

Q2 2023 AGENDA

Regional Emerging Technologies Advisory Committee



DATE: June 27, 2023
TIME: 9:00 a.m. – 3:15 p.m.
WEBINAR: MS Teams – See link in calendar invite or register [here](#)
AUDIO: Web audio or telephone 971-323-0535, code 684 834 998#

MEETING OBJECTIVES:

- Participants understand the CalNEXT program, including scope, scale, program features, and research focus.
- Snohomish PUD presents their emerging technology research.
- The committee receives an update on NEEA’s ongoing and planned activities through 2023, including an update on variable speed heat pump advanced features and capabilities.
- The committee receives an update on dual fuel projects planned and ongoing in the region.

AGENDA

Time	Topic	Lead	Packet Page #
9:00 a.m. (45 min)	Welcome & Announcements <ul style="list-style-type: none"> • Introductions and agenda review • Regional conferences and Product Council Updates • Key announcements and highlights from ET newsletter 	Eric Olson, Mark Rehley, NEEA All	Agenda p. 1-2
9:45 a.m. (90 min)	California IOU Emerging Technology Update <ul style="list-style-type: none"> • Introduction to CalNEXT • Overview of California ET landscape • Scanning & Screening • Technology Priority Maps • Projects Overview • Partnerships and coordination <p>Outcome: <u>Committee is updated on California’s CalNEXT program and opportunities for collaboration</u></p>	Eric Olson, NEEA Tim Minezaki, Energy Solutions	Memo p. 4

11:15 a.m. (15 min)	Break		
11:30 a.m. (30 min)	Innovation at Snohomish PUD <ul style="list-style-type: none"> Smart Energy Provider & Load Flex Microgrid EVs Outcome: <u>The committee is aware of ET projects at Snohomish PUD</u>	Eric Olson, NEEA Suzanne Frew, SNOPUD	Memo p. 5
12:00 p.m. (60 min)	Lunch		
1:00 p.m. (60 min)	2023 Scanning Projects <ul style="list-style-type: none"> NEEA will share out current and planned ET research for 2023 Residential HVAC Advanced Features & Capabilities Update Refrigerant Update Outcome: <u>The committee is updated on NEEA's scanning efforts and can provide feedback and share opportunities for collaboration</u>	Eric Olson, Christopher Dymond, NEEA	Memo p. 3
2:00 p.m. (60 min)	Dual-Fuel Technology <ul style="list-style-type: none"> NEEA, Energy Trust, and PSE will share updates on dual fuel efforts Outcome: <u>The committee is aware of dual fuel efforts in the region and provides feedback for research needs.</u>	Noe Contreras, NEEA, Kenji Spielman, Energy Trust, Jesse Durst, PSE	Memo p. 6
3:00 p.m. (15 min)	Feedback & Wrap-Up	NEEA ALL	

Memorandum – *Agenda Item (Tier 1)*



June 20, 2023

TO: Regional Emerging Technology Advisory Committee (RETAC)

FROM: Eric Olson, Manager, Emerging Technology & Product Management

SUBJECT: NEEA 2023 Scanning Efforts, Residential HVAC Advanced Features & Capabilities, Refrigerant Updates

Our Ask of You:

Please come prepared with a list of scanning priorities for your utilities, including opportunities to collaborate on research and field studies. NEEA will also provide a high-level update on residential variable speed heat pump advanced features and capabilities work, and forthcoming refrigerant change requirements.

Brief Overview/ Context:

Eric Olson will provide an overview of NEEA's ongoing and planned scanning projects for 2023.

Christopher Dymond will present an update on ongoing advanced features and capabilities work for residential variable speed heat pumps and upcoming energy efficiency ratio requirements and expected impacts to some refrigerants because of the Montreal Protocol.

Please contact [Eric Olson](#) if you have questions about NEEA's scanning efforts.

Please contact [Christopher Dymond](#) if you have questions around heat pump advanced features and capabilities or potential impacts of refrigerant changes.

