

2019 Q2

Emerging Technology Quarterly Report

IN THE SPOTLIGHT:

What's New



Welcome to Spring! It's awesome to see the new green tree leaves and Spring flowers popping up around town (although this is wreaking havoc with my allergies). At the same time, policies are springing up in our region and country around carbon reduction that have the potential to reinforce the value of energy efficiency to reduce energy waste. NEEA's overall emerging technology and market transformation portfolio includes electric and natural gas products that deliver great value and save energy. For the first time and from this time forward, this emerging technology update will highlight products for both fuels. This is consistent with NEEA's 2020-2024 business plan that combines the electric and natural gas work in one plan. You will notice that efficient products from both fuels share common market barriers and a combined focus will help accelerate the development and adoption of all energy efficient products. This is especially true of heat pump water heaters. The largest manufacturers of domestic and commercial water heaters offer standard electric and natural gas products. In fact, the market share is nearly equal between the two fuels. We know of at least one major water heater manufacturer who is actively working on commercializing a GAS heat pump water heater. Once this is available, water heater manufacturers will have heat pump products for both fuels giving their customers viable, cost effective, and efficient options regardless of their application.

As always, don't hesitate to connect with me if you have questions about our emerging technology portfolio or if you have ideas for products we should consider.

Thank you,

~ Mark Rehley, Sr. Manager ~

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Questions about this report may be addressed to:

Mark Rehley
Sr. Manager, Emerging Technology & Product Management
mrehley@neea.org

Readiness Levels*

AT A GLANCE

Ratings based on 1=low & 5=high

PRODUCT
PERFORMANCE*

MARKET/
COMMERCIAL*

PROGRAM*



Residential

Advanced Walls	3	2	1
Clothes Washers	4	5	5
Ductless Heat Pump Product Innovations	2	3	3
Smart Thermostats	3	5	4
Thin, Lightweight Triple Pane Window	3	1	2
Ultra-High Definition TVs	3	5	5



Commercial

Advanced Research Projects Agency - Energy (ARPA-e)	1	1	1
Luminaire Level Lighting Controls	2	3	3
Luminaire Level Lighting Controls with HVAC Control	2	3	3
Very High Efficiency DOAS	5	4	4



Industrial/ Agricultural

Compressed Air Saving Unit	2	3	3
Pump Operator Certification	2	3	5



Cross-Sector

Combination Hot Water and Space Heat (Gas & Electric)	3	4	2
Extended Motor Products	3	2	3
Split-system Heat Pump Water Heater	3	3	4
Switch Reluctance Motors	4	3	3
Variable-Capacity Split System Heat Pumps	3	3	4
Window Attachments	3	3	3

*PRODUCT PERFORMANCE READINESS: Measurement of energy savings viability, fitness for use, and the Regional Technical Forum measure status if applicable

*MARKET/COMMERCIAL READINESS: Measurement of supply chain maturity, product availability, presence of market failures, and lack of market maturity

*PROGRAM READINESS: Measurement of cost effectiveness, program delivery and interventions, and a risk assessment of technical, market, program and regulatory risk



Residential

EMERGING TECHNOLOGY PROJECTS

Advanced Walls

Product Description: External wall systems with increased insulative levels

Project Objective: Document three “Net Zero Class” wall systems, assess performance, and identify market barriers

Project Update: The project to identify new wall systems is just beginning.

Product Manager: Christopher Dymond
cdymond@neea.org
503.688.5454

Product	3	Comm/Market	2	Program	1
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Clothes Washers

Product Description: Residential appliance for washing clothes

Project Objective:

- Project 1 - Compare the water and energy use differences between a GE agitator top load washer that is ENERGY STAR certified versus a GE agitator washer that is not ENERGY STAR certified, including a tear down analysis.
- Project 2 – Develop and validate a lab test protocol that reflects real-world fabric types, load sizes, and/or washer settings while ensuring it is repeatable and reproducible for the industry to implement

Project Update:

- Project 1 is in the contracting stage.
- Project 2 is in the RFP (Request for Proposals) phase with plans to award a contract in Q2, 2019 with a due date of Q1, 2020.

