct field testing to gather real-world operational data (runtime, consumer acceptance, etc.).

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Product	2	Comm/Market	3	Program	1
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### ***Primary High-Performance Windows***

**Project Status:** Collaborative efforts continue through the U.S. DOE-funded Partnership for Advanced Window Solutions (PAWS). NEEA is influencing national window markets to benefit the alliance’s Northwest stakeholders.

The high-performance window installation in 12 Grand Ronde, OR, residential duplexes is complete. The Confederated Tribes of Grand Ronde selected high-performance windows as part of their net-zero design for this project. Insights gained from the installation include comparable weight and installation to conventional double-glazed windows, improved energy performance by 40%, minimization of air leakage, and enhanced thermal, visual and acoustic comfort, among others. A complete overview of the project is available at [betterbuiltnw.com](http://betterbuiltnw.com).

NEEA's collaboration with a national builder started in Q4 2022 and has extended into 2024. High-performance windows are a path to code credits for this builder. Windows have been installed in approximately three dozen homes; interviews with the builder and window installers indicate no incremental labor is required, and installation has proven no different than for double pane windows.

**Product Description:** Primary window using three panes of glass (or film or rigid plastic), two of standard thickness and a center thin pane of glass (or film). The overall thickness and weight are similar to standard double pane windows.

**Project Objectives:**

- Identify manufacturing technical needs for production of thin triple pane windows.
- Provide technical assistance on production processes (adapting double glazed equipment or new lines).
- Research motivating factors for increasing production of thin triple pane windows.
- Identify barriers in the supply chain.
- Investigate enhancements in thin triple pane window technology.

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Product	4	Comm/Market	3	Program	4
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### ***Secondary Windows Field Study***

**Project Status:** GTI Energy continues to conduct a technology assessment and market characterization. GTI Energy submitted the Final Test Plan to the California Energy Commission in Q2 2024, and Lawrence Berkeley National Laboratory (LBNL) is preparing for testing in its Quantitative Infrared Thermography Chamber for multiple manufacturers of different types of secondary windows, including vacuum insulated glass construction, silica aerogel, and single pane options.

**Product Description:** Retrofit products comprised of one or more panes of material such as glass, polymer or acrylic, with or without Low-E coatings, which are mounted in a frame attached either to the interior or exterior of existing windows without replacing the primary glass or frame.

**Project Objectives:** Primarily funded by the California Energy Commission (CEC), this multi-year, co-funded project, led by GTI Energy, seeks to:

- Advance high-performance window technologies by addressing the retrofit technical and cost challenges such as replacement cost, existing window size and weight incompatibilities, and durability;
- Demonstrate increased energy performance with a U-Factor  $\leq 0.13$ , Solar Heat Gain Coefficient (SHGC)  $\leq 0.20$ , Visual Transmittance (VT)  $> 0.42$ , and decreased HVAC energy consumption by at least 15% compared to current HVAC energy use with existing single pane windows;
- Reduce installation costs compared to code compliant windows; and
- Accelerate high-performance window uptake in the retrofit market through direct partnerships with manufacturers, suppliers and others.

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Product	4	Comm/Market	5	Program	4
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### ***Skinny Wall Retrofit Panels***

**Project Status:** This project is underway, and the feasibility study is now expected in Q4 2024.

**Product Description:** Highly efficient, customizable vacuum insulated panels (VIP) with an insulation value of up to R30 targeted for residential applications.

**Project Description:** A co-funded project with GTI Energy and NYSERDA to develop an easy-to-install, highly efficient, and customizable wall retrofit solution for residential buildings. Key innovations include using VIPs, 3D scanning and modeling of the building enclosure, and customized design and fabrication of retrofit panels.

**Project Objectives:**

- Determine retrofit parameters affecting thermal performance, air, vapor and moisture drainage, and weather-resistive barriers;
- Evaluate panel concept with the defined design characteristics;
- Fabricate full-scale prefabricated prototype panels retrofitting a 10’x20’ mock-up wall, including door, window and corner features;
- Recruit sites and develop a screening process for demonstration site(s);
- Construct and install VIPs; and
- Conduct energy performance modeling, including comparison to baseline building performance.

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Product	2	Comm/Market	1	Program	1
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### ***Advanced Prefabricated Zero Carbon Homes***

**Project Status:** This project is now underway. Due to a change in the project schedule, the next major update is due in Q4 2024.

**Product Description:** Prefabricated net-zero homes that meet California Title 24 Building Efficiency Standards with efficient HVAC, heat pump water heating, photovoltaic (PV) energy generation and energy storage.