Memorandum – *Agenda Item (Tier 1)*



June 20, 2023

TO: Regional Emerging Technology Advisory Committee (RETAC)

FROM: Eric Olson, Manager, Emerging Technology & Product Management

SUBJECT: California IOU CalNEXT Emerging Technology Overview and updates

Our Ask of You:

Come prepared with questions about the California Investor Owned Utilities electric portfolio emerging technology work (CalNEXT). Also, consider the metrics used by CalNEXT and if they would be useful to your utility as we continue to revamp the RETAC database.

Brief Overview/ Context:

Tim Minesaki from Energy Solutions will present on the electric California IOU's Emerging Technology program including the CalNEXT program, an overview of the California ET landscape, scanning and screening priorities, Technology Priority Maps, and opportunities for partnerships and coordination.

Information on CalNEXT can be found at www.calnext.com.

Please contact [Eric Olson](#) if you have questions about the CalNEXT Program.

Memorandum – *Agenda Item (Tier 1)*



June 20, 2023

TO: Regional Emerging Technology Advisory Committee (RETAC)

FROM: Eric Olson, Manager, Emerging Technology & Product Management

SUBJECT: Innovation at Snohomish County PUD

Our Ask of You:

Come prepared to listen to an update on Snohomish County PUD's innovation work. Bring questions around load flexibility, microgrids, electric vehicles, and being a smart energy provider.

Brief Overview/ Context:

Suzanne Frew, Sr. Project Manager, Strategy and Emerging Technologies at Snohomish County PUD, will present several projects at Snohomish PUD including lessons learned. Some topics that will be covered include, Snohomish PUD's participation as an American Public Power Association Smart Energy Provider; microgrid research; load flexibility projects; and EV integration including fleet planning.

Please contact [Eric Olson](#) if you have questions about Snohomish County PUD's Emerging Technology work.

Memorandum – *Agenda Item (Tier 1)*



June 20, 2023

TO: Regional Emerging Technology Advisory Committee (RETAC)

FROM: Noe Contreras, Sr. Product Manager

SUBJECT: Dual Fuel Technology Efforts in the Region

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Our Ask of You:

Please come prepared to share any dual fuel projects or priorities your utility is working on or share experienced or anticipated difficulties with dual fuel systems in your territory.

Brief Overview/ Context:

NEEA will present an overview of currently available technologies; a broader market perspective on dual fuel systems from outside the region; a high-level review of codes and policies in the region; and the results of a northwest region simulation study of dual fuel systems.

Also, Energy Trust of Oregon will present the framework of their residential pilot study, and Puget Sound Energy will present the findings of its residential pilot.

Please contact [Noe Contreras](#) if you have questions about dual fuel technologies and regional projects.

2023 Q2 *Emerging Technology Quarterly Newsletter*

WHAT'S NEW:

The second quarter of 2023 brought Efficiency Exchange 2023 (EFX23). Seeing so many partners and stakeholders in person, and talking face-to-face about technologies, testing and market transformation was great. The micro heat pump and central heat pump water heater demonstration products garnered a lot of attention; both technologies are experiencing an exciting amount of interest from around the alliance. Read more about both below.

NEEA also completed a [Hydrogen-Ready Appliances Assessment](#) to review the current and future needs of natural gas appliances served by a blend of conventional methane and hydrogen. The work was funded by Avista, Cascade Natural Gas, Montana Department of Environmental Quality and NW Natural.

Other published reports: [Calibrated Energy Savings for Very High Efficiency DOAS in Multi-Family Housing](#).

