Beyond the Burner: Scaling Hidden Efficiency Opportunities in Rooftop Units

Rebecca Hovey, Energy 350
Chris P. Smith, Energy 350
Meg Waltner, PE, Energy 350
Jason Jones, Northwest Energy Efficiency Alliance

ABSTRACT

Packaged rooftop units (RTUs) are used in approximately 60% of all air-conditioned commercial floor space in the US, with about 60% of these units using natural gas for heating, including over 400,000 units in the Northwest. With such high market penetration, implementing efficiency in RTUs has the potential to generate significant energy savings. For over 6 years, The Northwest Energy Efficiency Alliance (NEEA) has been working to improve the efficiency of RTUs by understanding and promoting equipment options that are not captured by current test procedures and are underrepresented in the RTU market. The options are increased cabinet insulation, reduced damper leakage, and energy recovery ventilation (ERV). These non-burner measures have the potential to achieve significant energy savings in the Northwest climate: 10% on average for insulation and reduced damper leakage and 27% for ERVs. NEEA's early efforts included modeling and lab testing to identify these measures and the development of a specification based on this modeling for an advanced performance RTU. Following the modeling, NEEA conducted a year-long field study capturing real-world performance data. Currently, NEEA is in the early stages of program development, with initial incentive offerings and case study development of additional installed advanced performance RTUs.

This paper shares the results to date from this effort, including the results of modeling, lab testing, and early field demonstration projects, as well as the early learnings from scaling NEEA's Advanced Performance RTU program in the Northwest.

Introduction

Packaged rooftop units (RTUs) are the most common HVAC solution for commercial buildings in the US. RTUs condition 60% of commercial floorspace and consume about one fifth of all commercial building energy (DOE 2017). RTUs are a relatively simple design option for commercial buildings because they can provide heating, cooling, and ventilation from one packaged piece of equipment. While different configuration options are available, most RTUs provide cooling via a direct expansion (DX) cooling system and heating via a non-condensing gas furnace. Heat pump RTUs are available from multiple manufacturers and are becoming more common, but the vast majority of RTU shipments are still gas RTUs.[1]

RTU are installed in a variety of commercial building types, sizes, and locations. NEEA recently conducted an assessment using the 2018 Commercial Building Energy Consumption Survey (CBECS) for their National RTU modeling study and determined the most common building types with RTUs are retail, office, schools, and warehouses (NEEA 2025). Roughly 60% of RTUs are shipped to US climate zones 4 and colder (CUAC ASRAC 2022), which NEEA determined are climate zones with heating dominated energy consumption in RTUs (NEEA

[1] Estimate based on NEEA interviews of RTU manufacturers in 2022.

2025). Over 80% of HVAC Energy Use Intensity (EUI) is represented by gas consumption for gas RTUs installed in moderate to cold climates (NEEA 2025). Even in warm climates like San Diego, CA, and El Paso, TX, around half of the HVAC EUI is represented by gas consumption, which is counter-intuitive because these are locations where the commercial building cooling load is larger than the heating load. However, when considering energy *consumption* (fuel use) instead of building *load*, gas consumption dominates in all but the hottest climates because DX cooling is an inherently more efficient system than a gas furnace on a site energy basis.

Because of high market saturation and large energy use, RTUs represent a significant opportunity for energy savings. This is particularly true for gas RTUs, since most RTUs are gas-fired and very little progress has been made on gas saving measures for RTUs over the last three decades. This is demonstrated by the federal efficiency standards for gas furnaces in RTUs[2], which have only increased from 80% in 1994 to 81% in 2023 (10 CFR 431.77) – meaning regulated furnace efficiency has only changed by 1% in the last 30 years.

Fortunately, there are multiple commercially available RTU upgrades that can reduce energy consumption that are not simply increasing furnace or cooling efficiency. This paper includes a compilation of key research studies on RTU energy savings opportunities, then summarize NEEA's efforts to increase market adoption of RTUs that capture these opportunities and how these efforts fit into national efforts to scale up advanced performance RTUs.

