Newsletter / November 19

Q4 2025: Emerging Technology

Highlights

The Q4 2025 Emerging Technology Newsletter showcases a range of impactful work led by the emerging technology and product management team at NEEA. Some key activities include:

- A new initiative to develop and influence refrigerator test procedures that will more accurately capture energy savings from emerging features like advanced inverter compressors and adaptive controls.
- Starting research on dual-fuel residential water heating that includes fully integrated operation between gas and electric heating sources to provide maximum flexibility in efficiency, performance, reliability and grid-enabled benefits.
- Selecting new sites to study Luminaire Level Lighting Controls (LLLC) integration with HVAC system controls.
- Conducting field studies on:
    - A gas-fired absorption heat pump in a multifamily building
    - Small commercial facility electric heat pump water heaters (up to 120 gallon)
    - Room heat pumps to understand performance in real-world applications

Future quarterly newsletters will include status updates and links to published reports on the activities above as they become available. NEEA staff scan for new emerging technologies for all sectors and end uses. Please let us know if you have a product or research idea. We would love to hear from you.

NEEA's emerging technology team also has several interesting Product Councils scheduled and is always open to topic ideas. Information on upcoming Product Councils is available on the neea.org. Please reach out to any of NEEA's product managers with questions or suggestions on the organization's emerging technology work.

RECENT AND UPCOMING PRODUCT COUNCILS

- *October 28, 2025 – Compliance & Conformance: Enabling Grid-Responsive Heat Pump Water Heaters*
- *November 12, 2025 – Navien Dual-Fuel Residential Heat Pump Water Heater*

To view recordings from any past session, visit our Materials Library.

For Questions:
Mark Rehley, Director of Codes, Standards + Emerging Technology
mrehley@neea.org

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Building Envelope

Secondary Window Research and Field Study — Eric Olson

DESCRIPTION

Product: Secondary windows, retrofit products comprising one or more panes of material such as glass, polymer or acrylic (with or without Low-E coatings) that are mounted in a frame attached either to the interior or exterior of existing windows without replacing the primary glass or frame. These products save energy through increased insulation and lowered window air leakage.

Project: This project aims to compile an inventory of manufacturers that offer secondary windows and to test manufacturer products for condensation mitigation. Selected test sites comprise multiple office spaces. Three manufacturers' products will be tested.

Fuel Type: Electric + Natural Gas

Project Status	*The contractor GTI Energy completed an initial list of manufacturer secondary window offerings and will continue to add to this live list as more products come online or are discovered. GTI Energy intends to complete a preliminary techno-economic analysis of secondary window systems by year-end 2025 or Q1 2026.*		
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 ≤ 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.* • *Accelerate high-performance window uptake in the retrofit market through direct partnerships with manufacturers, suppliers and others.*		
Readiness Levels	***Product**: 4*	***Commercial/Market**: 5*	***Program**: 4*

Building Envelope

Skinny Wall Retrofit Panel System Development — *Eric Olson*

DESCRIPTION

Product: Highly efficient, customizable vacuum insulated panels (VIP) including an insulation value of up to R30. This product is targeted for residential applications.

Project: This project, co-funded with GTI Energy and New York State Energy Research and Development Authority (NYSERDA), aims to develop an easy-to-install, highly efficient, and customizable wall retrofit solution for residential buildings. This project will demonstrate the ability to fabricate full-scale prefabricated prototype panels (including door, window and corner features), develop a screening process for demonstration sites and recruit participants. The project will select a demonstration site, construct and install VIPs and conduct energy performance modeling. Key innovations of the technology to be tested include using VIPs, 3D scanning and modeling of the building enclosure, and customized retrofit panel design and fabrication.

Fuel Type: Electric + Natural Gas

Project Status	*This project is underway. The final report is expected by Q4 2025.*		
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.* • *Demonstrate the ability to fabricate full-scale, prefabricated prototype panels retrofitting a 10'x20' mock-up wall, including door, window and corner features.* • *Demonstrate the energy performance benefits of the technology.*		
Readiness Levels	***Product**: 2*	***Commercial/Market**: 1*	***Program**: 1*

Building Envelope

Advanced Prefabricated Zero Carbon Homes Field Study — *Eric Olson*

DESCRIPTION

Product: Prefabricated net-zero homes that meet California Title 24 Building Energy Efficiency Standards that include efficient heat pumps for HVAC, heat pump water heaters and photovoltaic (PV) energy generation with energy storage.