Product Manager: Nick Leritz
nleritz@neea.org
503.688.5455

Product	4	Comm/Market	5	Program	5
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Residential

EMERGING TECHNOLOGY PROJECTS

Ductless Heat Pump (DHP) Product Innovations and Channel Developments

Product Description: HVAC split systems, including ductless split systems, utilize variable speed (inverter-driven) compressors and fans.

Project Objective: NEEA staff, Pacific Northwest National Lab (PNNL), Bonneville Power Administration (BPA) and Silicon Valley Power (SVP) are working on a project to identify 2-4 low cost standards of practice and/or technology solutions to maximize the annual performance of a DHP (mini-split) when installed in a home with a pre-existing heating system (electric zonal and electric forced air furnaces).

Project Update: Phase 1 is complete (identifying all use cases and currently available products). Phase 2 is complete. Phase 3 is underway (testing PNNL lab homes). Winter season data collection is complete; cooling season data collection is pending. Phase 4 is pending. Results are due in the fall of 2019.

Product Manager: Christopher Dymond
cdymond@neea.org
503.688.5454

Product	2	Comm/Market	3	Program	3
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Smart Thermostats

Product Description: Residential thermostats that control various heating and cooling equipment, utilize weather and occupancy data to better manage the systems, and engage homeowners to more closely manage energy use and comfort.

Project Objective: To develop a method to estimate energy savings for Smart Thermostats based on performance metrics. This will enable Northwest utilities to quickly screen new products for inclusion in Qualified Products Lists (QPLs) and estimate energy savings.

Project Status: This project has been adopted by the Consumer Products Strategy Steering Team. An updated research strategy has been developed and approved, and funding is being lined up for a 2019 implementation.

Product Manager: Dave Kresta
dkresta@neea.org
503.688.5459

Product	3	Comm/Market	5	Program	4
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Residential

EMERGING TECHNOLOGY PROJECTS

Thin, Lightweight Triple Pane Window

Product Description: Primary window using three panes of glass, two standard thickness and a center thin pane of glass. The thickness and weight are similar to standard, double pane windows.

Project Objective: Document product costs by component to demonstrate potential cost effectiveness, and document manufacturer engagement and interest.

Project Update: A contract is in place and documentation is expected in early Q2, 2019

Product Manager: Christopher Dymond
cdymond@neea.org
503.688.5454

Product	3	Comm/Market	1	Program	2
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Ultra-High Definition (UHD) TVs

Product Description: 4K Ultra high definition (UHD) TVs with various forms of advanced display technologies.

Project Objectives:

An updated Department of Energy (DOE) TV Test Procedure and IEC (International Electrotechnical Commission) test clip that adequately addresses existing features, such as Automatic Brightness Control (ABC) and Motion Detection Dimming (MDD) to prevent gaming of test results by manufactures and incorporates emerging technology such as UHD, True and Upscaled High Dynamic Range (HDR), Increasing panel brightness, Stand-by power, Etc.

An updated ENERGY STAR specification that addresses issues with ABC/MDD, new energy consuming features such as UHD, and accounts for the DOE test procedure and IEC test clip updates.

Project update: ENERGY STAR v.8 was released on 02/23/2018 with an effective date of 03/01/2019. The changes in this version along with minor edits to the federal test method are intended to address efficiency feature persistence and eliminate alleged gaming of testing. Work is underway to update the IEC test clip and inform more substantial edits to the federal test method to address new technology features such as HDR and connectivity.

Product	3	Comm/Market	5	Program	5
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Product Manager: Nick Leritz
nleritz@neea.org
503.688.5455



Commercial

EMERGING TECHNOLOGY PROJECTS

Advanced Research Projects Agency-Energy (ARPA-e)

Project Description: Approximately every three years, ARPA-E issues OPEN Funding Opportunity Announcements (FOAs) as a means to address the full range of energy-related technologies and fund those potentially disruptive technology concepts not currently supported through an ARPA-E focused FOA. ARPA-E selects individuals and organizations with experience in the energy sector to review and rate applications for funding. NEEA staff was invited by ARPA-E to review 20+ initial OPEN funding proposals including LED lighting, window attachments, and HVAC. The proposals gave NEEA staff visibility of a range of pre-commercialized technologies that might impact future energy efficient products for our region. As of Q1, 2019, ARPA-E is still in the phase of waiting for the awarded projects to complete their prototypes. Nothing new is out yet. In Q2 there will be summit for all past funding opportunity.