NEEA RTU Initiative Background

NEEA is an alliance of more than 140 utilities and energy efficiency organizations that works with the market to advance energy-efficient technologies to reduce energy waste in ways that promote reliability, comfort, and economic benefits for Northwest consumers and businesses. The Northwest region includes the states of Washington, Oregon, Montana, and Idaho. For the last 6+ years, NEEA's Advanced Performance RTU market transformation initiative has sought to improve commercial RTU performance in the Northwest by increasing the availability and market share of energy saving products. In this effort, NEEA first examined condensing gas RTUs with high furnace efficiency (>90%) as a key energy saving technology but found technical and financial challenges to scaling them to the commercial market (NEEA 2019). NEEA then expanded their focus to non-furnace efficiency improvements, namely increased enclosure insulation, reduced outside air (OA) damper leakage, and ventilation heat or energy recovery. NEEA's research found that these three features can significantly reduce HVAC load, resulting in energy savings greater than those possible from condensing gas furnaces and without the same technical challenges (NEEA 2020). Unlike condensing technology, load reduction strategies save energy regardless of heating fuel-type and therefore are an opportunity for both gas and heat pump RTUs.

In response to the energy savings opportunity from these three measures, NEEA developed a draft RTU specification (via NEEA's market-facing BetterBricks platform) which established two tiers of advanced performance RTU (BetterBricks 2024), detailed in Table 1 below. After establishing technical requirements for advanced performance RTUs, NEEA met with manufacturers to vet the system requirements and ensure the specification was technically

[2] Commercial RTU furnace efficiency is regulated under DOE's Commercial Warm Air Furnace (CWAF) product category.

feasible. NEEA then conducted multiple types of stakeholder outreach to understand the RTU supply chain and current availability of products that met the specification in order to understand possible barriers to increasing their market share. NEEA also conducted regional and national modeling to better understand the potential energy savings of RTUs that met its specification (NEEA 2025).

Table 1 summarizes the specification requirements and presents average HVAC energy savings for RTUs with these features (NEEA 2025). The energy savings are calculated by comparing the energy consumption of a gas or heat pump RTU that meets the specification compared to a standard replacement RTU of the same type (i.e. a baseline gas RTU or a baseline heat pump RTU that meets federal minimum efficiency standards). Energy savings are total HVAC savings, including both gas (when applicable) and electric energy use. While the magnitude of savings varies by climate zone, building type, and heating type, advanced performance RTUs meeting NEEA's specification always saves energy (NEEA 2025). This widespread national applicability is a key benefit of NEEA's Advanced Performance RTU Specification.

Table 1: Advanced Performance RTU system requirements and average HVAC energy savings

Performance Tier	**System Requirements**	**National Average HVAC Energy Savings**		**Northwest HVAC Energy Savings (CZ 4C)**	
		Gas RTU	HP RTU	Gas RTU	HP RTU
Tier 1	R-12 enclosure insulation Low-leak OA dampers	9%	8%	10%	8%
Tier 2	Tier 1 requirements plus Heat or energy recovery	20%	12%	36%	21%

While 9-10% energy savings for Tier 1 may seem relatively modest, this is comparable to the approximately 10% gas savings possible from a condensing furnace, which has long been thought of as the only efficiency measure for gas RTUs and has the technical and cost hurdles mentioned previously. Given the prevalence of gas RTUs and the need to achieve gas savings in the region, these are significant savings for the Northwest.

In the next section of this paper, we share findings from RTU lab and field testing completed to validate the modeled energy savings referenced above. The final section of this paper summarizes program work in the Northwest and lessons learned from attempts to scale the program.

Findings from Lab and Field Testing

The majority of NEEA's research into the energy savings possible from RTUs has leveraged building energy models. These models are robust after multiple iterative improvements and third-party collaboration and represent average savings for many different commercial building types. However, it is still valuable to further validate this modeled performance with real-world performance data, which provides further validity to the market and demonstrates that energy savings can be realized in practice. Measured energy impacts will validate the modeling results and increase confidence that the benefits of these features are grounded in reality. In this section we will share the results of two research studies to measure the impacts of advanced performance RTUs: laboratory testing and a field study.

Enclosure Loss Lab Testing

NEEA collaborated with Natural Resources Canada (NRCan) and Natural Gas Technologies Centre (NGTC) to lab test three gas RTUs (NGTC 2022). The goal of study was to investigate heat losses from the RTUs. The three modes of heat loss examined in the study were:

- Air leakage through the enclosure
- Air leakage from outside air dampers (when closed), and
- Thermal transmittance through the enclosure

The testing looked at three RTUs from different manufacturers with relevant features listed in Table 2. The lab used an existing enclosure heat loss test procedure, AHRI 1350[3], as the basis for the test method. Full details on the lab set up and how the testing was run are included in NGTC's report, so we'll focus on the results and relevant findings in this summary.