Recent Product Councils:

[NEEP Cold Climate Air Source Heat Pump Product List Refresher & Update](#)

[NBI Central Heat Pump Water Heaters for Multifamily Supply Side Assessment](#)

[Advanced Heat Pump Coalition Spring 2023 Webinar](#)

Upcoming Product Councils are 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, Manager, Emerging Technology & Product Management ~



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




































































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Product Summary & Readiness Levels

	PRODUCT	PROGRAM*	FUEL TYPE	SECTOR	ELECTRIC SAVINGS POTENTIAL**	PRODUCT PERFORMANCE*	MARKET/ COMMERCIAL*	PROGRAM READINESS*
Products	Paired Washer-Dryer	RPP	 		TBD	5	5	5
	Ultra-High Definition TVs	RPP	 		57	4	5	5
	Residential Laundry Field Study	RPP	 		N/A	5	5	5
HVAC	Very High Efficiency Dedicated Outside Air Systems	VHE DOAS	 		85	4	4	3
	Efficient Rooftop Units	ERTU	 		30	4	3	4
	Heat Pump Rating Representativeness	VSHP	 		TBD	4	5	4
	Heat Pump Advanced Features and Capabilities	VSHP	 		TBD	3	5	4
	Micro Variable Speed Heat Pump Field Study	VSHP	 		TBD	1	3	1
	Heat Pump Ready ENERGY STAR® Manufactured Homes	VSHP	 		TBD	4	5	3
	Dual Fuel Gas-Electric Heat Pump	N/A	 		TBD	1	2	1
Building	High-Performance Windows	HPW	 		60	4	3	4
	Secondary Windows	Window Attachments	 		35	4	5	4
Lighting	Luminaire Level Lighting Controls	LLLC	 		75	4	4	3
	LLLC with HVAC Control	LLLC	 		358	3	2	3
Water Heating	Combination Hot Water and Space Heat	N/A	 	 	130	1-4	1-3	2
	Heat Pump Water Heaters in Confined Spaces	HPWH	 	 	TBD	2-5	3-4	2-5
	Integrated Residential GHPWH	N/A	 		TBD	3	1	2
	Split System Heat Pump Water Heater	HPWH	 		50	3	3	3
	Integrated Commercial Heat Pump Water Heater	HPWH	 		50	3	3	4
	Central Commercial Heat Pump Water Heater	HPWH	 		50	3	3	3
Motors	Commercial & Industrial Fans	FANS	 	 	176	5	4	2
	Power Drive Systems	N/A	 	 	TBD	4	3	4
Other	Machine Learning (ML) Building Controls	N/A	 		TBD	1	2	2

* **Program Acronyms Defined:** Retail Product Portfolio (RPP); Ductless Heat Pumps (DHP); Variable Speed Heat Pumps (VSHP); Very High Efficiency Dedicated Outdoor Air Systems (VHE DOAS); Residential New Construction (RNC); Luminaire Level Lighting Controls (LLLC); Heat Pump Water Heater (HPWH); Efficient Gas Water Heaters (EGWH); Extended Motor Products (XMP); High-Performance Windows (HPW)

** Technical **electric savings potential** for the region in aMW

* **Readiness Level Definitions** provided on page 26; **Rating Scale** 1=low 5=high

Fuel Type Symbols: Electric  Gas 

Sector Symbols: Residential  Commercial  Industrial 



Paired Washer-Dryer Testing

Project Status: The final Version 2.0 NEEA Dryer Test Procedure and Summary of Changes and Rationale Analysis are available on neea.org.

Product Description: Residential appliances for washing and drying clothes.

Project Objectives: Measure the total energy required to wash and dry the same “real-world” load of laundry in matched washers and dryers, including compact washers with heat pump dryers, and front- and top-load washers with electric and natural gas heated dryers. This testing is leveraging previous NEEA work on both clothes washers and dryers. The testing also seeks to inform NEEA staff whether the previously established “real-world” load should be revised with an industry standard ANSI/AHAM HLD-1-2010 textile load, with 100% cotton textiles, to increase industry acceptance and to better ensure reproducibility.