Product Manager: Chris Wolgamott
 cwolgamott@neea.org
 503.688.5484

Product	1	Comm/Market	1	Program	1
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Luminaire Level Lighting Controls (LLLC)

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

Project Update: The Next Generation Lighting Systems (NGLS) competition in 2017 and 2018 selected connected lighting for testing its installation, commissioning and energy performance in a real-world test location. Installations for retrofit kits (Competition Two) is now closed for entries; installations took place in January 2018, and the installed systems will join the Competition One systems in the Living Lab at Parson's School of Design in New York City. NEEA staff have participated as observers in the process. Competition 3 is now in discussion; we will have the new installs the summer of 2019 and also be allowing past participants to update the previously installed systems.

Product Manager: Chris Wolgamott
 cwolgamott@neea.org
 503.688.5484

Product	2	Comm/Market	3	Program	3
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Commercial

EMERGING TECHNOLOGY PROJECTS

Luminaire Level Lighting Controls (LLLC) with HVAC Control

Product Description: Luminaire level lighting controls with additional sensors and supports for HVAC control

Project Update: NEEA staff has been working with the University of Oregon IDL (Integrated Design Lab) and has found two sites for a LLLC + HVAC pilot in the Portland area. We are currently working on a scope of work to define costs and research parameters. In Q2, 2019 we would like to have agreements in place and start the pilot. NEEA staff will be monitoring a couple of pilots that include LLLC and HVAC done by Seventhwave, out of the Mid-West.

Product Manager: Chris Wolgamott
 cwolgamott@neea.org
 503.688.5484

Product	2	Comm/Market	3	Program	3
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Very High Efficiency Dedicated Outside Air Supply (VHE DOAS)

Product Description: Replacing packaged rooftop units with a combination dedicated outdoor air system, heat recovery ventilator, and high efficiency heat pump. The key distinguishing feature is the separation of ventilation from heating and cooling via Dedicated Outside Air System (DOAS) with high efficiency heat recovery ventilation (HRV) system.

Project Objectives:

- Demonstration of feasibility and savings potential in different building types and climates.
- Improved energy modeling and modeling tools for DOAS/HRV systems

Project Update:

Five pilot projects are complete with draft technical reports and case studies. Two projects completed data collection and are in analysis stage with reports expected in Q2, 2019. Two projects have equipment installed and are collecting data into Q2, 2019. Additional limited involvement projects are being sought to fill data gaps (e.g. strip retail, big box retail and primary school).

Product Manager: John Jennings
 jjennings@neea.org
 4503.688.5471

Product	5	Comm/Market	4	Program	4
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Industrial/Agricultural

EMERGING TECHNOLOGY PROJECTS

Compressed Air Saving Unit

Product description: Variable control air nozzle for compressed air open blowing applications.

Project Objectives: Savings value for Regional Technical Forum (RTF) to review.

Project update: Ten sites have been identified as 80% complete with baseline and post intervention measurements. Savings look promising in most cases: 15-30% in some. Some installations were removed due to challenges with performance in application. A report is due out at the end of Q2, 2019.

Product Manager: Geoff Wickes
 gwickes@neea.org
 503.688.5456

Product	2	Comm/Market	3	Program	3
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Pump System Assessment Certification

Product description: Certification program for key processes, important steps and proven methodologies to manage and conduct any type of pumping systems audit, available through Pump Systems Matters.

Project Objectives: Identify ways that a Pumps System Assessment Professional (PSAP) can support energy savings.

