2024 Q4 Emerging Technology Quarterly Newsletter

WHAT'S NEW:

NEEA's Emerging Technology team is concluding a successful 2024 with the completion of several key projects, including:

- A Residential Laundry Field Study;
- A commercial display test procedure;
- A study of heat pump rating representativeness;
- A room heat pump field study;
- An analysis of Commercial Heat Pump Dryers; and
- And a residential dual-fuel configuration analysis.

The launch of a long-awaited field study on Luminaire Level Lighting Controls (LLLC) combined with HVAC control in a commercial building constitute a highlight of the year. Led by Senior Product Manager Chris Wolgamott, this study, delayed by the COVID-19 pandemic, finally secured the necessary building owner, manufacturer and contractor partners earlier this year. The LLLC system, installed in August 2024 and inspected in Q4 2024, will be monitored through Q3 2025 to assess its energy-saving potential. By dynamically adjusting HVAC and lighting based on occupancy, the technology promises significant savings beyond the 50%–80% already demonstrated for LLLC lighting alone. The study has garnered considerable interest from extra-regional agencies, including the U.S. Department of Energy (U.S. DOE), Pacific Northwest National Laboratory (PNNL), and DesignLights Consortium (DLC), who eagerly await the results of this pioneering research.

Recent and Upcoming Product Councils:

- November 5, 2024 – Heat Pump Water Heater Installation Tool
- December 3, 2024 – FEI Rated Fans and Flue Gas Thermo-Cooling: The Last Steps in Building Efficiency
- December 17, 2024 – Integrated Design Lab Series: Montana State University

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

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

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Product Summary & Readiness Levels

	PRODUCT OR PROJECT	PROGRAM*	FUEL TYPE	SECTOR	ELECTRIC SAVINGS POTENTIAL[1]	GAS SAVINGS POTENTIAL[2]	PRODUCT PERFORMANCE[3]	MARKET/ COMMERCIAL[3]	PROGRAM READINESS[3]
Consumer Products	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
HVAC	Efficient Rooftop Units	ERTU			N/A	9	4	3	4
	Heat Pump Rating Representativeness	AHP			TBD	N/A	3	5	4
	Room Heat Pumps	TBD			TBD	N/A	1	3	1
	Low Load Efficient Heat Pump Investigation	AHP			TBD	N/A	4	3	2
	Air-Conditioning, Heating, and Refrigeration Institute (AHRI) 1380 HVAC Connectivity Standard	EULF			TBD	N/A	2	2	2
	Dual-Fuel Gas-Electric Heat Pump Modeling	DFHP			TBD	TBD	3	3	1
	Dual-Fuel Gas-Electric Heat Pump Field Study	DFHP			TBD	TBD	3	3	1
	Cold Climate Room Heat Pump Field Testing	AHP			TBD	N/A	3	3	2
	Tri-Mode Heat Pump Study	TBD			TBD	N/A	2	2	1
Building Envelope	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
Lighting	LLLC with HVAC Control	LLLC			358	TBD	3	2	3
	Parking Lot Lighting with LLLC	TBD			TBD	N/A	3	3	1
Water Heating	Combination Hot Water and Space Heat	N/A			130	N/A	1-4	1-3	2
	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
	Integrated Commercial Heat Pump Water Heater	HPWH			50	N/A	3	3	4
	Industrial Heat Pumps	N/A			TBD	TBD	2	2	1
	Residential Heat Pump Water Heater Quality Assurance	HPWH			TBD	TBD	4	5	4
	Residential Water Hearing Demonstration – HPWH, Circulation, and Drain Heat Recovery	HPWH			TBD	TBD	3	3	2
Motors	Commercial & Industrial Fans	Fans			176	N/A	5	4	2
	Power Drive System Technology Assessment	N/A			292	N/A	5	4	1
	Heat Pump Engine Block Heaters	N/A			TBD	TBD	1	3	1
Other	Flexible Load Management	N/A			TBD	TBD	5	5	2

***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); End-Use Load Flex (EULF)

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 29; **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 Objective(s):

- 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.

