*Newsletter / June 10*

# Q2 2026: Emerging Technology

## Highlights

The Q2 2026 Emerging Technology Newsletter showcases the product management team's impactful work supporting the emerging technology program at NEEA, including:

- Selecting new field sites to study Luminaire Level Lighting Controls (LLLC) integration with HVAC system controls. These field studies will help to refine savings estimates compared to modeling efforts and begin testing the technology as a load flexibility resource.
- Partnering with The Motors Coalition to develop and align on the Power Index metric for motors with variable speed controls, including drives, through its member energy efficiency advocates and motor industry organizations.
- Continuing research on digital display technology with a focus on commercial displays and monitors. This new phase of work will launch into a technology landscape and include targeted product features and integrated system testing. This effort will also develop guidance for policy and test methodology for this product segment.
- Conducting field studies on:
    - Integrated dual fuel residential water heaters to assess user experience
    - Residential tri-mode heat pump to understand the capability of system controls
    - Gas high-efficiency dedicated outdoor air system to study system performance

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

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

### *RECENT AND UPCOMING PRODUCT COUNCILS*

- *April 14, 2026 – Advanced Heat Pump Savings Rate Modeling*
- *April 28, 2026 – Ductless Heat Pumps & Demand Response*
- *June 16, 2026 – Tri-Mode Heat Pumps*
- *June 23, 2026 – Room Heat Pump Savings*
- *June 30, 2026 – Advanced Heat Pump Coalition Webinar*

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

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## Building Envelope

### Secondary Window Research and Field Study — Blake Ringeisen

#### DESCRIPTION

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

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

**Fuel Type**: Electric + Natural Gas

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|---|---|---|---|
| ***Project Status*** | *The contractor GTI Energy continues to add to its list of manufacturer secondary window offerings and recently hosted the first Technical Advisory Council meeting, where attendees provided comments on product costs and performance. Additionally, GTI Energy submitted its preliminary techno-economic analysis of secondary window systems to the California Energy Commission (CEC) for review.* | | |
| ***Project Objectives*** | *Primarily funded by the CEC, this multi-year, co-funded project led by GTI Energy seeks to:*<br>• *Advance high-performance window technologies by addressing the retrofit technical and cost challenges such as replacement cost, existing window size and weight incompatibilities, and durability.*<br>• *Demonstrate increased energy performance with a U-Factor ≤ 0.13, Solar Heat Gain Coefficient (SHGC) ≤ 0.20, Visual Transmittance (VT) > 0.42, and decreased HVAC energy consumption by at least 15% compared to current HVAC energy use with existing single-pane windows.*<br>• *Reduce installation costs compared to code-compliant windows.*<br>• *Accelerate high-performance window adoption in the retrofit market through direct partnerships with manufacturers, suppliers and others.* | | |
| ***Readiness Levels*** | ***Product**: 4* | ***Commercial/Market**: 5* | ***Program**: 4* |

## Building Envelope

### *Skinny Wall Retrofit Panel System Development* — *Blake Ringeisen*

#### *DESCRIPTION*

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

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

**Fuel Type:** Electric + Natural Gas

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|---|---|---|---|
| ***Project Status*** | *This project will not proceed to further stages because co-funder priorities have shifted.* | | |
| ***Project Objectives*** | • *Determine retrofit parameters affecting thermal performance, air, vapor and moisture drainage, and weather-resistive barriers.*<br>• *Evaluate panel concept with defined design characteristics.*<br>• *Demonstrate the ability to fabricate full-scale, prefabricated prototype panels retrofitting a 10-by-20-foot mockup wall, including door, window and corner features.*<br>• *Demonstrate the energy performance benefits of the technology.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 1* | ***Program**: 1* |

## Building Envelope

### *Advanced Prefabricated Zero Carbon Homes Field Study* — *Blake Ringeisen*

### *DESCRIPTION*

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

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

**Fuel Type:** Electric

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|---|---|---|---|
| ***Project Status*** | *Contractor GTI Energy is participating in discussions around site selection. CEC will need to approve these sites for work to resume.* | | |
| ***Project Objectives*** | *Perform techno-economic analysis using as-built advanced home costs within this project as well as scaled future costs assuming broad adoption of energy efficiency and demand response technologies.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 2* | ***Program**: 1* |