Project: This project, co-funded with GTI Energy and the CEC), project EPC-23-018 will aim to develop manufactured homes that can achieve net-zero carbon operation. The project will design, build, commission and verify energy performance of pilot homes.

Fuel Type: Electric

Project Status	*This project remains on hold due to prior demonstration sites no longer being available. GTI Energy identified two alternative sites and is working on finalizing their participation in the study. Once the CEC approves the sites, work will resume.*		
Project Objectives	• *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.*		
Readiness Levels	***Product**: 2*	***Commercial/Market**: 2*	***Program**: 1*

Consumer Products

TVs, Monitors, and Commercial Display Testing Development — *Wendy Preiser*

DESCRIPTION

Product: Ongoing efficiency improvements in 4K ultra-high definition (UHD) televisions with various forms of advanced display settings, standby mode and other new technologies.

Project: NEEA developed and influenced improved testing methods that recognized escalating standby power usage and better evaluated dim, non-uniform displays that consumers often adjusted post-purchase. To date, NEEA's efforts have resulted in an updated ENERGY STAR® TV specification (V9), an industry standard test method based on the NEEA approach (ANSI/CTA-2037-D), U.S. adoption of ANSI/CTA-2037-D, the development of a U.S./Canada TV Industry Voluntary Agreement, and the potential 2026 adoption of the NEEA approach in several important International Electrotechnical Commission (IEC) energy efficiency test methods (e.g. TVs, Standby and Network Standby).

Building upon its efforts to improve the efficiency of TVs, and because international standards bundle the products, NEEA has identified an opportunity to improve the efficiency of monitors and displays. Most displays and monitors are similar in design and construction to TVs.

Fuel Type: Electric

Project Status	*Discussions continue among manufacturing participants in the TV Voluntary Agreement regarding test methods to set TV on-mode specification levels. Final peer-reviewed monitors and displays reports are in development.*		
Project Objectives	• *Influence adoption of key aspects of the NEEA test method and approach internationally.* • *Support ongoing discussions of on-mode power levels backed by TV test data within the TV Voluntary Agreement.* • *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.* • *Succeed in having the new test procedure inform an update to the U.S. DOE federal energy test standard.*		
Readiness Levels	***Product**: 4*	***Commercial/Market**: 5*	***Program**: 4*

Consumer Products

Residential Laundry Field Study — *Wendy Preiser*

DESCRIPTION

Product: Quantified and analyzed data reflecting energy usage by installed base case residential clothes washers and dryers.

Project: This study focuses on quantifying usage data on an installed sample of residential appliances for washing and drying clothes. A user diary and metered data were collected on water usage, load sizes, textile mix, washer and dryer cycles selected, how efficiently washers remove water from the load, and how efficiently clothes were dried. The research leverages NEEA's Residential Building Stock Assessment (RBSA) by selecting a statistically representative sample of RBSA participant households and studying their laundry use patterns and equipment energy use.

Fuel Type: Electric + Natural Gas

Project Status	*Results are being compared to other robust regional datasets to fine-tune energy use and cycle frequency projections, which will enhance NEEA's confidence in the data and bring richer insights for those examining energy efficiency opportunities with residential laundry. The final report is now expected by the end of Q4 2025.*		
Project Objectives	• *Gain insights that will allow updates to energy savings opportunities, inform current ENERGY STAR specification development, inform future U.S. Department of Energy (U.S. DOE) rulemakings, and facilitate collaboration with other partners to replicate the study in their territories.*		
Readiness Levels	***Product**: 5*	***Commercial/Market**: 5*	***Program**: 5*

Consumer Products

Combo Washer-Heat Pump Dryer Testing — Wendy Preiser

DESCRIPTION

Product: A combination all-in-one washer-dryer is an appliance that cleans and dries the clothes in a single tumble-type drum. Three manufacturers have introduced models in the U.S. market that feature heat pump technology in a combo unit. Heat pump dryers tend to be 40-60% more efficient than electric resistance dryers. Dryers are the second highest energy consuming home appliance.