Product Manager: Eric Olson
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Product	5	Comm/Market	5	Program	5
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Ultra-High Definition (UHD) TVs

Project Status: ENERGY STAR v9 went into effect in October 2022 and currently has over 30 TVs on the list including TVs from at least one major manufacturer. At the Consumer Electronics Show 2023 in early January, industry stakeholders announced continued work toward a voluntary agreement to report TV energy usage per the test procedure. Lastly, in May 2023, the United States Department of Energy (U.S. DOE) issued final rule to adopt ANSI/CTA-2037D as the required test procedure for TVs. This rule is voluntary until September 2023 and then will become the official U.S. DOE test procedure required for all TVs.

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.
- Conduct retail testing of up to 150 TVs using updated draft test clips and draft test procedure. Use data analysis results to inform final test clip, final test procedure and future ENERGY STAR specification.

Product Manager: Chris Wolgamott
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Product	4	Comm/Market	5	Program	5
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Residential Laundry Field Study

Project Status: Monitoring equipment is installed at the first group of homes, and metering is ongoing. Data collection on the washer and dryer energy use will take place for about four weeks, with the participants journaling their washer and dryer cycles for at least one week.

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 future U.S. DOE rulemakings, and facilitate collaboration with other partners to replicate the study in their territories.

Product Manager: Eric Olson
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Product	5	Comm/Market	5	Program	5
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Very High Efficiency Dedicated Outside Air Systems (DOAS) Optimization

Project Status: Monitoring of the Sartori School in Renton is complete; the final report is anticipated in Q3 2023. Two additional sites are currently being monitored: Harder Mechanical Contractors, Inc. in Portland, OR with energy recovery ventilation (ERV) and variable refrigerant flow (VRF) heating/cooling systems, monitoring through Q2 2023; and SERA Architects in Portland, OR with ERV and VRF heat pumps, monitoring through Q4 2023.

Product Description: A system-based approach for commercial HVAC systems that uses high efficiency heat recovery ventilation (HRV) or energy recovery ventilation (ERV) that features 82% or greater sensible effectiveness; a high-performance heating and cooling system that meets ENERGY STAR performance standards; ventilation fully separated from heating and cooling; and right-sized heating and cooling equipment.

Project Objectives: Test and validate HVAC systems utilizing very high efficiency DOAS design principles with multiple HVAC designs, including forced air and chilled beam designs, against conventional equipment. Results inform improved modeling of very high efficiency DOAS design principles in various building types and equipment selection.

Product Manager: Eric Olson
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Product	4	Comm/Market	4	Program	3
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Very High Efficiency Dedicated Outside Air Systems (DOAS) in Multifamily Applications

Project Status: The project is complete. The code minimum balanced system reduced HVAC energy by 14% on average, while the very high efficiency DOAS balanced ventilation system reduced HVAC energy by 41%, an efficiency increase of 27%. The research concludes that very high efficiency DOAS principals are applicable for multifamily buildings and that best practices for components, configurations, and controls can be developed. The full report is available on neea.org.

Product Description: A system-based approach for commercial HVAC systems that uses high efficiency HRV or ERV that features 82% or greater sensible effectiveness; a high-performance heating and cooling system that meets ENERGY STAR performance standards; ventilation fully separated from heating and cooling; and right-sized heating and cooling equipment.

Project Objectives: Test DOAS design principles in a multifamily application with highly efficient DOAS and HRV equipment in an application with electric resistance in the dwelling units. The research seeks to understand the potential energy opportunity when usage of in-unit electric resistant heaters is reduced. Monitoring data will also support DOAS modeling improvements.

Product Manager: Eric Olson
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Product	4	Comm/Market	4	Program	3
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Efficient Rooftop Units (RTUs)

Project Status: The installation of the units in Portland, OR is complete, and monitoring is underway.

Product Description: Packaged, weatherized, commercial natural gas indirect air heating systems that may or may not include ventilation, air conditioning or both. Efficient 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: 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
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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, and lab testing began in May 2023 at UL Solutions' facility. Units will be tested with [AHRI 210/240 M1](#) and [CSA SPE07:2023](#) test procedures, and NEEA and Natural Resources Canada (NRCAN) are conducting repeated tests of two units to evaluate the repeatability of the SPE07 test procedure. NEEA is also contracting with the University of Nebraska to begin data analysis.