Table 2: Lab test RTU characteristics

RTU Type	Base Model	Mid-Efficiency	High-Efficiency
Nominal cooling capacity	5 tons	5 tons	7 tons
Supply airflow	2,000 cfm	2,000 cfm	2,800 cfm
Furnace efficiency	81%	81%	94% (condensing)
ERV	No	Yes	Yes
Enclosure quality	Basic (1/2" insulation R2)	Good (1" insulation R7)	High (2" insulation R12)
Outside air damper quality	Basic (no rating)	High (Class 1A)	High (Class 1A)

Overall, the testing was successful at measuring air leakage, thermal transmittance, and total heat loss rates for all three units, and at isolating air leakage from the dampers versus the enclosure. There is a lack of published researched on the impacts of enclosure air leakage, so this lab testing provided new insights into the importance of enclosure construction, showing that the magnitude of energy loss from enclosure air leakage was comparable to damper leakage and low insulation R-value. Knowing the relative energy impact of each feature might identify which feature is a larger opportunity for savings than another. This would inform NEEA's specification and program focus.

Air leakage results

The total air leakage results for each RTU are included in Table 3. These results are helpful to show what component is the largest driver of heat loss for each unit.

Table 3: Damper and enclosure air leakage test results per RTU

[3] AHRI 1350: Mechanical Performance Rating of Central Station Air-handling Unit Casings. This test procedure is designed for larger custom air handlers

Air Leakage Result	Base Model	Mid-Efficiency	High-Efficiency
Total enclosure leakage losses at 1 in w.c. (CFM for the casing area – excluding damper)	42	26	188
Total damper leakage losses at 1 in w.c. (CFM for the damper area)	199	9	10
Total leakage losses at 1 in w.c. (CFM for the entire unit area (casing + damper))	241	35	199

Notably, damper leakage is the highest rate of heat loss for the Base Model unit, but enclosure leakage is the highest rate of heat loss for the Mid-Efficiency and High-Efficiency units. It's not fair to compare between units with the values with these results, because the High-Efficiency unit is a larger unit physically and capacity wise, so it makes sense that a larger enclosure would contribute more to heat loss rates.

Table 4 presents results normalized by surface area (i.e., CFM/100ft^2) which allows for comparisons in heat loss rates between units.

Table 4: Damper and enclosure air leakage test results normalized by surface area

Air Leakage Result	Base Model	Mid-Efficiency	High-Efficiency
Enclosure leakage rate at 1 in w.c. (CFM/100 ft² casing - excluding damper)	67	28	127
Damper leakage rate at 1 in w.c. (CFM/100 ft² damper)	4,115	150	129
Total leakage rate at 1 in w.c. (CFM/100 ft² casing + damper)	355	38	127

These results show how leaky the unrated economizer damper is on the Base Model compared to the outside air dampers on the Mid-Efficiency and High-Efficiency units. The Base Model damper leakage rate is also 4-10 times the code-minimum damper leakage rate in ASRHAE 90.1. [4] This is an important finding because there is an assumption that all RTUs sold today are "code minimum" RTUs. In reality, more than half of the RTU market is replacements, and equipment replacements don't always count as a building renovation that would trigger energy code compliance. Low leak dampers are a commonly available option because they are a code requirement, but this is an illuminating example of how code requirements do not guarantee complete market change.

Thermal transmittance and total heat loss results

The lab study also provided results on heat loss rates for air leakage and thermal transmittance, summarized in Table 5. Details on the methodology to test and calculate these results are available in the full lab test report (NGTC 2022). To compare across components, the air leakage rate (cfm) was converted into a heat loss rate (effective UA, Btu/h°F) based on the temperature differential inside and outside the unit during testing.

[4] The minimum damper leakage rate in ASHRAE 90.1 varies by climate zone. It is 400 cfm/100ft^2 for colder climates (e.g., Minneapolis, MN) and 1000 cfm/100ft^2 for moderate climates (e.g., Seattle, WA).

Table 5: Heat loss effective UA (Btu/h°F) from air leakage and thermal transmittance

Component	Base Model	Mid-Efficiency	High-Efficiency
Enclosure leakage	43.9	27.2	197.9
Damper leakage	207.9	9.4	10.5
Thermal transmittance	30.7	26.2	60.7
Total	**282.5**	**62.8**	**269.1**

For all units, air leakage was a larger contributor to total heat loss rates than thermal transmittance. Interestingly, the unit with the highest insulation levels (High-Efficiency) had worse thermal transmittance than the mid-level insulation (Mid-Efficiency). The lab noted this unexpected result and hypothesized that because the HMU was a larger unit, it used larger fans to mix the internal air during testing, which could have removed potential cold pockets of air and therefore increased the rate. Construction style, which was not directly assessed in this study, could also have impacted heat loss rates by causing more or less thermal bridging at the corners and connection points of the enclosure. Overall, the heat loss impact of varying levels of insulation is inconclusive from this study, however, we can learn that thermal transmittance in general is likely a lower heat loss rate than air leakage.