Project: Combo washer-dryers are among the first heat pump dryer technologies to gain consumer acceptance in the U.S. These units offer advantages such as 120-volt connection and ventless drying, making them suitable for residences that may not be able to accommodate a traditional dryer. In contrast, stand-alone heat pump dryers have experienced limited consumer adoption, even after a decade of market intervention efforts. Although they offer strong energy savings potential, some users have encountered challenges such as longer drying times and more frequent lint maintenance, which may have contributed to slower uptake. As combo units with heat pump technology enter the market, NEEA is exploring whether these newer models could encounter similar usability concerns that affect broader adoption of the technology and long-term consumer satisfaction.

Fuel Type: Electric + Natural Gas

Project Status	*Consumer adoption of all-in-one units continued to be strong. This research was rescoped to understand potential post-purchase dissatisfiers that might impact long-term advances in heat pump dryer technology. Testing is expected to begin Q1 2025.*		

Project Objectives	*This research aims to:*
	• *Test equipment to understand actual performance and energy consumption compared to U.S. DOE and ENERGY STAR estimates:*
	  ○ *Are cycle times falling within reasonable expectations?*
	  ○ *Are usage instructions clear?*
	  ○ *Are maintenance/cleaning instructions clear and reasonable?*
	  ○ *Does lint accumulation impact performance and energy use over time?*
	  ○ *Does connectivity impact cycle time and energy use performance?*		

Readiness Levels	***Product**: 4*	***Commercial/Market**: 5*	***Program**: 5*

Consumer Products

Residential Refrigerator Test Procedure Exploration — *Wendy Preiser*

DESCRIPTION

Product: Residential refrigerators are currently tested at one ambient temperature (90°F) per the U.S. DOE test method. Technologies such as advanced adaptive control systems, in combination with other technologies, can deliver energy savings that are not evident with the current test procedure. Refrigerators are the highest energy-consuming home appliance.

Project: During the 2020–2021 ENERGY STAR Emerging Technology Award period, an alternate test procedure was used to qualify residential refrigerator products. This approach revealed that units with adaptive controls and compressors can deliver a savings of 27% above baseline efficiency by adjusting energy use based on cooling demand. Controls are a relatively inexpensive way to deliver meaningful savings to consumers. Models released after the conclusion of the Emerging Technology Award period are not tested at multiple ambient temperatures, which means similar savings may go unrecognized due to limitations with the current test method.

To address this, NEEA is conducting lab research to identify a more effective testing approach and to scan for top-selling high efficiency models that could demonstrate regional energy savings in the near-term.

Fuel Type: Electric

Project Status	*Vendors are submitting lab testing bids.*		
Project Objectives	*This research aims to help the project team:* • *Advance refrigerator savings opportunities by supporting energy-efficient technologies, leveraging data for future comments on test procedures and ENERGY STAR specifications.* • *Develop a plan to influence test procedure updates that reflect energy savings of advanced invertor compressors and other advanced technologies.* • *Identify an alternative refrigerator test procedure that has a similar level of burden to the current U.S. DOE approach but is more representative of real-world use, revealing the benefits of new technology.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 3*	***Program**: 2*

HVAC

Heat Pump Rating Representativeness Study — *Christopher Dymond*

DESCRIPTION

Product: Residential variable speed heat pumps and air conditioners.

Project: NEEA, in collaboration with Northeast Energy Efficiency Partnerships (NEEP), AHRI, BC Hydro; NRCan, 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 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.

Fuel Type: Electric

Project Status	*Project completed in Q3 2025. The final report is now available on the Northeast Energy Efficiency Partnerships (NEEP) website. In addition, Natural Resources Canada (NRCan) just completed a companion research project report (to which NEEA also contributed) on the representativeness of load-based testing.*		
Project Objectives	• *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.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 5*	***Program**: 4*
Link to Report	Rating Representativeness Report Phase 1 Rating Representativeness Report Phase 2		

HVAC

Low-Load Efficient Heat Pump Investigation — *Christopher Dymond*

DESCRIPTION

Product: Variable speed heat pumps are designed to be highly efficient when running under low loads. Some heat pumps are 40%–50% more efficient than single-speed systems under low load conditions. NEEA is especially interested in this because these conditions account for over 60% of the operating hours of a properly sized system in the Northwest.