## Consumer Products

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

#### *DESCRIPTION*

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

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

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

**Fuel Type**: Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *Final peer-reviewed monitors and displays report is complete and will be published in Q3.* | | |
| ***Project Objectives*** | • *Influence adoption of key aspects of the NEEA test method and approach internationally.*<br>• *Support ongoing discussions of on-mode power levels backed by TV test data within the TV Voluntary Agreement.*<br>• *Achieve ENERGY STAR adoption of NEEA-developed test procedure and methodology for monitors and displays, with buy-in by industry stakeholders including major manufacturers and energy efficiency advocates.*<br>• *Succeed in having the new test procedure inform an update to the U.S. DOE federal energy test standard.* | | |
| ***Readiness Levels*** | ***Product**: 4* | ***Commercial/Market**: 5* | ***Program**: 4* |

## Consumer Products

### *Residential Laundry Field Study* — *Wendy Preiser*

#### *DESCRIPTION*

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

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

**Fuel Type:** Electric + Natural Gas

| | | | |
|---|---|---|---|
| ***Project Status*** | *The final report is available on neea.org.* | | |
| ***Project Objectives*** | *Gain insights that will allow updates to energy savings opportunities, inform current ENERGY STAR specification development, inform future U.S. Department of Energy (U.S. DOE) rulemakings, and facilitate collaboration with other partners to replicate the study in their territories.* | | |
| ***Readiness Levels*** | ***Product**: 5* | ***Commercial/Market**: 5* | ***Program**: 5* |
| ***Link to Reports*** | Residential Laundry Field Study | | |

## Consumer Products

### *Combo Washer-Heat Pump Dryer Testing* — *Wendy Preiser*

#### *DESCRIPTION*

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

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

**Fuel Type:** Electric + Natural Gas

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|---|---|---|---|
| ***Project Status*** | *Consumer adoption of all-in-one units continued to be strong. This research was rescoped to understand potential post-purchase dissatisfiers that might impact long-term advances in heat pump dryer technology. Lab testing on one of three units is complete.* | | |
| ***Project Objectives*** | *Test equipment to understand actual performance and energy consumption compared to U.S. DOE and ENERGY STAR estimates, examining if:*<br>○ *Cycle times fall within reasonable expectations*<br>○ *Usage instructions are clear*<br>○ *Maintenance/cleaning instructions are clear and reasonable*<br>○ *Lint accumulation impacts performance and energy use over time*<br>○ *Connectivity impacts cycle time and energy use performance* | | |
| ***Readiness Levels*** | ***Product**: 4* | ***Commercial/Market**: 5* | ***Program**: 5* |

## Consumer Products

### *Residential Refrigerator Test Procedure Exploration* — *Wendy Preiser*

### *DESCRIPTION*

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

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

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

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *Contracting is complete. Phase 1 sampling plan is complete. Sample procurement has begun. Testing began in Q2 2026.* | | |
| ***Project Objectives*** | *Help the project team:*<br>• *Advance refrigerator savings opportunities by supporting energy-efficient technologies, leveraging data for future comments on test procedures and ENERGY STAR specifications.*<br>• *Develop a plan to influence test procedure updates that reflect energy savings of advanced inverter compressors and other advanced technologies.*<br>• *Identify an alternative refrigerator test procedure that has a similar level of burden to the current U.S. DOE approach but is more representative of real-world use, revealing the benefits of new technology.* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 3* | ***Program**: 2* |

# HVAC

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

### *DESCRIPTION*

**Product:** Variable speed heat pumps (VSHPs) are designed to be highly efficient when running under low loads. Some heat pumps are 40%–50% more efficient than single-speed systems under low load conditions, which account for over 60% of the operating hours of a properly sized system in the Northwest.

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

**Fuel Type:** Electric

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| ***Project Status*** | *All phases of this investigation are complete, and the summary report is now included in the link below.* | | |
| ***Project Objectives*** | *Core project objectives are to determine the incremental costs of VSHPs compared to baseline and to determine why some VSHPs exhibit significantly better part-load (low-load) operating performance compared to others.*<br>• *Phase 1 of the project reviewed existing publicly available data.*<br>• *Phase 2 included conducting a virtual teardown of equipment to compare a dozen different heat pumps based on technical service manuals.*<br>• *Phase 3 consisted of lab testing several variable speed heat pumps to validate and understand how heat pumps operate under part-load conditions.*<br>• *Phase 4 included performing a physical teardown of subcomponents to provide insight on component differences, manufacturing costs and components that enable low-load efficiency.* | | |
| ***Readiness Levels*** | ***Product**: 4* | ***Commercial/Market**: 3* | ***Program**: 3* |
| ***Link to Report and Presentations*** | • Preliminary findings presented at the Product Council on April 2, 2024.<br>• Summary presentation given at the Product Council on March 25, 2025.<br>• *Low-Load Efficient Heat Pump Investigation: 2020 – 2025 Summary Report* | | |