**Project Description:** A co-funded project with GTI Energy and the CEC project EPC-23-018 to develop advanced, highly efficient manufactured homes that can achieve zero carbon operation with on-site photovoltaic power generation and battery energy storage. Homes will meet the California 2022 Title 24 Building Energy Efficiency Standards and will use HPWHs and air source heat pumps.

**Project Objectives:**

- Design, build and commission energy-efficient, all-electric manufactured homes with integrated PV and battery energy storage.
- Perform field validation of zero carbon operation.
- Perform techno-economic analysis using as-built advanced home costs within this project as well as scaled future costs assuming broad adoption of energy efficiency and demand response technologies.

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Product	2	Comm/Market	2	Program	1
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### Luminaire Level Lighting Controls with HVAC Control

**Project Status:** Installation started in mid-August 2024. The project should begin data collection by the close of Q3 2024 and conclude by Q3 2025.

**Product Description:** Luminaire Level Lighting Controls (LLLC) integrated with basic HVAC systems (rooftop units with only thermostats) simplifying the equipment necessary to control thermostats.

**Project Objectives:** Determine whether additional energy savings are possible from more granulated sensors in every general lighting fixture. Analyze the data using simple thermostats (as a cost-effective way to do LLLC+HVAC) and LLLC to help reduce HVAC usage. With more than 50% of the building stock being less than 15,000 square feet and not having a complex Building Management System, the NEEA team is seeking a cost-effective and straightforward way to use the occupancy data from the LLLC system to inform the HVAC on setpoints and setbacks based on who is in the space.

**Product Manager:** Chris Wolgamott  
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Product	4	Comm/Market	4	Program	3
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### Parking Lot Lighting with LLLC

**Product Status:** The contractor is conducting a market survey, including existing demand response systems and currently available parking lot luminaire technology, and is conducting industry interviews. The market analysis report is complete; Phase 3 is underway and should be completed by the end of Q2 2025.

**Product Description:** Exterior lighting with LLLC.

**Project Objective:** Develop and field test a simple, cost-effective parking lot lighting LLLC technology that will reduce electric demand from parking lot lighting during times of peak electric demand.

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Product	3	Comm/Market	3	Program	1
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### Combination Hot Water and Space Heat (Gas)

**Project Status:**

- Stone Mountain Technologies, Inc. (SMTI) 80kBTU/hr gas heat pump: Multifamily site testing is complete. Early results illustrated a net efficiency of 136%, a 54% gas consumption savings for hot water-only mode, and 55% for combined space heating and water heating mode. Single-family hydronic and forced-air heating sites are complete. Early results showed 110% to 130% efficiencies, saving the home 18% to 25% in operating costs.
- Vicot Solar Technology Co., Ltd gas heat pump 20 kW (68kBTU/h): The team has learned the functionality and capabilities of the system. Early COP<sub>gas</sub> ranges between 1.15 and 1.41 in air to water testing. Under an application combined with a hydronic air handler, the COP<sub>gas</sub> ranges between 1.04 and 1.22. There is room for improvement with an optimized air handler.

**Product Description:** An integrated appliance providing space and water heating. Production options include different refrigerants and water, air and refrigerant working fluids.

**Project Objective:** Demonstrate the performance and adaptability of these systems to provide space conditioning and domestic water heating systems in existing homes and small commercial applications.

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Product	1-4	Comm/Market	1-3	Program	2
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### *Integrated Residential Gas Heat Pump Water Heaters*

**Project Status:** GTI Energy confirmed prior findings that indicated heat losses in the process limit the system's performance. The manufacturer is actively working on solutions and redesigning certain areas to enhance the heat pumping process. GTI Energy is optimistic about achieving a COP of 1.1 to 1.2 with these improvements. Meanwhile, NEEA is conducting a market research project to understand what motivates consumers to choose higher efficiency storage water heaters.

**Product Description:** A HPWH using either an adsorption or absorption thermal cycle powered by natural gas.

**Project Objective:** Evaluate the performance of a prototype, full-size, adsorption gas HPWH.

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Product	2-5	Comm/Market	3-4	Program	2-5
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### *Integrated Commercial Heat Pump Water Heaters (Electric)*

**Project Status:** NEEA continues to work closely with A. O. Smith, other manufacturers, and Ecotope on multiple installations to fine-tune performance and suggest improvements to manuals for product and installation. NEEA is working to understand better these products' market potential in commercial applications. The Advanced Water Heating Specification (AWHS) was updated to Version 8.1 in July 2024 and includes commercial integrated water heaters in the Commercial section. Cadeo completed a study of the market size for commercial water heaters in the Northwest and found that more than 60% of commercial hot water usage could be met with a light commercial HPWH solution.