Product Description: Heat pumps that can vary their speed to meet heating and cooling demands, enabling the heat pump to operate across a wider ambient temperature range and to have superior performance under low load conditions.

Project Description: NEEA is working collaboratively with NEEP; the 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 (formerly EXP07) 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.

Product Manager: Christopher Dymond
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Product	4	Comm/Market	5	Program	4
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Heat Pump Advanced Features and Capabilities (Improvements)

Project Status: Consultation with subject matter experts is complete, and final work plan documentation is underway.

Product Description: NEEA contracted with Cadeo Group to assist with defining specifications, energy saving estimates, and identification methods for four improvements to heat pump technologies: Low Load Efficiency, Cold Climate Capability, Minimizing Auxiliary Heat, and Connected Commissioning. Current AHRI metrics do not cover these features and capabilities. Other heat pump improvements with the potential to increase performance, including auto demand response, adaptive defrost and low-energy crankcase heaters, will be investigated in the future.

Project Objectives: Conduct a literature review and gap analysis and develop work plans that address knowledge and technology gaps. These features and capabilities will become part of NEEA's VSHP program if successful.

Product Manager: Christopher Dymond
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Product	3	Comm/Market	5	Program	4
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Micro Variable Speed Heat Pump (VSHP) Field Study

Project Status: Phase 1 research concluded in mid-Q1 2023. Phase 2 (field deployment), which included 8-weeks of customer experience, began in April 2023, and concluded at the end of May 2023. The 8-week customer experience work began in April 2023, and Phase 2 concluded at the end of May 2023. Data synthesis is ongoing, with completion expected in June 2023 and results expected to be presented at a Product Council in July 2023.

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.

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.

Product Manager: Christopher Dymond
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Product	1	Comm/Market	3	Program	1
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Heat Pump Ready ENERGY STAR Manufactured Homes

Project Status: Due to uncertainty regarding enforcement responsibilities between the U.S. DOE and HUD, the compliance date has been delayed until July 2025. The alliance will continue to participate with U.S. DOE, ENERGY STAR and regionally at the program level during this phase. The contractor research is complete, and four elements have been identified to improve the installation of heat pumps in the field. NEEA is working with U.S. DOE and the [Northwest Energy-Efficient Manufactured Housing Program™](#) (NEEM) program administrator to define U.S. DOE program requirements that give credit for the NEEM program's continuous process improvement, air sealing and duct sealing aspects.

An analysis of the Inflation Reduction Tax Act identified elements of the specification that would benefit NEEM and the unique way that ENERGY STAR homes are certified in the Northwest. A report is expected to be published by NEEM by Q3 2023.

Product Description: Manufactured homes that can be shipped as “Heat Pump Ready” to comply with the new ENERGY STAR manufactured home specification.

Project Objectives: The updated ENERGY STAR Manufactured Home specification went into effect May 31, 2023, and requires that such homes be equipped with a heat pump. The revised Northwest Energy-Efficient Manufactured Housing Program™ (NEEM) specification for a Heat Pump Ready ENERGY STAR manufactured home will enable factories to sell homes prepped for a heat pump installation in the field. It also enables installation tracking to ensure the homes meet the ENERGY STAR spec.

1. Conduct HVAC contractor interviews to ensure product acceptance.
2. Develop a mechanical and electrical specification; document process changes to achieve ENERGY STAR specification levels.
3. Develop a database to enable tracking of products that meet the ENERGY STAR specification.

Product Manager: Christopher Dymond
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Product	4	Comm/Market	5	Program	3
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Air-Conditioning, Heating, and Refrigeration Institute (AHRI) 1380 HVAC Connectivity Standard

Project Status: Planning.

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.