# HVAC

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

### *DESCRIPTION*

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

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

**Fuel Type:** Electric + Natural Gas

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| ***Project Status*** | *NEEA hosted a Product Council illustrating project findings and is working with partners to publish additional in-depth modeling.* | | |
| ***Project Objective*** | *Understand energy and cost savings from centrally ducted dual-fuel systems across various representative applications in the Northwest.* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 4* | ***Program**: 1* |
| ***Link to Report*** | *ResHVAC Dual-Fuel Systems Analysis* | | |

# HVAC

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

### *DESCRIPTION*

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

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

**Fuel Type:** Electric + Natural Gas

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| ***Project Status*** | *Team has successfully collected data and will start plans to close the project. Final report is expected in Q3 2026. Team provided brief insights during Efficiency Exchange 2026.* | | |
| ***Project Objective*** | *Understand the efficiency of residential dual-fuel systems, which combine highly efficient gas water and space heating with an electric heat pump. By using an integrated controller, these systems can enhance fuel flexibility and dynamically manage energy use, offering both energy cost savings and grid flexibility during times of peak demand.* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 4* | ***Program**: 1* |

# HVAC

## Cold Climate Room Heat Pump Field Testing

Christopher Dymond

### DESCRIPTION

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

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

**Fuel Type:** Electric

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| ***Project Status*** | • *Field study data collection period has ended, all data loggers are being retrieved and analysis has begun. Data being used to generate energy savings estimates.*<br>• *Final interviews are being scheduled for June.*<br>• *ACEEE paper and Final Report are under development.* | | |
| ***Project Objectives*** | • *Obtain lab test data collected from manufacturers to characterize heat performance vs. ambient temperature.*<br>• *Conduct field testing to gather real-world operational data (runtime, consumer acceptance, etc.).* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 3* | ***Program**: 2* |

## HVAC

### *Tri-Mode Heat Pump Study* — *Christopher Dymond*

#### *DESCRIPTION*

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

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

**Fuel Type:** Electric

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| ***Project Status*** | *The market research survey and interviews with manufacturers are complete. The final report is being edited. A NEEA Product Council presentation is scheduled for June 16.* | | |
| ***Project Objectives*** | • *Conduct a detailed market survey of tri-mode heat pumps available in North America, Asia and Europe.*<br>• *Generate a rough estimate of energy savings potential.*<br>• *Conduct a preliminary evaluation of market barriers for these systems through interviews with subject matter experts.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 3* | ***Program**: 2* |

## HVAC

### *Tri-Mode Heat Pump Demonstration* — *Christopher Dymond*

#### *DESCRIPTION*

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

The system in this project consists of a single outdoor multi-head split system with three to four indoor ductless heads in which one of the heads is a water heater with a wraparound heat exchanger. This solution is uniquely appropriate for apartment buildings and relatively small new homes. A key benefit of this product subcategory is that the tank and controls are comparatively simple and low cost when compared to fully hydronic based tri-mode systems. The customer also benefits from the ability to place the domestic water tank inside a space without any ventilation needs or impact on interior comfort.

**Project:** This project is a collaboration with a major U.S. original equipment manufacturer to demonstrate a refrigerant-based distribution system tri-mode heat pump system as a low-cost, simple alternative for small residential buildings (under 2,000 square feet), a configuration common in southern Europe.

**Fuel Type:** Electric

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|---|---|---|---|
| ***Project Status*** | *Early stage, with site identification and field study scope of work under development.* | | |
| ***Project Objectives*** | • *Demonstrate viability of this product type in new residential and multifamily construction.*<br>• *Gather customer and installing contractor experience and identify potential pitfalls and unique market challenges.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 3* | ***Program**: 2* |

## HVAC

### *Duct Loss Meta Study* — *Christopher Dymond*

#### *DESCRIPTION*

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

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

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

**Fuel Type:** Electric + Natural Gas

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| ***Project Status*** | *Review of literature and current technology options were conducted in August 2025. Interviews with subject matter experts completed in Q1 2026. A summary report is expected for Q3 2026.* | | |
| ***Project Objectives*** | • *Provide an updated summary of current methods through secondary research and simple analysis.*<br>• *Conduct a comparative analysis of existing methods.* | | |
| ***Readiness Levels*** | ***Product**: 2-5* | ***Commercial/Market**: 2-4* | ***Program**: 4* |