Key findings and new research questions

By comparing these heat loss rates, we learned a lot about the relative energy impact of three RTU enclosure components: damper leakage, enclosure leakage, and enclosure thermal transmittance. Notably, damper leakage will be the largest contributor to heat loss rate for a unit if the unit has leaky dampers. However, this is a low hanging fruit improvement as low leak dampers are a readily available option. If a unit has low leak dampers, then the casing leakage represents the largest heat loss rate. Thermal transmittance was a smaller contributor to heat loss than air leakage.

While these findings are insightful, there are a couple big caveats to the findings of this study: the results were not weighted by time spent in a given condition and the test conditions were not dynamic. They do not represent average annual heat loss rates, but a point in time measurement with very specific laboratory conditions. Therefore, we do not know the true impact on annual fuel consumption from these RTU components. If you factored in time spent in a given mode into the results, that may shift the priority of each feature. For example, this lab test looked at the heat loss rate of outside air dampers when they are closed, but RTU dampers are usually only closed during unoccupied periods (i.e. at night). In contrast, the unit is losing heat through the enclosure during all hours of the day. The ARHI 1350 test method also prescribed specific temperatures and pressures for testing, but in the real world the outside air temperature and internal static pressure of the unit would vary. Temperature differential heavily influences thermal transmittance rates, and air leakage rates are significantly impacted by static pressure.

Overall, the testing showed that enclosure air leakage is significant and is worth further consideration into the opportunity for energy savings along with damper leakage and enclosure insulation. Additionally, these results demonstrated there is significant variation enclosure construction quality between products available on the market.

KBOO field study

After lab testing was completed, NEEA decided to pursue a field study with two of the lab-tested RTUs (Better Bricks 2025). The purpose of this field study was to demonstrate the energy savings possible from advanced performance RTUs in a real-world installation. A local radio station in Portland, OR (KBOO) was identified as a good candidate for the study because their existing RTUs were at end of life and occupants were experiencing thermal discomfort from poor temperature control. KBOO readily agreed to host the study in exchange for new equipment.

Two of KBOO's end of life RTUs were replaced with an advanced performance gas RTU with low-leak dampers, moderate insulation, and integrated ERV (the Mid-Efficiency unit in Table 2) and a standard gas RTU with basic dampers and minimal insulation (the Base Model in Table 2). The study also added a bolt-on ERV to the standard gas RTU. The objectives of the research were to:

- Measure if overall savings in the field aligned with energy modeling and lab research.
- Determine how savings in the field were distributed between insulation, damper, and ERV performance.
- Determine if a bolt-on ERV has the same performance as an integrated ERV.

After installing the new equipment and monitoring for about a year, our team documented a list of qualitative and quantitative findings – these findings were a mix of expected and unexpected.

The project resulted in 64% whole building gas savings for the site, which confirmed the significant savings possible from RTU upgrades. These savings were calculated from a comparison of baseline and study period utility bill data for total site gas consumption and an algorithm to normalize for typical weather[5]. The team was not able to isolate the savings to specific features of the RTU; however, they did identify factors that likely contributed to the savings:

- Ductwork improvements leading to reduced leakage and wasted heat.
- ERV's reduced the heating load significantly. These components resulted in 19% savings for the advanced performance unit and 23% savings for the standard unit.
- Furnace efficiency improvements. Even though the new units had similar rated efficiencies to the ones they replaced, it is likely that the existing units did not perform at their rated efficiencies.
- Reduced damper leakage and improved insulation. The team estimates these were a smaller component of overall energy savings, while measuring a lower heat loss rate in the advanced performance unit with these features.
- Other operational factors not captured in the analysis, such as shifting operations or internal loads.