Project: Activities included lab testing, field testing, product teardowns, modeling, database evaluation and manufacturer interviews. The report will summarize research activities.

Fuel Type: Electric

Project Status	*All phases of this investigation are complete, and the report is underway with anticipated publication in Q1 2026.*		
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 reviewed existing publicly available data.* • *Phase 2 included conducting 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 included performing a physical teardown of subcomponents to provide insight on component differences, manufacturing costs, and components that enable low-load efficiency.*		
Readiness Levels	***Product**: 4*	***Commercial/Market**: 3*	***Program**: 3*
Link to Report and Presentations	• Preliminary findings presented at the Product Council on April 2, 2024. • Summary presentation given at the Product Council on March 25, 2025.		

HVAC

Dual-Fuel Residential Heat Pump Modeling — *Noe Contreras*

DESCRIPTION

Product: A forced-air gas furnace or hydronic furnace combined with an air-source heat pump with integrated controls to determine best conditions for operating each heating source.

Project: Gas and electric systems can be combined in multiple ways to provide residential space conditioning. Different combinations and control schemes will lead to different operating costs, energy use, and emissions. This project is an exploratory analysis to identify dual-fuel systems with lower operating costs, reduced energy use, and reduced emissions in the Northwest.

Fuel Type: Electric + Natural Gas

Project Status	*This modeling research completed as of Q4 2025.The report link is included below.*		
Project Objectives	• *Understand energy and cost savings from centrally ducted dual-fuel systems across various representative applications in the Northwest.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 3*	***Program**: 1*
Link to Report	**Dual-Fuel Heat Pump Systems Analysis - Northwest Energy Efficiency Alliance (NEEA)**		

HVAC

Dual-Fuel Residential Heat Pump Field Study — *Noe Contreras*

DESCRIPTION

Product: A forced-air gas furnace or hydronic furnace combined with an air-source heat pump with integrated controls to determine best conditions for operating each heating source.

Project: This field study evaluates a dual-fuel HVAC system combining a tankless gas water heater supply, hydronic air handling unit (AHU) and air-source heat pump. The tankless unit supplies 100% of the domestic hot water and circulates hot water through the hydronic AHU for space heating from a supplemental perspective. The heat pump provides space heating until a switchover point is reached.

Fuel Type: Electric + Natural Gas

Project Status	*The team installed new control boards on two units that were not available during the initial update. In addition, troubleshooting support for router configuration was conducted. During this process, it was discovered that router setups provide multiple options for Wi-Fi Protected Access, some of which were not supported by the product's software. As a result, the software was updated to improve compatibility.*		
Project Objectives	• *This research aims to understand the efficiency of residential dual-fuel systems, which combine highly efficient gas water and space heating with an electric heat pump. By using an integrated controller, these systems can enhance fuel flexibility and dynamically manage energy use, offering both energy cost savings and grid flexibility during times of peak demand.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 3*	***Program**: 1*

HVAC

Cold Climate Room Heat Pump Field Testing — *Christopher Dymond*

DESCRIPTION

Product: Room heat pumps are installed in a sash window and are plugged into a standard 15A 120-volt AC outlet. Cold climate versions are defined as Type 4 by Environmental Protection Agency (EPA) test method, meaning they feature active defrost capabilities, can operate in temperatures below 5°F, and maintain substantial heating capacity in cold weather.

Project: Washington State University is leading a field and customer experience study to install 26 cold climate room heat pumps. The project is jointly funded by the Bonneville Power Administration (BPA) and NEEA, with additional support from regional utilities including Energy Trust of Oregon, Glacier PUD, Puget Sound Energy, Okanogan PUD, Ravalli Coop, and Seattle City Light.

Fuel Type: Electric

Project Status	• *All systems are operational with data loggers in place since mid-April 2025.* • *Second round of customer interviews complete (two remaining).* • *Data loggers retrieved by November 1, then redeployed for winter data collection by December 1.*		
Project Objectives	• *Obtain lab test data collected from manufacturers to characterize heat performance vs. ambient temperature.* • *Conduct field testing to gather real-world operational data (runtime, consumer acceptance, etc.).*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 3*	***Program**: 2*

HVAC

Tri-Mode Heat Pump Study — *Christopher Dymond*

DESCRIPTION

Product: 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: Market assessment of the different types of tri-mode heat pumps and products are currently available as well as interviews of 10 subject matter experts.