Product Managers:

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Christopher Dymond
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Product	3	Comm/Market	3	Program	1
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Dual Fuel Gas Heat Pump

Project Status: Energy modeling is underway, analyzing different air source heat pumps (ASHPs) with several building types in the Northwest's various climate zones. The results are expected in Q3 2023.

Product Description: A forced air gas furnace combined with an electric air source heat pump 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.

Product Manager: Noe Contreras
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Product	4	Comm/Market	5	Program	1
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Primary High-Performance Windows (HPWs)

Project Status: Collaboration efforts continue through the U.S. DOE-funded Partnership for Advanced Window Solutions (PAWS). NEEA is exerting national influence on window markets to benefit the alliance's Northwest stakeholders.

NEEA's collaboration with Habitat for Humanity (Bend, OR) is underway. To achieve net-zero performance, Habitat for Humanity will install HPWs in 12 townhome units as part of its 27th Street Townhome project in 2023. Habitat shared a [HPW Case Study](#) at the 2023 BuildRight conference in Portland, OR, reporting that upgrading from double pane to HPW cost approximately \$40 per window, or \$700 for an entire unit with no incremental labor cost. By comparison, rigid foam insulation would cost \$5,000 per unit, mainly due to the incremental labor.

Also, in Q4 2022, NEEA worked with a national builder to include HPWs in a 100-home development built over two to three years in the region. HPWs are a path to code credits for this builder. Construction has begun, and windows have been installed in approximately a dozen homes. Interviews with the builder and window installers indicate no incremental labor is required, and installation was no different than for double pane windows.

Work continues for evaluating benefit/cost ratios for single- and multifamily markets.

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.

Product Manager: Rick Dunn
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Product	4	Comm/Market	3	Program	4
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Study of High-Performance Window Incremental Manufacturing Cost

Project Status: NEEA contracted with Stephen Selkowitz Consultants to explore several technical pathways to make the required thermal improvements over conventional windows. The report concluded that upgrading to a thermally enhanced double glazed window, or shifting to a triple glazed window, can be achieved at an incremental manufacturing cost of approximately \$1.80 – \$2.10 per square foot. The [complete report](#), including impacts to consumer pricing, is available on neea.org.

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 and quantify the incremental manufacturing cost of upgrading window thermal properties to support window markets in the Northwest to meet ENERGY STAR v7 window performance criteria.

Product Manager: Rick Dunn
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Secondary Windows

Project Status: Installation of commercial secondary windows at all six pilot sites is complete: 915 Broadway (Vancouver, WA); Romney Hall (Bozeman, MT); Crane Aerospace & Electronics (Seattle, WA); SBH Legal (Portland, OR); Creekside Business Park (Beaverton, OR) and Big Sky Economic Development (Billings, MT). Post-installation metering will continue at specific sites until mid-2023. A comprehensive technical report is being drafted and is expected in mid-2023.

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 that is attached either to the interior or exterior of existing windows without replacing the primary glass or frame.

Project Objectives: Increase familiarity with product costs (for both materials and installation in the Northwest), product energy savings, market opportunity in the Northwest, installer capability and market drivers, especially value proposition for owners and owner representatives.

Product Manager: Rick Dunn
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Product	4	Comm/Market	5	Program	4
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Luminaire Level Lighting Controls (LLLC)

Project Status: Next Generation Lighting Systems (NGLS) and NEEA continue to collect data from the NEEA office install. In 2023 NGLS hopes to conduct additional studies on the LLLC system, which has not been possible with limited site use due to COVID-19. NGLS continues to look for additional whole-floor space sites in 2023.

Product Description: Advanced lighting control systems, either with wireless sensors or with luminaire integrated lighting controls to provide occupancy-sensor and light-level control plus energy metering.

Project Objective: The NGLS program's prior competitions in 2017 and 2018 selected connected lighting for testing installation, commissioning and energy performance in a real-world test location. In 2021, NGLS added a new project studying the installation, color tuning, energy monitoring and occupancy/daylighting performance of the system, with the possibility of future studies.