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Product	4	Comm/Market	5	Program	5

Residential Laundry Field Study

Project Status: The field monitoring phase of the study is complete. Additional data analysis is underway, and the final report is expected by the close of Q4 2024.

Product Description: Residential appliances for washing and drying clothes.

Project Objective(s): 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.

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Product	5	Comm/Market	5	Program	5

Monitor and Commercial Display Testing

Project Status: The test procedure modifications for monitors and commercial displays are complete. Testing is complete on monitors and beginning on commercial displays to assess level settings. The potential for energy savings continues to be explored.

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

Project Objective(s): 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 represents true energy use better 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.

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Product	3	Comm/Market	5	Program	1

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 continued 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 began 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 Objective(s): 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.

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Product	4	Comm/Market	5	Program	5

Commercial Heat Pump Dryers

Project Status: Testing is complete. The final analysis is in progress and is expected to be completed 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 Objective(s): 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 vs. conventional commercial dryers; and
- Utilize learning to inform future ENERGY STAR and U.S. DOE test procedure developments or rulemakings.

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Product	1	Comm/Market	3	Program	1

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 2025.

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 Objective(s): 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.

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Product	4	Comm/Market	3	Program	4

Heat Pump Rating Representativeness

Project Status: Field and lab testing, analysis and final report have been completed. Final edits and publication are pending.

Product Description: Variable speed heat pumps and air conditioners.

Project Description: NEEA in collaboration 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 conducted a unique project to evaluate the accuracy of the test procedure for heat pumps. The study observed the heat pump performance in a controlled field installation and compared those observations with corresponding laboratory test results. The results of this study were used to inform federal test procedure development and inform future Canadian standard CSA C700 load-based tests for heat pumps.

Project Objective(s):

- Identify how well U.S. DOE Appendix M1 represents field performance.
- Identify how well CSA SPE07 represents field performance.
- Identify which lab data is essential for accurate ratings
- 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

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 Objective(s): 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

Low Load Efficient Heat Pump Investigation

Project Status: Phases 1–3 have been completed. Preliminary 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 Objective(s): 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 reviewed existing publicly available data.
- Phase 2 conducted a virtual teardown of equipment to compare a dozen different heat pumps based on technical service manuals.
- Phase 3 consisted 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

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(s): Support efforts to harmonize connectivity standards among several standards, including heat pumps, ENERGY STAR, OpenADR and others.

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Product	3	Comm/Market	3	Program	1

Dual-Fuel Heat Pumps

Project Status: Initial results from modeling multiple dual-fuel configurations have been reviewed and updated. Preliminary findings indicated that a hydronic furnace and air source heat pump (ASHP) is the most attractive configuration from an operational cost perspective. NEEA will consider conducting sensitivity analysis on the output and integrating water heating load for the hydronic furnace. Through a collaboration with the utilization technology development (UTD) program, GTI Energy will lab test traditional dual-fuel units in the first half of 2025 and simultaneously test a dual-fuel system from iFLOW (hydronic furnace and ASHP). Lastly, site selection is underway for the residential dual-fuel HVAC technology field demonstration.

Product Description: A forced air gas furnace or hydronic furnace combined with an ASHP with integrated controls.

Project Objective(s): 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

Dual-Fuel Heat Pump Field Study

Project Status: This project is underway. Site identification is proceeding to recruit 10 demonstration participant sites to install the systems by the end of 2024. The system includes a variable speed cold climate ASHP, 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 ASHP with integrated controls.

Project Objective(s): 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	3	Comm/Market	5	Program	1

Cold Climate Room Heat Pump Field Testing

Project Status: This project is underway. Washington State University is conducting the research funded by the Bonneville Power Administration and NEEA with support from Clark PUD, Chelan PUD, Energy Trust of Oregon, Puget Sound Energy and Idaho Power. Project sites are being identified. Room HP units will be installed in December 2024 and January 2025.

