

2018 Q2

Emerging Technology Quarterly Report

IN THE SPOTLIGHT:

What's New



In Q1, 2018, NEEA staff received information about several high efficiency electric motors, including a new version of switch reluctance motor that provides improved variable capacity efficiency and control. We have the electric vehicle market to thank for lowering the cost of power electronics, making these new motors cost effective. While this motor technology holds promise, currently only small motors are commercially available. Stay tuned for updates on these and other motors as we get more data on their performance, cost and sizes. As always, let us know if you see other technologies that you find interesting.

Thank you!

~ Mark Rehley, Sr. Manager ~

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Readiness Levels*

AT A GLANCE

Ratings based on 1=low & 5=high



Residential

	PRODUCT PERFORMANCE*	MARKET/COMMERCIAL*	PROGRAM*
Combo Electric Hot Water & Space Heat - CO2 (Carbon Dioxide)	1	1	1
Connected Thermostats	3	5	4
Ductless Heat Pump Product Innovations and Channel Developments	2	3	3
Ultra-High Definition TVs	3	5	5



Commercial

Luminaire Level Lighting Controls	2	3	3
Luminaire Level Lighting Controls with HVAC Control	2	3	3
Very High Efficiency DOAS	6	4	4



Industrial/ Agricultural

Compressed Air Saving Unit	2	3	3
Pivot Commissioning	1	1	1
Pump Operator Certification	2	3	5



Cross-Sector

Advanced Research Projects Agency - Energy (ARPA-e)	1	1	1
Extended Motor Products	3	2	3
Inverter Driven Packaged Terminal Heat Pump	1	3	1
Split-system Heat Pump Water Heater	3	3	4
Switch Reluctance Motors	3	3	3
Window Attachments	3	3	3

*Full Readiness Level Definitions provided on pages [9](#) & [10](#)

***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

Combo Electric Hot Water and Space Heat - CO2 (Carbon Dioxide)

Product description: An integrated appliance providing space and water heating with CO2 as a refrigerant

Project update: Seven Sanden combined space and water heating systems have been installed so far, with an eighth scheduled for installation in the first week of April. The eighth site will be a forced air site, installed in a recent-model Energy Star manufactured home in Northern Idaho. A few more sites are needed, so please contact Charlie Stephens (information below) or Ken Eklund at WSU (360 956-2019, or eklundk@energy.wsu.edu) if you are interested in partnering on this project.

To date, the heat pump units and water heater tanks have performed well, with the only problems evidenced so far being control system component failures (aquastat, relay, system control circuits, etc.). Pump energy use is important to overall energy use, the systems in colder climates seem to perform better than in warmer climates, and the team has seen significant differences in the capabilities of installers.

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Product	1	Comm/Market	1	Program	1
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Connected Thermostats

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

Project Update: Over 50 people from around the region convened in Portland on January 11th to delve into the world of Smart Thermostats. A complete workshop recap is available [here](#). Next step will be to present the findings to the Consumer Products Regional Market Strategy Steering team on May 2nd. Based on direction from the Steering team, NEEA will work through it's normal Portfolio process to develop a NEEA intervention strategy.

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Product	3	Comm/Market	5	Program	4
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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 Updates:

- **Quick Connect:** The project was completed Q1 2018. Four field test installations were completed with good functionality, no leaking of refrigerant lines, but some installation changes due to fixed line set. Very little data and no standards are available for quick connectors, adding complexity to this product configuration. The recording of a webinar is available.
- **Direct Distribution Project:** NEEA staff collaborated with Haier, owner of GE Appliances, to sell their systems through a direct to installer packaged approach as a way to reduce costs. Several contractors and utilities have expressed interest, and Haier is considering how to resource this pilot project.
- **Maximizing Mini-Split Performance:** NEEA staff are working with PNNL on a project to determine what controls or training approach can maximize the use of the mini-splits when installed in displacement mode.

- **Defrost Investigation:** Recent winter weather revealed the potential for DHPs under foggy conditions to dramatically drop in capacity. An updated cold climate DHP specification and recommended practices are in development, and NEEA staff are working with manufacturers to identify possible solutions.