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Product	4	Comm/Market	4	Program	3
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Luminaire Level Lighting Controls with HVAC Control

Project Status: This project remains on hold; however, as many businesses' employees start to return to the office, NEEA hopes that site identification can resume by summer 2023.

Product Description: LLLC with additional sensors and supports for HVAC control.

Project Objectives: Determine whether additional energy savings are possible from more granulated sensors in every general lighting fixture. Analyze different HVAC control strategies in terms of how the controls look at the information being collected by the lighting sensors.

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Product	3	Comm/Market	2	Program	3
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Combination Hot Water and Space Heat

Project Status:

- Stone Mountain Technologies, Inc. (SMTI) 80kBTU/hr gas heat pump: The residential field performance evaluation extension is ending in 2023 with a final report expected in 2024.
- Vicot Solar Technology Co., Ltd gas heat pump 20 kW (68kBTU/h): The unit is in transit and lab testing is scheduled for late Q3/early Q4 2023.

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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Heat Pump Water Heaters (HPWHs) in Confined Spaces

Project Status: [“The Amazing Shrinking Room”](#) report and [Product Council presentation recording](#) highlighting findings is available on neea.org. Additional work funded by Pacific Gas & Electric with other products and intervention strategies continues, and results will be shared with the Product Council in Q3 2023. Work continues with manufacturers to include findings in their installation instructions and manuals.

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

Project Objectives: Understand the performance impacts on HPWHs of different room volumes, specifically small spaces like utility closets, and test different interventions at restoring efficiency compromised by a small enclosure.

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Product	2-5	Comm/Market	3-4	Program	2-5
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Split-System Heat Pump Water Heaters

Project Status: Commercial multifamily HPWHs from Nyle, Mitsubishi, and WaterDrop, which uses an ECO2 engine, have been added to the [Commercial Multifamily Heat Pump Water Heater Qualified Products List](#). At Efficiency Exchange 2023, Small Planet Supply showed its packaged skid product designed to produce enough hot water for a 50-unit multifamily building. The system arrives wholly contained on a trailer and can be craned or forklifted into place. Market leaders are also migrating to more extended warranties and shorter lead times.

Product Description: Split-system HPWHs separate the heat pump from the water tank. These products offer a heat pump alternative for locations where the integral product doesn't physically fit. While only one split-system product has been available to date, more manufacturers are entering the market. 2023 shows promise for four more manufacturers to enter the market.

Project Objective: Lab and field test commercially available split-system water heaters to confirm performance and compliance with NEEA's [Advanced Water Heating Specification](#).

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Product	3	Comm/Market	3	Program	3
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Integrated Residential Gas Heat Pump Water Heaters

Project Status: An adsorption heat pump developer has shipped its integrated water heater prototype to the U.S. for independent lab testing. Test results are expected in Q3 2023.

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

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

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Product	3	Comm/Market	1	Program	2
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Integrated Commercial Heat Pump Water Heaters

Project Status: NEEA is working closely with A.O. Smith and Ecotope on multiple installations to fine-tune performance and suggest product and installation manual improvements. The A.O. Smith CHP 120, a 120-gallon commercial HPWH, shows promise and is expected to be listed on the [Qualified Products List](#) by Q3 2023. Learnings from monitoring equipment reinforced the need to consider water heaters as a system solution rather than as an individual component. Due to mixing valve and room volume issues, the unit uses more electric resistance heating than anticipated. Additional monitoring equipment was installed, and NEEA is working with the manufacturers, market actors and building owners to rectify the challenges.

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.

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Product	3	Comm/Market	3	Program	4
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Central Commercial Heat Pump Water Heaters

Project Status: The Ecosim tool continues to be enhanced and is expected to be available sometime in 2023 in addition to the Ecosizer tool. The latest updates for the central commercial HPWH QPL are available on the [Advanced Water Heating Specification/Resources](#) section of neea.org.