Fuel Type: Electric

Project Status	*Market research survey and interviews with manufacturers are complete. The final report and a NEEA Product Council presentation are pending.*		
Project Objectives	• *Conduct a detailed market survey of tri-mode heat pumps available in North America, Asia and Europe.* • *Generate a rough estimate of energy savings potential.* • *Conduct a preliminary evaluation of market barriers for these systems through interviews with subject matter experts*		
Readiness Levels	***Product**: 2*	***Commercial/Market**: 2*	***Program**: 1*

HVAC

Duct Loss Meta Study — *Christopher Dymond*

DESCRIPTION

Product: This is a precursor study to determine if ductless heat pump solutions would be superior to current options of repairing, replacing or downsizing failed or underperforming existing ducts.

Project: A 2004 study revealed that residential HVAC in the average Northwest home loses more than 30% of heating energy due to duct leakage and conduction. NEEA seeks to determine whether any changes in duct sealing, indoor air quality and ventilation solutions over the past decade warrant further investigation as a potential Market Transformation program.

This project is exploring the current market landscape and evaluating efficient solutions aimed at reducing heating and cooling losses from ductwork. The study will include literature research, product reviews and interviews with subject matter experts.

Fuel Type: Electric + Natural Gas

Project Status	*Review of literature and current technology options conducted in August 2025. Interviews with subject matter experts are expected through November 2025 and the final report is expected by the end of 2025.*		
Project Objectives	• *Provide an updated summary of current methods through secondary research and simple analysis.* • *Conduct a comparative analysis of existing methods.*		
Readiness Levels	***Product**: 2-5*	***Commercial/Market**: 2-4*	***Program**: 4*

HVAC

Gas High Efficiency DOAS Energy Savings Modeling — *Adam Gage*

DESCRIPTION

Product: The gas high efficiency Dedicated Outdoor Air System (DOAS) HVAC system leverages the same system energy saving strategies (e.g., decoupled ventilation and conditioning and a high-efficiency heat recovery ventilator) as electric very high efficiency DOAS but uses a central gas-fired boiler as the heating source rather than electric heat pumps.

Project: This modeling effort investigated the energy use and savings potential in a sample set of Northwest commercial and residential dwelling buildings with a series of standard HVAC configurations. The project team includes A2 Efficiency and Energy 350.

Fuel Type: Electric + Natural Gas

Project Status	*Modeling is complete. The team is now reviewing results to understand the energy savings potential for gas high efficiency DOAS in the Northwest.*		
Project Objectives	• *Evaluate the energy use and savings of gas high efficiency DOAS in new and existing commercial and residential dwelling buildings.* • *Identify how climate and building type impact energy savings potential.* • *Understand the gas efficiency savings potential for gas high efficiency DOAS in the Northwest.*		
Readiness Levels	***Product**: 2*	***Commercial/Market**: 3*	***Program**: 2*

Lighting

LLLC Including HVAC Control Field Test — *Chris Wolgamott*

DESCRIPTION

Product: Luminaire Level Lighting Controls (LLLC) integration with basic HVAC system controls (rooftop units with dedicated thermostats), simplifying the equipment necessary to control thermostats. With more than 50% of the building stock being less than 15,000 square feet and lacking a complex Building Management System, NEEA is seeking a cost-effective and straightforward way to use occupancy data from the LLLC system to inform HVAC setpoints and setbacks based on who is in the space.

Project: This field test pilot is validating savings with this new integrated control system.

Fuel Type: Electric + Natural Gas

Project Status	*Data collection is underway and will continue through Q4 2025. The project is getting a lot of interest from multiple extra-regional agencies, including the U.S. DOE, Pacific Northwest National Laboratory, Design Lights Consortium and others. Project staff are working with funders to find additional sites for more field testing. The final report is expected by the end of Q4 2025.*		
Project Objectives	• *Determine whether additional HVAC 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.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 3*	***Program**: 3*

Motor-Driven Systems

Installed Fan In-Situ FEI Methodology Development — *Kristen Aramthanapon*

DESCRIPTION

Product: Fans and blowers (1 horsepower and above) that are rated using the Fan Energy Index (FEI) and not packaged in a mechanical system that already has an efficiency-rating such as HVAC products. The FEI is accepted as the best metric to characterize an efficient fan at an operating point compared to a "minimally compliant" reference fan under the same conditions.