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Product	2	Comm/Market	3	Program	3
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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 update: ENERGY STAR v8 was finally 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. Additionally, work on updates to the IEC (International Electrotechnical Commission) test clip as well as to inform more substantial edits to the federal test method are underway to address new technology features such as HDR (high dynamic range) and connectivity.

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Product	3	Comm/Market	5	Program	5
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Commercial

EMERGING TECHNOLOGY PROJECTS

Luminaire Level Lighting Controls (LLLC)

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

Project Update: The Next Generation Lighting Systems (NGLS) competition in 2017 selected connected lighting for testing its installation, commissioning and energy performance in a real world test location. 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 and judges.

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Product	Comm/Market	Program	
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Luminaire Level Lighting Controls (LLLC) with HVAC Control

Product Description: Luminaire level lighting controls with additional sensors and supports for HVAC (heating, ventilation, and air conditioning) control

Project Update: A couple of manufacturers have extended their luminaire level lighting control systems to also control HVAC systems. NEEA staff are working with these manufacturers to identify one or two sites to test the concept of LLLC for HVAC. Our goal is to have a site located in Q2, 2018 and to start testing before the end of the year.

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Product	2	Comm/Market	3	Program	3
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Commercial

EMERGING TECHNOLOGY PROJECTS

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. Key distinguishing feature is the separation of ventilation from heating and cooling via Dedicated Outside Air System (DOAS) with high efficiency heat recovery ventilation system.

Project Update: Nine projects are underway around the region. Eight projects have complete installations, and the project for Hillsboro School District is under construction. The Hillsboro Schools project will be the first to employ the full range of VHE DOAS technologies developed as part of the project (Heat Recovery Ventilation [HRV], Variable Refrigerant Flow [VRF] for heating and cooling, ventilation zoning, and Smart Building Gateway).

Four projects will have a technical report with analysis of a full year of performance data by Q1, 2018. The first case study is complete and case studies for the next 3 projects are at various stages of completion. Data collection for the first three projects will be decommissioned in Q1.

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Product	6	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 update: The project to researched the savings value for the RTF is complete, but collection of market category shipment data is on hold pending the allocation of resources. There is still good market interest.

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Product	2	Comm/Market	3	Program	3
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Pivot Commissioning

Product description: Assessment services designed to maintain efficiency of pivot irrigation equipment

Project update: NEEA staff began to scope with market actors and utilities an investigation of pivot commissioning protocols and methods.

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Product	1	Comm/Market	1	Program	1
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Pump Operator Certification

Product description: Certification program for key processes, important steps and proven methodologies to manage and conduct any type of pumping systems audit

Project update: The Hydraulic Institute (HI) is continuing to work on getting enough pump system assessment professionals to take the test to validate the exam. Following this, NEEA staff will access the projects to determine if energy was saved and if the certification is useful to our region.

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Product	2	Comm/Market	3	Program	3
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Cross-Sector

EMERGING TECHNOLOGY PROJECTS

Advanced Research Projects Agency-Energy (ARPA-e)

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. Later this year NEEA staff will review the second round of full proposals. The proposals give NEEA staff visibility of a range of pre-commercialized technologies that might impact future energy efficient products for our region.

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Product	1	Comm/Market	1	Program	1
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Extended Motor Products (XMP)

Pumps Project: The Initiative Start for pumps was completed Q1, 2018 with unanimous approval by RPAC (Regional Portfolio Advisory Committee). The pumps initiative started for fractional to 200hp clear water pumps and circulators. Pumps is now moved out of product category.

Fan Product Description: Fan, motor and integrated controls

Fan Project Updates: Work on the development of standardized specification, testing and label to make the fan selection process reflective of higher performance in more applications has begun. NEEA Staff is verifying and validating the Fan Energy Index (FEI), market assessment of installed base, market channel and regional potential savings. The Target market is 1-200hp fans for commercial and industrial applications, and is heading towards an RTF (Regional Technical Forum) “planning measure.”

The estimated savings are 125 aMW at this point, with a lot of room remaining. The intended out come for this project is the development of FEI, specification, test procedure and market facing label and searchable database.

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Product	3	Comm/Market	2	Program	3
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Cross-Sector

EMERGING TECHNOLOGY PROJECTS

Inverter Driven Packaged Terminal Heat Pump (IPTHP)

Product description: All-in-one packaged heat pumps that use inverter driven variable refrigerant compressors found in mini-split systems. Similar to conventional packaged terminal air conditioners (PTAC) found in many hotels but significantly quieter and more efficient.