# HVAC

## ResHVAC AI and Digital Twins

Christopher Dymond

### DESCRIPTION

**Product:** Decision making for residential HVAC systems

**Project:** Current large language model prompts can produce inconsistent results. This investigation will explore how large language models (LLMs) will shift how residential HVAC systems are purchased, how products are selected, and how contractors interact with customers. The product being investigated is the development of a default and open-source model context protocol which can provide the framework for LLMs to use a variety of available data sources and tools. The premise is that a reduction in transactional friction and improved outcomes can be achieved if LLMs know what resources and data are needed to respond to customer inquiries.

The first phase includes market assessment and development of a minimum requirements document that defines what AI needs to know. The second phase (if approved) will develop a mockup demonstration of a model context protocol which leverages existing data resources from DOE, AHRI, NEEP, open-source load calculation tools and digital twins of homes to assist with LLM inquiries about what HVAC system is appropriate for a particular home.

**Fuel Type:** Electric + Natural Gas

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| ***Project Status*** | *The first phase of market assessment and minimum requirements has begun as well as scheduling a kickoff meeting with future advisory committee.* | | |
| ***Project Objectives*** | • *Provide an updated summary of current market actors and products through secondary research.*<br>• *Define what an LLM needs to aid in accurate HVAC system selection.*<br>• *Develop a prototype that demonstrates capability and reduced transactional friction for programs and contractors.* | | |
| ***Readiness Levels*** | ***Product**: 1* | ***Commercial/Market**: 2* | ***Program**: 2* |

# HVAC

## Gas High Efficiency DOAS Energy Savings Modeling

Adam Gage

### DESCRIPTION

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

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

**Fuel Type:** Electric + Natural Gas

| | | | |
|---|---|---|---|
| ***Project Status*** | *Report documenting findings is available on neea.org (see link below).* | | |
| ***Project Objectives*** | • *Evaluate the energy use and savings of gas high efficiency DOAS in new and existing commercial and residential buildings.*<br>• *Identify how climate and building type impact energy savings potential.*<br>• *Understand the gas efficiency savings potential for gas high efficiency DOAS in the Northwest.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 3* | ***Program**: 2* |
| ***Link to Report*** | *Gas High Efficiency DOAS Energy Savings Analysis - Northwest Energy Efficiency Alliance (NEEA)* | | |

# HVAC

## Gas High Efficiency DOAS Field Study — Adam Gage

### DESCRIPTION

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

**Project:** The Department of Administrative Services building in Salem, OR is a real-world application of a gas high efficiency DOAS. NEEA has installed metering equipment and will observe the HVAC system's performance over a 12-month period (March 2026-February 2027). Findings will be used to refine modeling and inform real-world savings.

**Fuel Type:** Electric + Natural Gas

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|---|---|---|---|
| ***Project Status*** | *Installation of metering equipment is complete. Data pipeline and visualization dashboard operating to monitor performance.* | | |
| ***Project Objectives*** | • *Evaluate the energy use and savings of gas high efficiency DOAS in a deep office building retrofit independent of NEEA's influence.*<br>• *Validate and inform modeling assumption to better predict savings across building types.*<br>• *Better understand the gas efficiency savings potential for gas high efficiency DOAS in the Northwest.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 3* | ***Program**: 2* |

## Lighting

### *LLLC Including HVAC Control Field Test* — *Chris Wolgamott*

#### *DESCRIPTION*

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

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

**Fuel Type:** Electric + Natural Gas

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|---|---|---|---|
| ***Project Status*** | *Data collection was extended to gain more heating season data and will continue through Q3 2026. The project is getting a lot of interest from multiple extra-regional agencies, including the U.S. DOE, Pacific Northwest National Laboratory and Design Lights Consortium. Project staff are working with funders to find additional sites for more field testing. The final report is expected by the end of Q3 2026.* | | |
| ***Project Objectives*** | • *Determine whether additional HVAC energy savings are possible from more granular sensors included in each general lighting fixture.*<br>• *Analyze data using simple thermostats (as a cost-effective way to achieve LLLC + HVAC) and LLLC to help reduce HVAC usage.* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 3* | ***Program**: 3* |

## Motor-Driven Systems

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

#### *DESCRIPTION*

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

**Project:** Specific speed (Ns) is a dimensionless design index that is being actively researched as a better method for fan selection. Ns is based on operating point pressure and airflow parameters to design impeller type and determine whether a fan design should be centrifugal, axial or mixed flow. NEEA is investigating whether utilizing specific speed for fan selection can lead to a higher FEI. NEEA is researching factors and design criteria that can lead to fan selections that result in a higher FEI.