Product Description: A small heat pump designed to condition a single room that 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 Objective(s):

- Obtain lab test data collected from manufacturers to characterize HP performance vs. ambient temperature.
- Conduct field testing to gather real-world operational data (runtime, consumer acceptance, etc.).

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Product	2	Comm/Market	3	Program	1

Tri-Mode Heat Pump Study

Project Status: Product contracting is underway.

Product Description: Tri-Mode heat pumps use a single outdoor unit to drive indoor space heating, space cooling and domestic water heating. They are integrated systems that can use either refrigerant or water as the distribution fluid coupled to a variable speed vapor compression heat pump.

Project Objective(s):

- A detailed market survey of tri-mode heat pumps available in North America, Asia and Europe.
- Preliminary estimate of energy savings potential.
- Preliminary evaluation of market barriers for these systems.

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Product	2	Comm/Market	2	Program	1

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.

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 Objective(s):

- 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

Secondary Windows Field Study

Project Status: Progress continues on this project. Lab test results with baseline performance are expected by the end of 2024, along with the field demonstration test plan.

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 Objective(s): 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 ≤ 0.13, Solar Heat Gain Coefficient (SHGC) ≤ 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

Skinny Wall Retrofit Panels

Project Status: This project is underway, and the Feasibility Report is delayed until Q1 2025.

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 Objective(s):

- 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 comparisons to baseline building performance.

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Product	2	Comm/Market	1	Program	1

Advanced Prefabricated Zero Carbon Homes

Project Status: This project is underway; the next major milestone, Advanced Manufactured Home Design, will be completed by the end of 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 Objective(s):

- 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

Luminaire Level Lighting Controls with HVAC Control

Project Status: Installation was completed in mid-August 2024. The project is collecting data and will continue until Q3 2025. The project is getting a lot of interest from multiple extra-regional agencies, including the U.S. DOE, PNNL, DLC and others.

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 Objective(s): 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 lacking 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.

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Product	4	Comm/Market	4	Program	3

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(s): 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

Combination Hot Water and Space Heat (Gas)

Project Status: The final report for the Stone Mountain Technologies, Inc. (SMTI) combination project in Chicago, IL is expected by the end of 2024.

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

Project Objective(s): 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

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(s): 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

Integrated Commercial Heat Pump Water Heaters (Electric)

Project Status: NEEA continues to work closely with manufacturers and Ecotope on multiple installations to fine-tune performance and suggest improvements to manuals for product and installation. NEEA is working to understand these products' market potential in commercial applications. A market size study completed by Cadeo for commercial water heaters in the Northwest found that more than 60% of commercial hot water usage could be met with an integrated commercial heat pump water heater.

The latest version of the Commercial/Multifamily HPWH Systems Qualified Product List was posted in Q4 2024. The latest information for integrated commercial HPWHs can be found on the Advanced Water Heating Specification's page on neea.org.

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

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Product	3	Comm/Market	1	Program	2

Central Commercial Heat Pump Water Heaters (Electric)

Project Status: Case studies and design tools are available on 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 a Nyle e360 installation in the new Splash Apartments complex in Portland, OR. The interactive tools produced by D+R International will be used to inform architects, mechanical engineers, building owners and plumbers. NEEA hosted a Product Council on September 24, 2024 to showcase these new tools; a recording of the presentation is available on NEEA's website.

The latest version of the Commercial/Multifamily HPWH Systems Qualified Product List was posted in Q4 2024. The latest information for central commercial HPWHs can be found on the Advanced Water Heating Specification's page on neea.org.

NEEA is supporting the alignment and agreement of AHRI 1300 and ENERGY STAR's new draft test methodology with the Advanced Water Heating Specification (AWHS).

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 Objective(s): 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 the New Buildings Institute and the California Energy Commission.

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Product	3	Comm/Market	3	Program	3

Advanced Commercial Gas Water Heating

Project Status: Modeling gas absorption heat pumps and electric heat pumps installed in commercial gas-fired water heating products such as boilers, storage tank and tankless water heaters. Site identification is underway to secure 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 Objective(s): 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.