Project update: Pump Systems Matters (PSM) has completed all required activities to get a certification up and running except having 50 people sit for the exam to validate the exam and the process. PSMs is looking for willing applicants to participate who would like to review the Body of Knowledge and sit for the exam. Contact Geoff Wickes at NEEA or Mark Sullivan at the Hydraulic Institute. msullivan@pumps.org

Product Manager: Geoff Wickes
 gwickes@neea.org
 503.688.5456

Product	2	Comm/Market	3	Program	5
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Cross-Sector

EMERGING TECHNOLOGY PROJECTS

Combination Hot Water and Space Heat (Gas & Electric)

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

Electric:

- CO2 refrigerant split system – Sanden Eco-Runo
- 410a refrigerant integrated system – Chiltrix

Gas:

- Condensing gas integrated system – NTI
- Vapor Compression Heat Pump – Intellichoice, m-Trigen
- Stirling cycle heat pump – boostHEAT, Thermolift
- Internal combustion engine (ICE) driven heat pump – Tecogen Illios, Blue Mountain Energy
- Absorption heat pump – Stone Mountain Technologies Inc. (SMTI), Robur

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.

Project Status: Electric

- Eco-Runo: Eight Sanden 2.25-ton Eco Runo heat pump systems have been installed. Data has been collected for two years on about half and less for the rest of the units. The first project report (draft) is expected in May, and the remaining due by Q3, 2019

Project Status: Gas

- Robur - Absorption Air Source Heat Pump: Two Robur units were installed and commissioned in a large retirement facility located in Salem, OR. Field testing will run through November of this year with a final report complete in Q1, 2020.
- Blue Mountain Energy - ICE Heat Pump: The engine and sub-assembly development and integration of all system components was completed in Q1. Three prototype units are being built for verification of system performance in Q2. Product testing is expected to be complete by December, 2019 with a final report by Q1, 2020.
- SMTI - Absorption Air Source Heat Pump: Installation of two field test units on two homes in La Crosse, WI was completed. Monitoring of the field units continues through the remainder of this year, and a final report will be complete in Q1, 2020.
- SaltX – Thermal-Mechanical Heat Pump: The target application was changed from water heating only to a combination water and space heating application. The product requirements were documented and market investigation was completed in Q1. The planned project completion date is December, 2019, and a final report will be complete in Q1, 2020.

Product Manager: Jeff Rigotti & Christopher Dymond
 jrigotti@neea.org & cdymond@neea.org
 503.688.5494 & 503.688.5454

Product	3	Comm/Market	4	Program	2
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Cross-Sector

EMERGING TECHNOLOGY PROJECTS

Extended Motor Products (XMP)

Product Description: Integrated motor systems with optimized performance to a system curve. Includes motor, controller, and fan / pump / compressor combinations.

Fan Product Description: Fan, motor and integrated controls.

Fan Project Objectives: Develop standardized specification, testing method and label to make fan selection reflect performance and energy use.

Fan Project Update: NEEA staff hired a contractor to manage the RTF (Regional Technical Forum) analysis, and the RTF is working on getting an advisory group together. It is currently on the RTF docket for Q2, 2019.

Compressed Air Description: Compressor, motor and integrated controls.

Compressed Air Objectives: Leverage the XMP label concept to allow the marketplace to select the most appropriate air compressor for the customer application. Develop a functional label, performance measurement of wire to air metric, UES (Unit Energy Savings), through the RTF

Compressed Air Status: NEEA staff has been engaging with CAGI (Compressed Air & Gas Institute) for the last six years and they have expressed continued interest. Recently CAGI has reached out to NEEA and asked staff to present at their annual conference to better understand where the XMP effort stands for pumps.

Pump Project Objectives: Validate RTF planned savings for clear water pumps and circulators.

Project update: NEEA staff has an active working group working with the initiative team. Research is about 80% complete. PG&E assisted with funding the \$600K research project. Research findings have started to be transferred to the RTF as they become available. The research will go to the RTF for “proven” status. Savings look promising. The Hydraulic Institute database has almost 2000 pumps listed with an Energy Rated label.

Product Manager: Geoff Wickes
 gwickes@neea.org
 503.688.5456

Product	3	Comm/Market	2	Program	3
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Cross-Sector

EMERGING TECHNOLOGY PROJECTS

Split-system Heat Pump Water Heater

Product description: Split-system heat pump water heaters separate the heat pump from the water tank. These products offer a heat pump alternative for locations where the integral product doesn't fit.