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *This project is underway.* | | |
| ***Project Objective*** | *Better understand factors that can influence fan selection and how they might impact FEI.* | | |
| ***Readiness Levels*** | ***Product**: 5* | ***Commercial/Market**: 4* | ***Program**: 2* |

## Motor-Driven Systems

### Process Pump Research — Kristen Aramthanapon

### DESCRIPTION

**Product:** Process pumps are an extended motor product (XMP) that meet American Society of Mechanical Engineers (ASME) B73.1 specification and are generally used to pump light, non-viscous fluids.

**Project:** The current DOE regulation requires covered clean water pumps to report a Pump Efficiency Index (PEI) metric in their federal database. Process pumps are excluded from this requirement, even though many are used to pump clean water. NEEA has compared a number of process pumps by attempting to calculate PEI metrics using their pump curves.

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *The results of this work are expected to be published in 2026.* | | |
| ***Project Objective*** | *Identify energy savings opportunities for pumps that are not classified as clean water pumps.* | | |
| ***Readiness Levels*** | ***Product**: 5* | ***Commercial/Market**: 4* | ***Program**: 2* |

## Motor-Driven Systems

### Power Drive System Metric Validation

Kristen Aramthanapon

### DESCRIPTION

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

**Project:** NEEA is assessing the savings opportunity for multiple synchronous reluctance magnet-assisted motors with embedded speed control and a compact footprint for industrial applications.

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *Research is in progress and is expected to be completed in Q3 2026.* | | |
| ***Project Objective*** | *Establish a Power Index (PI) metric for variable torque applications that can be used for rating motors and power drive systems.* | | |
| ***Readiness Levels*** | ***Product**: 5* | ***Commercial/Market**: 4* | ***Program**: 2* |

## Water Heating

### Combination HVAC and Water Heating System Field Study — Chuck Karras

#### DESCRIPTION

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

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

**Fuel Type:** Natural Gas

| | | | |
|---|---|---|---|
| ***Project Status*** | *Project is complete and the final report is available on neea.org.* | | |
| ***Project 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.* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 2* | ***Program**: 2* |
| ***Link to Report:*** | *Gas-Fired Absorption Heat Pump: Hybrid System Approach Field Study - Northwest Energy Efficiency Alliance (NEEA)* | | |

## Water Heating

### Commercial Domestic Hot Water Systems Modeling — Chuck Karras

#### DESCRIPTION

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

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

**Fuel Type:** Electric + Natural Gas

| | | | |
|---|---|---|---|
| ***Project Status*** | *This investigation modeled multiple variables across a range of values to present findings on all combinations. The first draft of the final report clearly shows that GHPs (and especially modulating GHPs) provide an efficiency increase compared to baseline gas equipment and an end-user cost benefit compared to similar systems using baseline gas, electric resistance and electric heat pump-based systems.*<br><br>*Final draft of the report is expected in Q2 2026.* | | |
| ***Project Objective*** | *Understand energy and cost savings from thermally driven heat pumps as replacements for boilers, natural gas-fired storage tanks and tankless systems across various representative applications in the Northwest.* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 3* | ***Program**: 2* |

## Water Heating

### Commercial Domestic Hot Water System Field Study (Dual Fuel) — Chuck Karras

#### DESCRIPTION

**Product:** An efficient dual-fuel water heating system that pairs an electric heat pump water heater with traditional gas-fired water heating equipment to deliver central hot water.

**Project:** NEEA is conducting a field study to assess central water heating technologies across multiple target building types. These field tests take place in a multifamily/transitional housing environment. The project involves installing a central electric heat pump water heater working in conjunction with standard commercial gas-fired water heating equipment.

**Fuel Type:** Electric + Natural Gas (Dual Fuel)

| | | | |
|---|---|---|---|
| **Project Status** | *This dual-fuel project (an electric heat pump in conjunction with gas water heaters) was installed in Q4 2025. Issues with the electric heat pump and recommendations from the manufacturer after visiting the site to switch out the unit have delayed collection of meaningful data. The team is discussing alternative options for the current electric heat pump to ensure that ongoing testing at this site yields higher quality results.* | | |
| **Project Objective** | *Understand energy and cost savings from dual-fuel commercial water heating systems across various representative applications in the Northwest.* | | |
| **Readiness Levels** | ***Product**: 3* | ***Commercial/Market**: 3* | ***Program**: 2* |

## Water Heating

### Commercial Domestic Hot Water System Field Study (GHP hybrid) — Chuck Karras

#### DESCRIPTION

**Product:** An efficient gas-only commercial water heating system that pairs a gas-fired absorption heat pump with traditional gas-fired water heating equipment to deliver central hot water.