Project: This project seeks to identify which fan systems and corresponding applications can achieve better efficiency through proper selection using the FEI, sizing, speed control, design and other fan parameters. This project also investigates the feasibility of developing a methodology for measuring the in-situ FEI of fans once they are installed and operating in the field.

Fuel Type: Electric

Project Status	*The results of this project were published in July 2025 and are linked below.*		
Project Objectives	• *To better understand how fan efficiency is affected when operating point differs from design point.*		
Readiness Levels	***Product**: 5*	***Commercial/Market**: 4*	***Program**: 2*
Link to Report	Calculating In Situ Fan Energy Index - Northwest Energy Efficiency Alliance (NEEA)		

Motor-Driven Systems

Process Pump Research — Kristen Aramthanapon

DESCRIPTION

Product: Process pumps are an extended motor product (XMP) that meet American Society of Mechanical Engineers (ASME) B73 specification and are generally used to pump light, non-viscous fluids.

Project: Conduct research to compare the efficiency between clean-water pumps and similar pumps that are designed to pump unclean water. Currently, only clean-water pumps are under regulation by U.S. DOE to report Pump Efficiency Index (PEI) in their federal database.

Fuel Type: Electric

Project Status	*Preliminary research is complete, and NEEA staff are analyzing the data to determine next steps.*		
Project Objectives	• *Identify energy savings opportunities for pumps that are not classified as clean-water pumps.*		
Readiness Levels	***Product**: 5*	***Commercial/Market**: 4*	***Program**: 2*

Motor-Driven Systems

Power Drive System Metric Validation

Kristen Aramthanapon

DESCRIPTION

Product: Power drive systems (PDS) couple variable speed controls with an electric motor, allowing the motor to run at reduced speed, matching the specific needs of the application and reducing energy consumption.

Project: This project builds off NEEA's work developing the Power Index (PI) metric with the National Electrical Manufacturers Association (NEMA), which reports the 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 an initial technical potential estimate for the region.

Fuel Type: Electric

Project Status	*The motors coalition completed lab testing of motor and drive combinations to validate the calculation method for the PI metric.*		
Project Objectives	• *Establish a PI metric for variable torque applications that can be used for rating motors and power drive systems.*		
Readiness Levels	***Product**: 5*	***Commercial/Market**: 4*	***Program**: 2*
Link to Report:	**Validation Analysis of the Power Index Calculation Procedure**		

Water Heating

Combination HVAC and Water Heating System Field Study — Noe Contreras

DESCRIPTION

Product: In commercial water heating, high-efficiency natural gas technologies like gas-fired absorption heat pumps (GAHPs) offer an efficient alternative to conventional systems. By leveraging existing mechanical room redundancies, GAHPs can be paired with hydronic heating equipment such as boilers, storage tanks, or tankless water heaters.

Project: This project focused on extended monitoring of a gas-fired absorption heat pump installed in a multifamily building and later expanded to include hybrid gas-fired absorption heat pump/boiler systems in single-family homes.

Fuel Type: Natural Gas

Project Status	*Project is complete and the final report is available on neea.org.*		
Project Objectives	• *Demonstrate the performance and adaptability of these systems to provide space conditioning and domestic water heating systems in existing homes and small commercial applications.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 2*	***Program**: 2*
Link to Report:	***Gas-Fired Absorption Heat Pump: Hybrid System Approach Field Study - Northwest Energy Efficiency Alliance (NEEA)***		

Water Heating

Advanced Commercial Gas Water Heating Modeling — Chuck Karras

DESCRIPTION

Product: Commercial water heating systems are typically sized using worst-case load estimates based on industry heuristics or detailed hot water draw analyses. NEEA is interested in understanding more about a hybrid system (e.g., gas-fired absorption heat pumps paired with a traditional gas-fired appliance) or a dual-fuel system. (e.g., central heat pump water heater paired with a traditional gas-fired appliance).