**Product Description:** Generally sized from 80–120 gallons and similar to integrated residential HPWHs, commercial HPWH applications cover a broad range of hot water uses.

**Project Objective:** Conduct a feasibility study to determine in-field COP, resistance heat utilization and success in keeping up with hot water demand.

**Product Manager:** Adam Gage  
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Product	3	Comm/Market	1	Program	2
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### Central Commercial Heat Pump Water Heaters (Electric)

**Project Status:** Case studies and design tools are now available on [BetterBricks.com](https://www.betterbricks.com), and additional content will be added as it is developed.

NEEA, in cooperation with the Bonneville Power Administration, commissioned D+R International to develop an interactive case study of the “Splash Block” to act as a tool to inform architects, mechanical engineers, building owners and plumbers. NEEA will host a [Product Council](#) on September 24, 2024 to provide a deeper dive into the Splash Block Nyle e360 installation.

The AWHS has been updated and includes commercial unitary water heaters. The latest updates for the central commercial HPWH QPL are available in the [Advanced Water Heating Specification/Resources](#) section of neea.org. NEEA is supporting the alignment and agreement of AHRI 1300 with the AWHS and is working through the details, calculations and boundary conditions.

**Product Description:** Commercial HPWHs used in multifamily buildings with central water heating and a distribution system. Several products are available and new products from major manufacturers are expected soon.

**Project Objectives:** Test design tools and new HPWHs as efficient electric solutions for central water heating. The results should lead to an updated product specification, test method and potentially a QPL. NEEA staff are supporting a couple of projects in this area, one with the Bonneville Power Administration and one with New Buildings Institute and the California Energy Commission.

**Product Managers:**

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Product	3	Comm/Market	3	Program	3
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### Advanced Commercial Gas Water Heating

**Project Status:** Planning continues on a market characterization with the North American Heat Pump Collaborative to further understand the market. NEEA is working with a partner to model gas absorption heat pumps installed in commercial water heating applications. Additionally, NEEA is working with a partner to understand the opinions and applicability of gas heat pump water heating equipment in Washington. Work is ongoing to secure up to three field site demonstrations in the Northwest.

**Product Description:** Central water heating systems utilize a thermally driven heat pump, buffer tank, indirect storage tank and other smaller components to deliver domestic hot water.

**Project Objectives:** Understand energy and cost savings from thermally driven heat pumps as replacements for boilers, natural gas-fired storage tanks and tankless systems across various representative applications in the Northwest region.

**Project Manager:** Noe Contreras  
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Product	3	Comm/Market	3	Program	2
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### Industrial Heat Pumps

**Project Status:** NEEA continues to explore the Industrial Heat Pump (IHP) opportunity with the Bonneville Power Administration and Cascade Energy. Initial work will determine the opportunity's scale and scope, manufacturers and suppliers of the technologies, barriers to adoption and possible solutions, ultimately leading to measure-based solutions and calculators.

**Product Description:** Industrial heat pumps can harvest low-grade heat and turn it into useful heat for manufacturing processes or space conditioning. Current performance levels can achieve working temperatures of 212°F–570°F (100°C–300°C) for process heat.

**Project Objectives:** Determine the energy savings opportunity from industrial-scale thermally driven heat pumps, market potential, currently available products, barriers to adoption and potential solutions.

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 Eric Olson  
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Product	2	Comm/Market	2	Program	1
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### ***Commercial and Industrial Fans Product Research***

**Project Status:** NEEA began assessing the applications into which Fan Energy Index (FEI)-rated fans are sold to better understand the savings associated with different fan classes.

**Product Description:** Stand-alone fans that are not packaged as part of an efficiency rated product.

**Project Objective:** The FEI describes the fan efficiency at a design point compared to a “minimally compliant” reference fan at that same operating point and is accepted as the best metric to characterize “efficient fans” at a particular operating point. This project seeks to identify which fan systems and corresponding applications can best achieve efficiency through proper selection using the FEI, proper sizing, speed control, design and other efficiency options.

**Product Manager:** Kristen Aramthanapon  
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Product	5	Comm/Market	4	Program	2
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### ***Power Drive System Technology Assessment***

**Project Status:** NEEA continues to clarify previously identified barriers that impede the widespread adoption of retrofit drives and characterizes variable torque systems as the most appropriate and cost-effective power drive systems (PDS).

**Product Description:** Power drive systems (PDS), also referred to as complete drive modules (CDMs), combine an electric motor and variable speed controls to provide feedback to the equipment.