**Project:** NEEA is conducting a field study to assess central water heating technologies across multiple target building types. This field test is taking place in a multifamily housing environment. The project involves a gas-fired absorption heat pump combined with standard commercial gas storage water heating equipment.

**Fuel Type:** Natural Gas

| | | | |
|---|---|---|---|
| **Project Status** | *Project has pivoted to a new GHP manufacturer as the originally planned manufacturer of the GHP has halted all business operations. The newly selected unit is expected to be installed imminently.*<br><br>*Data collection began in late Q2.* | | |
| **Project Objective** | *Understand energy and cost savings from a hybrid gas-only commercial water heating system across various representative applications in the Northwest.* | | |
| **Readiness Levels** | ***Product**: 3* | ***Commercial/Market**: 3* | ***Program**: 2* |

## Water Heating

### Commercial Domestic Hot Water System Replicated Field Study (GHP hybrid) — Chuck Karras

#### DESCRIPTION

**Product:** This research expands the testing of a Gas Absorption Heat Pump to another target building type (hotels). Because identifying volunteer testing locations for this study has been unsuccessful, this effort is being replicated via a lab study that simulates a typical hotel water use profile.

**Project:** NEEA is conducting a lab study to replace the planned field study to assess central water heating technologies across multiple target building types. This research is designed to replicate a typical hotel environment and involves a gas-fired absorption heat pump in conjunction with standard commercial gas storage water heating equipment.

**Fuel Type:** Natural Gas

| | | | |
|---|---|---|---|
| **Project Status** | *A vendor has been selected to perform this work through an RFQ and RFP process. The final contract discussions are underway with the expectation that this work can begin in late Q2.* | | |
| **Project Objective** | *Understand energy and cost savings from a hybrid gas-only commercial water heating system across various representative applications in the Northwest.* | | |
| **Readiness Levels** | ***Product**: 3* | ***Commercial/Market**: 3* | ***Program**: 2* |

## Water Heating

### Residential Dual-Fuel Water Heater — Chuck Karras

#### DESCRIPTION

**Product:** A residential dual-fuel hot water heater that natively includes both a 120-volt electric heat pump and a gas-fired burner with integrated controls in a single water heater.

**Project:** NEEA is an active partner in a lab study conducted by GTI Energy to assess the performance of this new dual-fuel residential water heating product. This novel residential product has a similar footprint to typical residential water heaters and can be plugged into a standard outlet.

**Fuel Type:** Electric + Natural Gas

| | | | |
|---|---|---|---|
| ***Project Status*** | *Preliminary data has been received from the lab conducting this research which validates the product's high efficiency performance. Complete lab testing data and the final report are anticipated in early Q3.*<br>*Installation and field testing in two volunteer Washington homeowner locations is expected to begin in Q3 (one in NW Natural territory and one in Puget Sound Energy territory).* | | |
| ***Project Objective*** | *Identify energy and cost savings from a dual-fuel residential water heater across multiple load profiles, product operation modes, input water temperatures and climates.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 1* | ***Program**: 1* |

## Water Heating

### Split-System Heat Pump Water Heater Innovation Prize — Adam Gage

#### DESCRIPTION

**Product:** Water heating is one of the largest energy uses in U.S. homes, but affordable and energy-efficient options are not yet available for compact spaces today. Small-capacity split-system heat pump water heaters would solve this problem and extend efficiency benefits to people living in homes and apartments where more modest, small, electric resistance water heaters are commonly found. NEEA estimates these systems can reduce water heating electricity use by up to 60%, saving individual households hundreds of dollars annually while significantly lowering emissions. Split-system heat pump water heaters represent a major market opportunity, with 1 to 2.4 million units in potential annual sales.

**Project:** The Hot Water Innovation Prize is a national competition designed to hasten the development of affordable and easy-to-install split-system heat pump water heaters for space-constrained installations. The Prize is led by the Northwest Energy Efficiency Alliance (NEEA) with support from a national coalition of energy efficiency organizations. The Prize focuses on real-world feasibility and market readiness, rewarding manufacturers for the development of turnkey systems with an indoor tank and an outdoor compressor. This makes high-efficiency water heating possible where today's heat pump water heaters don't fit.