Project update: Attended AHR (Air Conditioning, Heating, Refrigeration Exhibition) in Atlanta January of 2019. Several manufacturers are talking about introducing split systems, but nothing is firm or available to test at this time.

Product Manager: Geoff Wickes
 gwickes@neea.org
 503.688.5456

Product	3	Comm/Market	3	Program	4
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Switch Reluctance Motors

Product Description: A Switched Reluctance Motor (SRM) is a type of stepper motor, an electric motor that runs by reluctance torque. It is easier to control and has greater efficiency at part load conditions.

Project Objective: Document efficiency potential for the northwest including considerations for savings from applications where a gear box or belt are eliminated.

Project Update: A report is expected in Q3, 2019

Product Manager: Mark Rehley
 mrehley@neea.org
 503.688.5499

Product	4	Comm/Market	3	Program	3
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Cross-Sector

EMERGING TECHNOLOGY PROJECTS

Variable-Capacity Split System Heat Pumps

Product Description: A split-system heat pump based on the successful inverter-driven technology found in ductless heat pumps.

Project Objective: Develop and validate a test procedure to generate an accurate seasonal COP (Coefficient of Performance) value heat pumps. This project is a collaboration of NEEA, PG&E (Pacific Gas & Electric), BPA (Bonneville Power Administration), Purdue University, 7 Canadian utilities, Natural Resources Canada and the Electric Power Research Institute (EPRI), with the Canadian Standards Association.

Project Update: The CSA (Canadian Standards Association) EXP-07 test procedure was published and is now available for free on the CSA website https://store.csagroup.org/?cclcl=en_US. NRCAN (Natural Resources Canada) and NEEA have contracted Underwriter Laboratories in Plano, TX to conduct testing of roughly 12 cold climate heat pumps using the new test procedure. Data is being shared and additional resources are being sought from other utilities interested in the improved test procedure.

Product Manager: Christopher Dymond
cdymond@neea.org
503.688.5454

Product	3	Comm/Market	3	Program	4
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Window Attachments

Product Description: Products that attach to existing low performance windows to increase their energy performance; includes films, blinds, storm windows, secondary glazing systems, awnings, etc.

Project Objective: Assess the energy savings and product performance of low-e surface applied films.

Project Description: In Q2, 2019, PNNL (Pacific Northwest National Lab) will install and test in-place, on an occupied administrative building, the newest generation of hard-coat, washable Low-e Surface Applied Films (SAF). This physical testing will evaluate technical, qualitative, and product “fit for use” durational performance including visual and thermal comfort improvements. The testing will occur for 9 to 12 months through seasonal changes and temperature extremes.

Product Manager: Mark Rehley
mrehley@neea.org
503.688.5499

Product	3	Comm/Market	3	Program	3
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Definitions

MARKET & COMMERCIAL READINESS

	Level 1: Pre-commercial	Level 2: Limited	Level 3: Niche	Level 4: Growing	Level 5: Wide
Supply Chain Maturity & Market Demand	Not commercially available or limited, pre-commercial availability	Commercially available outside of region Requires special order Limited market awareness	Commercially available in NW from 1 manufacturer through standard channels Niche market demand	Commercially available in NW 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



Mark Rehley

Sr. Manager, Emerging Technology & Product Management

mrehley@neea.org
503.688.5499



Christopher Dymond

Sr. Product Manager

cdymond@neea.org
503.688.5454



Chris Wolgamott

Sr. Product Manager

cwolgamott@neea.org
503.688.5484



Dave Kresta

Sr. Product Manager

dkresta@neea.org
503.688.5459



Geoff Wickes

Sr. Product Manager

gwickes@neea.org
503.688.5456



Jeff Rigotti

Sr. Product Manager, Natural Gas

jrigotti@neea.org
503.688.5494



John Jennings

Sr. Product Manager

jjennings@neea.org
503.688.5471



Nick Leritz

Sr. Product Manager

nleritz@neea.org
503.688.5455

TOGETHER We Are Transforming the Northwest