Project Update: In Q4, 2017 modeling analysis showed that IPTHPs have good savings potential if they have cold temperature performance. NEEA staff continues to look for inverter driven PTHPs that have a defrost strategy. The National Renewable Energy Lab (NREL) is developing a mini-split version of a PTAC that NEEA staff hope to use in a field test in Q4 of 2018. Friedrich has a variable speed version of their Vert-I-Pak that NEEA staff is considering for the new CSA Heat Pump test procedure

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Product	1	Comm/Market	3	Program	1
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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: Lab testing has begun on the VKIN split system heat pump and is expected to be done in April. Preliminary results will be available shortly thereafter to determine compliance with the Advanced Water Heater Specification.

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Product	3	Comm/Market	3	Program	4
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Cross-Sector

EMERGING TECHNOLOGY PROJECTS

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 Description: NEEA staff are reviewing documentation by manufacturers of switch reluctance motors (i.e. Software Motor Corporation). The technology looks promising but is only available in small motor sizes. NEEA staff are interested in estimate energy savings for motor driven systems assuming SRMs are used exclusively in the region.

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Product	3	Comm/Market	3	Program	3
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Window Attachments

Product Description: Products that attach to primary windows to increase their energy performance including films, blinds, storm windows, secondary glazing systems, awnings, etc.

Project Description: NEEA staff are now finalizing a savings potential and economic analysis of Low-e Surface Applied Films (SAF). A computer energy modeling study was commissioned and the preliminary report is initially estimating a building savings range of from 5 to 12%. NEEA staff also closely following new product research and development including a suspended laminated films light bending dynamic films for a lightweight Secondary Glazing Systems (SGS) product.

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Product	3	Comm/Market	3	Program	4
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Definitions

MARKET & COMMERCIAL READINESS

	Level 1	Level 2	Level 3	Level 4	Level 5	
Supply Chain Maturity / Product Availability	Not commercially available or limited, pre-commercial availability	Commercially available outside of the Northwest Requires special order in Northwest	Commercially available in NW from 1 manufacturer through standard channels	Commercially available in NW from at least two manufacturers Stocked throughout the region	Commercially Available from 2+ manufacturers, well developed supply chain Widely and easily available	
Presence of Market Failures / Lack of Market Maturity	N/A	Existing market not ready, but similar to other successfully transformed markets warranting further efforts Limited market awareness	Limited market research suggests market failures/barriers and opportunities to intervene Growing market interest	Market characterization provides details on barriers and opportunities, some barriers already being addressed Growing desire for product	Market is starting to function well and appears on path to sustainable, financial viability	

PRODUCT PERFORMANCE READINESS*

	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Energy Savings Viability	Concept not validated	Concept validated	Limited assessment	Extensive assessment	Comprehensive analysis	Approved
Fitness for Use	Claims of energy savings may not be credible due to lack of documentation or validation by unbiased experts	An unbiased expert has measured technology characteristics and factors of energy use through one or more tests in typical applications with a clear baseline	An unbiased expert has measured technology characteristics and factors of energy use through one or more test in typical applications with a clear baseline	Additional testing in relevant applications and environments has increased knowledge of performance across a broad range of products, applications, and system conditions	Results of lab and field tests have been used to develop methods for reliable prediction of performance across a broad range of products, applications, and system conditions	Protocols are established and approved (by reaching RTF “approved” level)
RTF Measure Status (if applicable)		Planning	Planning	Provisional	Provisional	Proven

Definitions cont...

PROGRAM READINESS

	Level 1	Level 2	Level 3	Level 4	Level 5	
Cost Effectiveness	N/A	Not cost effective, but preliminary analysis shows a pathway to cost effectiveness	Not cost effective, but shows pathway to cost effectiveness with higher volumes, more competition, improved technology	Marginally cost effective levels	Cost effective	
Program Delivery/ Interventions	No program design	Limited program design	Preliminary program design, small-scale pilots	Program design complete, larger scale pilots underway	Ready for full-scale programs	
Risk Assessment (Technical, 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 in place	



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TOGETHER We Are Transforming the Northwest