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| **Project Status** | *Hot Water Innovation Prize split-system heat pump water heater prototypes were tested by a third-party laboratory and reviewed by a panel of judges. A winner will be announced at ACEEE's Summer Study this August. NEEA is actively seeking co-sponsors to join the effort.* | | |
| **Project Objectives** | • *Measure the performance of product prototypes in a third-party laboratory.*<br>• *Holistically evaluate prototypes' abilities to meet customers' needs. (considering performance, cost, product dimensions, etc.).*<br>• *Name contest winner and facilitate demonstration projects.* | | |
| **Readiness Levels** | ***Product**: 4* | ***Commercial/Market**: 2* | ***Program**: 2* |

## Water Heating

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

#### DESCRIPTION

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

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

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *Northwest site recruitment has concluded. The six sites include a restaurant, a school, an office, a multi-use commercial space, a university art studio, and a city hall.* | | |
| ***Project Objectives*** | • *Evaluate field performance.*<br>• *Determine associated costs.*<br>• *Collect building owner perspectives.*<br>• *Identify best practices.* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 4* | ***Program**: 2* |

## Other/Special Projects

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

#### *DESCRIPTION*

**Product:** Connecting autonomous behind-the-meter products and applications. Current pipeline of technologies includes water heating, line voltage thermostats, residential variable-speed heat pumps, electric vehicle (EV) charging, battery storage, commercial buildings and street lighting.

**Project:** NEEA received special funding to explore connected devices capable of operating under flexible load management. These devices can be used for traditional demand response opportunities and may also enable leveraging future energy imbalance markets and potential carbon markets. NEEA is beginning by focusing on open architecture connected pathways that work with the marketplace and operate with limited awareness by the end customer. Efforts include improving ANSI/CTA-2045-B to reduce costs and increase adoption, working with industry stakeholders to adopt The AHRI standard 1430 and AHRI 1530 (which apply to residential and commercial water heaters, respectively) and working with the AHRI on developing and enhancing standards for residential and commercial HVAC systems.

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *The final report for the residential connected water heater field study will be available in Q3 2026. The study confirms that both heat pump water heaters and electric resistance water heaters are reliable dispatchable resources that support load shifting and load shedding and can be managed to maintain customer comfort and minimize risk of snapback impacts to the grid when events end.*<br><br>*Collaboration with industry stakeholders to advance standards for residential and commercial HPWHs, such as CTA-2045-B Level 2, continues. The industry is actively exploring updates to other connectivity standards to further enhance grid flexibility.*<br><br>*Modeling efforts to quantify the load-shifting benefits of variable speed heat pumps (VSHP) in Northwest climate zones and residential building stock concluded in January 2026. Research confirms that multiple manufacturers offer products that can participate in utility programs and that VSHPs can be a flexible resource during the coldest and warmest times of the year (report link below).*<br><br>*Research is advancing on other technologies with high potential for load shifting, including battery storage, smart-grid-enabling technologies and EV chargers.* | | |
| ***Project Objective*** | *Create pathways for utilities to access behind-the-meter loads that can flex to help support the integration of intermittent resources on the grid.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 5* | ***Program**: 2* |
| ***Link to Webinar*** | *Variable Speed Heat Pump Load Flexibility Modeling* | | |

## Other/Special Projects

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

#### *DESCRIPTION*

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

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

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *The committee continues to work on revising the standard and uncovering additional opportunities for improvements. A rough draft is now anticipated later in 2026.* | | |
| ***Project Objectives*** | • *Harmonize connectivity standards among several existing standards, including CTA-2045-B, OpenADR 3 and Home Connectivity Alliance.*<br>• *Ensure that equipment supports the needs of utilities with the necessary capabilities to respond to a variety of grid requests while maintaining customer comfort.*<br>• *Establish industry guidelines for product performance to minimize the need for and use of electric resistance auxiliary heating.* | | |
| ***Readiness Levels*** | ***Product**: 2* | ***Commercial/Market**: 2* | ***Program**: 1* |

## Other/Special Projects

### CSA Z5050/AHRI-1390 Commercial Smart Grid Interface — Eric Olson

#### DESCRIPTION

**Product:** CSA Z5050/AHRI-1390 applies to communication, infrastructure and system functionality related to the implementation of energy management strategies for demand response-ready commercial buildings and equipment.