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Product	3	Comm/Market	3	Program	2

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 Objective(s): 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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Product	2	Comm/Market	2	Program	1

Residential Heat Pump Water Heaters

Project Status: NEEA contracted with Larson Energy and Cascade Engineering Services to complete a study in which multiple characteristics were observed, and tests were performed on four residential HPWHs qualified to Tier 4 of NEEA's AWHS.

Product Description: An electric powered residential unitary air-to-water heat pump, generally with a backup electric element, used for domestic hot water.

Project Objective(s): The evaluations were designed to randomly select products listed in the AWHS to validate they are performing as efficiently as expected. Findings will be shared with the manufacturers upon finalization.

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Product	4	Comm/Market	5	Program	4

Residential Water Heating Demonstration—HPWHs, Circulation and Drain Heat Recovery

Project Status: This project is under development. It has a green light from the UA Local 290 Training Facility and is supported by the American Council for an Energy-Efficient Economy (ACEEE). Vendors are being contacted.

Product Description: Partner with the UA 290 Training Facility in Tualatin, OR to build from Piping & Instrumentation Diagrams (P&ID) provided by NEEA to demonstrate the three different technologies surrounding residential water heating systems (HPWHs, drain water heat recovery and circulation pumps).

Project Objective(s): Demonstration, training and test rigs for HPWHs, drain water heat recovery and water heating circulators. The demonstration process will be part of the ACEEE Hot Water Forum to be held in Portland, OR March 4–6, 2025. The demonstration will include three training cells and one competition cell (i.e., the HPWH Installation Rodeo—it will be filmed, and awards will be presented).

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Product	3	Comm/Market	3	Program	2

Commercial and Industrial Fans Product Research

Project Status: To better understand the savings associated with different fan classes, NEEA has characterized different fan systems in relationship to existing and proposed federal standards and started a taxonomy that describes equipment containing fan components that may require a specified Fan Energy Index (FEI).

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

Project Objective(s): 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.

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Product	5	Comm/Market	4	Program	2

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.

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 Objective(s): 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.

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Product	5	Comm/Market	4	Program	1

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 Objective(s): 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

Flexible Load Management – Specially Funded Project

Project Status: NEEA continues to influence AHRI by requiring 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 operate 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, electric vehicle (EV) charging, consumer appliances, battery storage, commercial buildings, street lighting and others.

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

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Product	5	Comm/Market	5	Program	2

MARKET & COMMERCIAL READINESS

	Level 1: Pre-commercial	Level 2: Limited	Level 3: Niche	Level 4: Growing	Level 5: Wide
Supply Chain Maturity & Market Demand	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
Savings Reliability & Fitness for Use	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
Cost Effectiveness Knowledge *(technical and market potential, product cost at scale, non-energy benefits)*	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
Market & Program Knowledge	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
Risk Assessment *(Market, Program, Regulatory)*	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

CONTACT US: Ask questions • Request feedback • Suggest technologies

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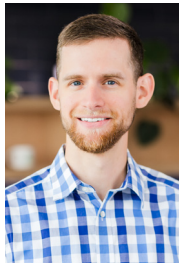

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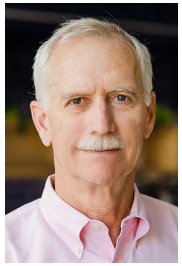

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TOGETHER We Are Transforming the Northwest

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Cascade Natural Gas Corporation — A Subsidiary of MDU Resources Group, Inc.
P.U.D. Chelan County
Clark Public Utilities
EnergyTrust of Oregon
Idaho Power — An IDACORP Company
NorthWestern Energy
NW Natural®
PACIFIC POWER
Portland General Electric
PSE Puget Sound Energy
Seattle City Light
Snohomish County PUD — Public Utility District No. 1
Tacoma Power — Tacoma Public Utilities