**Project Objectives:** This project builds off NEEA’s work developing the Power Index (PI) metric with the National Electrical Manufacturers Association (NEMA), describing the percent of power savings expected from a complete PDS. This project will continue researching how PI can be used to calculate savings when retrofitting an adjustable speed drive (ASD) to a motor-driven system, establishing minimum PI values, and understanding power quality requirements for PDS. Additionally, the research will provide a high-level market characterization and initial technical potential estimate for the region.

**Product Manager:** Kristen Aramthanapon  
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Product	5	Comm/Market	4	Program	1
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### *Heat Pump Engine Block Heaters for Backup Generators*

**Project Status:** This project is in the planning phase and is seeking an appropriate test site in the region.

**Product Description:** An air source heat pump engine block heater for 1 MW and greater backup generators.

**Project Overview:** Engine block heaters are a critical component for large (1 MW and greater) emergency backup generators designed to keep critical systems operating in the event of a power emergency. Backup generators (also called stand-by generators) typically use continuous-use electric resistance heaters to keep the engine warm and ready to start.

**Project Objectives:** This project seeks to quantify the energy savings potential of next generation heat pump engine block heaters compared to the current generation of heat pump engine block heaters, and electric resistance engine block heaters.

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Product	1	Comm/Market	3	Program	1
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### ***Flexible Load Management (Special Project)***

**Project Status:** NEEA continues to influence AHRI by recommending CTA-2045B Level 2 for residential and commercial HPWHs. AHRI 1430 applies to 40–80-gallon electric water heaters and AHRI 1530 applies to electric commercial water heaters over 80 gallons.

**Product Description:** Connecting informed autonomous behind-the-meter applications.

**Project Overview:** NEEA has received special funding to explore connected devices capable of operating under flexible load management. These devices can be used for traditional demand response opportunities and may also enable leveraging future energy imbalance markets and potential carbon markets. To start, NEEA is focusing on open architecture connected pathways that work with the marketplace and operated in the background with limited awareness by the end customer. Initial technologies are water heating and line voltage thermostats. Future products may include inverter driven HVAC, EV charging, consumer appliances, battery storage, commercial buildings, street lighting and others.

**Project Objective:** Create pathways for behind-the-meter loads that can help support the integration of renewables on the grid.

**Product Manager:** Geoff Wickes  
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Product	5	Comm/Market	5	Program	2
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	Level 1: Pre-commercial	Level 2: Limited	Level 3: Niche	Level 4: Growing	Level 5: Wide
<b>Supply Chain Maturity &amp; Market Demand</b>	Not commercially available or limited, pre-commercial availability	Commercially available outside of region  Requires special order  Limited market awareness	Commercially available in Northwest from one manufacturer through standard channels  Niche market demand	Commercially available in Northwest from at least two manufacturers  Growing market demand	Commercially available from 2+ manufacturers, well developed supply chain across region  Wide market demand

**PRODUCT PERFORMANCE READINESS**

	Level 1: Unvalidated	Level 2: Engineering Validation	Level 3: Lab Validation	Level 4: Limited Field Validation	Level 5: Confirmed
<b>Savings Reliability &amp; Fitness for Use</b>	Manufacturer claims energy savings but not validated by unbiased experts	Concept validated by unbiased expert via technical review and engineering calculations	Independent lab testing of product features and energy use in typical applications with clear baseline established	Lab and small-scale field testing across broader range of applications and systems conditions	Reliable prediction of performance across the range of intended applications; fully evaluable savings via established protocols by regional or national bodies

**PROGRAM READINESS**

	Level 1: None	Level 2: Exploratory	Level 3: Preliminary Pilots	Level 4: Full-scale Pilots	Level 5: Ready
<b>Cost Effectiveness Knowledge</b> <i>(technical and market potential, product cost at scale, non-energy benefits)</i>	None or very limited	Performance readiness at 2; initial market size calculated (units per year)	Performance readiness at 3; product cost at-scale estimated	Performance readiness at 4; product costs at or trending towards at-scale levels; preliminary estimates of non-energy benefits	Performance readiness at 5; CE calculations based on solid estimates or proven values
<b>Market &amp; Program Knowledge</b>	None or very limited	Preliminary research exposes barriers and/ or similarities to other successfully transformed markets warranting further efforts	Market research illuminates barriers and opportunities to intervene; preliminary logic model developed; small-scale pilots	Formal market characterization underway; larger-scale pilots to test program elements and barrier removal	Formal logic model developed; market characterization and large-scale pilots prove out program design and barrier removal
<b>Risk Assessment</b> <i>(Market, Program, Regulatory)</i>	No risk assessment	Limited risk assessment	Preliminary risk assessment complete - major categories of risk understood	Well-developed risk assessment - no major unresolved risks	Periodic risk assessment process in place



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**TOGETHER We Are Transforming the Northwest**