**Project:** NEEA is participating in the CSA Z5050/AHRI-1390 standards technical committee. The committee seeks to develop a binational standard that defines the communication protocols, data requirements, and equipment performance for grid-connected commercial buildings when participating in load flexibility programs.

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *The committee was recently reformed and is working to establish common goals for the U.S. and Canada, as well as specific responsibilities for each organization in developing the standard.* | | |
| ***Project Objectives*** | *Develop a binational standard to enable commercial buildings to be grid-connected and participate in utility flexibility programs.* | | |
| ***Readiness Levels*** | ***Product**: 1* | ***Commercial/Market**: 3* | ***Program**: 1* |

## Other/Special Projects

### *AHRI-1300 Performance Rating of Commercial Heat Pump Water Heaters Standard*

***Adam Gage***

### *DESCRIPTION*

**Product:** AHRI standard 1300 applies to factory-assembled commercial heat pump water heaters (CHPWH), defined as equipment to provide potable or service hot water using alternate sources of energy, such as air, water and ground (geothermal) by means of electrically driven, mechanical vapor compression refrigerant systems.

**Project:** NEEA is participating in the AHRI standards technical committee. Activities are centered on defining a test methodology for the CHPWH and a seasonal metric to represent its performance.

**Fuel Type:** Electric

| | | | |
|---|---|---|---|
| ***Project Status*** | *The committee continues to work on revising the standard, and uncovering additional opportunities for improvements.* | | |
| ***Project Objectives*** | • *Harmonize test methodology with the existing ENERGY STAR methodology and NEEA's Advanced Water Heating Specification.*<br>• *Define a seasonal performance metric for the CHPWH that accounts for performance across a range of operating conditions.* | | |
| ***Readiness Levels*** | ***Product**: 3* | ***Commercial/Market**: 5* | ***Program**: 3* |

# Readiness Level Criteria Definitions

*Rating Scale: 1 = Low, 5 = High*

### PRODUCT PERFORMANCE READINESS

| | Level 1: Unvalidated | Level 2: Engineering Validation | Level 3: Lab Validation | Level 4: Limited Field Validation | Level 5: Confirmed |
|---|---|---|---|---|---|
| **Savings Reliability & Fitness for Use** | Manufacturer claims energy savings but not validated by unbiased experts | Concept validated by unbiased expert via technical review and engineering calculations | Independent lab testing and product features and energy use in typical applications with clear baseline established | Lab and small-scale testing across broader range of applications and systems conditions | Reliable prediction of performance across the range of intended applications; fully evaluable savings via established protocols by regional or national bodies |

### COMMERCIAL / MARKET READINESS

| | Level 1: Pre-Commercial | Level 2: Limited | Level 3: Niche | Level 4: Growing | Level 5: Wide |
|---|---|---|---|---|---|
| **Supply Chain Maturity & Market Demand** | Not commercially available or limited, pre-commercial availability | Commercially available outside of region; Requires special order; Limited market awareness | Commercially available in Northwest from one manufacturer through standard channels; Niche market demand | Commercially available in Northwest from at least two manufacturers; Growing market demand | Commercially available from 2+ manufacturers, well developed supply chain across region; Wide market demand |

### PROGRAM READINESS

| | Level 1: None | Level 2: Exploratory | Level 3: Preliminary Pilots | Level 4: Full-Scale Pilots | Level 5: Ready |
|---|---|---|---|---|---|
| **Cost Effectiveness Knowledge** *(technical and market potential, product cost at scale, non-energy benefits)* | None or very limited | Performance readiness at 2; initial market size calculated (units per year) | Performance readiness at 3; product cost at-scale estimated | Performance readiness at 4; product costs at or trending towards at-scale levels; preliminary estimates of non-energy benefits | Performance readiness at 5; CE calculations based on solid estimates or proven values |
| **Market & Program Knowledge** | None or very limited | Preliminary research exposes barriers and/or or similarities to other successfully transformed markets warranting further efforts | Market research illuminates barriers and opportunities to intervene; preliminary logic model developed; small-scale pilots | Formal market characterization underway; larger-scale pilots to test program elements and barrier removal | Formal logic model developed; market characterization and large-scale pilots prove out program design and barrier removal |
| **Risk Assessment** *(market, program regulatory)* | No risk assessment | Limited risk assessment | Preliminary risk assessment complete; major categories of risk understood | Well-developed risk assessment; no major unresolved risks | Periodic risk assessment process in place |

## Questions? Contact Us


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