OEMs are migrating to a single SKU model that incorporates all components of the central HPWH system, including the heat pump (heat engine), storage, control valves, recirculation pumps, control logic and demand response capabilities on a skid or pre-engineered and designed system. The SKU includes a system warranty, manual and factory-trained commissioning agent. Entities such as OEMs, suppliers and engineering houses can submit a Product Assessment Datasheet for their product. Three new manufacturers are currently going through the process of submitting their products for inclusion on the QPL.

The [Central Heat Pump Water Heaters for Multifamily Supply Side Assessment Study](#), developed by the New Buildings Institute, was published in January 2023 and presented at a [NEEA Product Council in April 2023](#). The findings and recommendations in this report delineate the most effective mechanisms for transforming the central HPWH market for multifamily applications.

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.

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Product	3	Comm/Market	3	Program	3
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Commercial and Industrial Fans Product Research

Project Status: Investigating opportunities for energy savings with technology improvements in the fan and fan system. Additional work is ongoing to explore other opportunities with the qualification of approved calculators that could be made publicly available and easily accessible.

Product Description: Stand-alone fans that are not embedded into packaged units.

Project Objective: The Fan Energy Index (FEI) describes the fan efficiency at a design point compared to a “minimally compliant” reference fan at that same operating point. FEI is the best metric to characterize “efficient fans” at a particular operating point. Proper sizing of the fan for design conditions leads to more efficient operations; however, FEI is rarely used by designers and specifiers in their fan selection, and the total cost of ownership is not a considered metric. This project seeks to understand the barriers to using FEI as a design consideration.

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Product	5	Comm/Market	4	Program	2
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Compressed Air Leak Detection Equipment Evaluation

Project Status: The field test is complete and the [summary memo](#) is available for download on neea.org. The Prosaris™ OL1 yielded quantitative results similar to those of typical leak detection equipment. Additionally, the Prosaris OL1 provides an easier-to-use data gathering and reporting platform.

Product Description: Equipment used to identify compressed air leaks, typically in manufacturing and process applications.

Project Objective: Test the Prosaris OL1 Leak Detection Platform against typical leak detection equipment in a side-by-side analysis to determine its speed, ease of use and accuracy compared to typically used equipment.

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Commercial Adjustable Speed Drive (ASD) Market Penetration Study

Project Status: NEEA contracted with Johnson Consulting Group (JCG) to better understand the market penetration of, and path to decision making for, commercial adjustable speed drives in the Northwest. JCG conducted 40 subject matter expert (SME) interviews across the commercial pump and ASD markets. Interviewees included SMEs, manufacturers/manufacturers' representatives, specifying/design engineers, systems integrators/contractors, and distributors. A final report is anticipated in Q3 2023.

Product Description: ASDs, sometimes referred to as power drive systems (PDS), combine an electric motor and variable speed controls to provide feedback to the equipment.

Project Objective: This project includes three research objectives:

- Assess the proportion of commercial pumps and fans paired with ASDs across the alliance's four-state region.
- Assess the distribution, by horsepower and by application (retrofit, naturally occurring replacement, new construction), of commercial fans and pumps paired with commercial ASDs across the alliance's four-state region.
- Explore and document the decision-making process, including triggers for consideration of drive/device pairing, steps typically taken, and influential factors throughout the process.

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Product	5	Comm/Market	4	Program	1
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Machine Learning (ML) Building Controls

Project Status: NEEA, in collaboration with BrainBox, initially selected two locations in Seattle, WA for monitoring and validation, but restricted site access and metering complexity have led NEEA and BrainBox to seek an alternative second site for monitoring. Data collection at the original first site continues.

Product Description: Applying artificial intelligence (AI) systems to adjust, improve and optimize control of equipment to accommodate changing conditions such as use, occupancy, comfort, air quality, time of use rates and demand response automatically and continually.

Project Objective: Field test one or two products to validate manufacturers' claims.

Product Manager: Eric Olson
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Product	1	Comm/Market	2	Program	2
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	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 <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
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 <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*