Project: NEEA conducted a parametric modeling study to evaluate the performance of various commercial water heating technologies.

Fuel Type: Electric + Natural Gas

Project Status	*Early modeling shows that gas-fired absorption heat pumps are a highly efficient alternative to conventional systems, with operational costs influenced by the chosen control strategies.*		
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.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 3*	***Program**: 2*

Water Heating

Advanced Commercial Gas Water Heating Field Study — Chuck Karras

DESCRIPTION

Product: An efficient central gas-fired water heating system pairs gas-fired absorption heat pumps or central heat pump water heaters with traditional gas-fired equipment to deliver domestic hot water.

Project: NEEA is conducting a field study to assess central water heating technologies. One site will install a gas-fired absorption heat pump paired with a commercial gas storage water heater in a multifamily building, while another will use a central heat pump water heater with similar equipment in transitional housing/hotel.

Fuel Type: Electric + Natural Gas and Natural Gas-Only

Project Status	*Implementor Energy350 has completed profiling operations and system sizing for each building. System designs, equipment layout and installation schedule are being finalized. Full system commission is expected by Q1 2026.*		
Project Objectives	• *Understand energy and cost savings from hybrid or dual-fuel commercial water heating systems across various representative applications in the Northwest.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 3*	***Program**: 2*

Water Heating

Split-System Heat Pump Water Heater Innovation Contest — Adam Gage

DESCRIPTION

Product: Electric water heaters in single-family and manufactured homes tend to have larger tank sizes with high draw patterns. The updated federal water heating standard will generally require HPWHs in these housing types. However, indwelling electric water heaters in low-rise multifamily buildings have smaller tank sizes and draw patterns. Water heaters in these units are typically smaller and installed in space-constrained locations. New federal water heating standards do not require HPWHs for these types of water heating applications.

Project: The Hot Water Innovation Prize seeks to catalyze the innovation and production of energy-efficient split-system HPWH technologies addressing space-constrained applications, such as in low-rise multifamily buildings where the most common electric water heating product is out of scope of the updated federal water heating standard. The goal is to ensure all consumers have access to low-cost, easily installed and efficient water heating options.

Fuel Type: Electric

Project Status	*Hot Water Innovation Prize manufacturers will supply their split-system HPWH prototype units for lab testing beginning in January 2026. NEEA is actively seeking co-sponsors to join the effort.*		
Project Objectives	• *Measure the performance of product prototypes in a third-party laboratory.* • *Holistically evaluate prototypes' abilities to meet customers' needs. (considering performance, cost, product dimensions, etc.).* • *Name contest winner and facilitate demonstration projects.*		
Readiness Levels	***Product**: 4*	***Commercial/Market**: 2*	***Program**: 2*

Water Heating

Small Commercial Heat Pump Water Heater Field Study — *Adam Gage*

DESCRIPTION

Product: HPWHs used in small commercial applications. “Small commercial” refers to unitary products up to 120 gallons and similarly sized split-system products where the heat pump and tank are sold together. A prior market opportunity study by NEEA and the Bonneville Power Administration found that more than 60% of Northwest commercial hot water usage could be met with a simple light (small) commercial HPWH solution.

Project: NEEA is supporting a larger New Buildings Institute study by bringing six field studies to the Northwest. Performance at each site will be monitored for up to one year. Findings will be published by year-end 2026.

Fuel Type: Electric

Project Status	*Northwest site recruitment is underway.*		
Project Objectives	• *Evaluate field performance.* • *Determine associated costs.* • *Collect building owner perspectives.* • *Identify best practices.*		
Readiness Levels	***Product**: 3*	***Commercial/Market**: 4*	***Program**: 2*

Other/Special Projects

Flexible Load Management – Specially Funded Project — *Eric Olson*

DESCRIPTION

Product: Connecting informed autonomous behind-the-meter applications. 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 and street lighting.

Project: NEEA 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. NEEA is beginning by focusing on open architecture connected pathways that work with the marketplace and operate in the background with limited awareness by the end customer. Efforts include improving ANSI/CTA-2045-B to reduce costs and increase adoption, working with industry stakeholders to adopt The AHRI standard 1430 and AHRI 1530 (which apply to residential and commercial water heaters, respectively) and working with the AHRI on the development and enhancement of standards for residential and commercial HVAC systems.

Fuel Type: Electric

Project Status	*Participant enrollment in the connected water heater field study concluded in July 2025. Data collection continued through October 2025 with a final report due in December 2025. Efforts are also underway to test the load shifting capabilities and other benefits of grid-connected central heat pump water heaters, validating the performance of multiple Universal Control Modules (UCM) modules with CTA-2045-B, and maximizing equipment control logic. In parallel, NEEA is collaborating with industry stakeholders to advance standards improvements such as CTA-2045B Level 2 for residential and commercial HPWHs. Additionally, the industry is actively exploring updates to other connectivity standards to further enhance grid flexibility.* *Modeling is also underway to quantify the load shifting benefits of variable speed heat pumps in Northwest climate zones and residential building stock. Findings will be available at the end of 2025 and will inform future research efforts.* *Research is also advancing on other technologies with high potential for load shifting, including battery storage, smart-grid-enabling technologies, and EV chargers.*		
Project Objectives	• *Create pathways for utilities to access behind-the-meter loads that can flex to help support the integration of intermittent resources on the grid.*		
Readiness Levels	***Product**: 2*	***Commercial/Market**: 5*	***Program**: 2*

Other/Special Projects

AHRI-1380 Residential Variable Speed HVAC Connectivity Standard — *Eric Olson*

DESCRIPTION

Product: AHRI standard 1380 applies to communication, infrastructure, and system functionality related to the implementation of energy management strategies for demand response-ready, variable capacity HVAC systems in residential and small commercial applications. AHRI-1380 establishes standardized communication required to enable equipment to participate in load flexibility programs, defines the infrastructure or minimum pathways to allow direct communication between the equipment and utilities, and specifies the system functionality (including control modes and how the system responds to requests).

Project: NEEA is participating in the AHRI unitary equipment standards technical committee. Activities are centered on progress with adding OpenADR 3 and Home Connectivity Alliance communication protocols as well as updating to CTA-2045-B. Efforts continue to address how equipment responds when exiting events to avoid equipment snapback, how to integrate non-electric auxiliary heating, and clarifying lab test procedures

Fuel Type: Electric

Project Status	*The committee working group plans to have a rough draft completed in 2025.*		
Project Objectives	*This work supports efforts to:* • *Harmonize connectivity standards among several existing standards, including CTA-2045-B, ENERGY STAR and OpenADR 3.* • *Ensure that equipment supports the needs of utilities with the necessary capabilities to respond to a variety of grid requests while maintaining customer comfort.* • *Establish industry guidelines for product performance to minimize the need for and use of electric resistance auxiliary heating.*		
Readiness Levels	***Product**: 2*	***Commercial/Market**: 2*	***Program**: 1*

Readiness Level Criteria Definitions

Rating Scale: 1 = Low, 5 = High

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 and product features and energy use in typical applications with clear baseline established	Lab and small-scale 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

COMMERCIAL / MARKET 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

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 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

Questions? Contact Us

Kristen Aramthanapon
Sr. Product Manager,
Motor Driven Systems
karamthanapon@neea.org

Juan Carlos Blacker
Sr. Product Manager
Whole Building
jblacker@neea.org

Noe Contrares
Sr. Product Manager, Gas
Products
ncontreras@neea.org

Christopher Dymond
Sr. Product Manager,
Residential HVAC
cdymond@neea.org

Adam Gage
Sr. Product Manager,
Water Heating,
Commercial HVAC
agage@neea.org

Chuck Karras
Sr. Product Manager
Gas Products
ckarras@neea.org

Lynne Mosley
Sr. Program Coordinator,
Emerging Technologies
lmosley@neea.org

Eric Olson
Sr. Product Manager,
Emerging Technology
eolson@neea.org

Wendy Preiser
Sr. Product Manager,
Consumer Products
wpreiser@neea.org

Mike Smith
Sr. Manager, Emerging
Technology
msmith@neea.org

Chris Wolgamott
Principal Product Manager,
Lighting, Commercial HVAC
cwolgamott@neea.org