In addition to measured energy savings, the study provided valuable lessons about site conditions and logistical challenges from retrofitting existing RTUs with advanced performance RTUs. After discovering the extremely poor condition of the existing ductwork, repairs were completed

[5] The RTU's were the major gas load on the radio station building, with the only other gas use hot water for sinks. However, the site had some atypical electrical loads that likely impacted gas use for HVAC.

before the new units could be connected to the air distribution system. Ductwork improvements were an unexpected impact of the study, and these repairs ended up being the largest driver of energy savings. Site improvements (like ductwork repairs) are a different type of market intervention to the equipment upgrades that are the focus of NEEA's RTU program, so the team did not change the direction of the program based on this result. However, if we learn this is a common issue for replacement RTU's, the overlap with the RTU program could be to have educational materials that prepare consumers for related costs/logistics that might come up with an RTU replacement.

The study also illuminated the effects of weight increases on project cost and overall feasibility. Both new units weighed enough more than the RTUs they were replacing to trigger a structural analysis of the building. The contractor advised the project team to select a much lighter unit to avoid that barrier. This was not an option with the units already purchased. The analysis found the roof could support the new equipment as-is. It cost $4,628 in structural engineering costs and resulted in a minor delay. In a worst-case scenario, the analysis could have required costly structural upgrades and led to further delays that could've derailed the entire project.

Another key takeaway was the variability of equipment costs. While the costs for this field study are not fully reflective of the market, since they were based on existing units available from the lab testing, they still provide a cost data point. Notably, the advanced performance unit was over four times the cost of the standard unit without the bolt-on ERV. Then for the standard unit, the bolt-on ERV was just as expensive as the unit itself. The major driver of such a large incremental cost for the advanced performance unit is the fact that it was a premium product. To bring down costs in the long-term, advanced performance features need to be integrated into mass market units at the factory and avoid field installation.

Overall, the project did not provide quantified energy savings between baseline and efficient cases, but did demonstrate significant energy savings potential, and provided information about the barriers to increased uptake of advanced performance RTU. Another overall finding of the study was the difficulty of measuring energy savings from advanced performance RTU features in the field and to isolate savings by individual components (i.e., damper air leakage vs. enclosure air leakage). Since advanced performance RTU features all save energy by reducing load (and therefore run hours) rather than improving operating efficiency while the unit is running, to accurately measure energy savings it is critical to establish a baseline load profile and maintain the key drivers of this load profile during the baseline and study period.

Northwest Program Launch

Based on their early energy savings research, NEEA created the Advanced Performance RTU specification (see Table 1). The lab and field testing summarized above showed that RTU with these features deliver measurable energy savings. However, products that meet the specification continue to have relatively low market adoption. In response to this low market penetration and high savings potential, NEEA officially launched a program to increase market adoption of advanced performance RTUs in late 2024.

Program goals

The short to mid-term goal of the program is to increase regional market share and installations of advanced performance RTUs. Next is to leverage those installs to validate modeled savings and generate marketable content that demonstrates the value of advanced performance RTU. This content will show that advanced performance RTUs aren't just a *viable* alternative to common RTU replacement and selection practices but the *preferred* one. Finally, the program's long-term goal is to lock in savings with a federal standard for whole unit efficiency. While the focus of the program is on savings in the Northwest, it's important to keep in mind the Northwest accounts for a fraction of the overall RTU market. Influencing such an established market takes time and starts with small steps, as outlined above.

Program design considerations

A market transformation program such as this has significantly more flexibility in its offerings than a traditional utility incentive program. At the simplest level we can offer time, money, and clout to market actors. Currently, primary program target market actors are manufacturers, manufacturer sales representatives, and independent sales representatives. To encourage participation NEEA is offering:

- Buydowns to subsidize incremental equipment costs for select early adopter projects
- Building/Data Logging/BMS Access payments to end use owners to further offset incremental costs
- Marketing materials like independent case studies for manufacturers
- Development of training and education opportunities for sales reps and their engineer and contractor customers
- Research funding to address data gaps and validate available equipment

Barriers to market transformation

To design the program, we first identify barriers, then we can get creative on how to remove that barrier with the resources we have. In this section we'll discuss four main barriers to RTU market transformation: costs, availability of products, market segmentation, and market segmentation. All three barriers are interrelated.

Costs

Increased cost is the most common barrier to the adoption of energy efficient technology across our entire industry, so it comes as no surprise that the same holds true for RTUs. Products that currently meet the specification cost more than baseline products, in some cases it's been nearly double. The reality is that the program's specified feature set is currently unavailable on a standard gas RTU which limits the program, for now, to promoting premium units that come at a premium price. It's like we're trying to get a Honda Civic with heated seats and a sunroof, but right now heated seats are only available on a BMW.

This is frustrating because we understand that increased insulation is not a particularly expensive upgrade from a raw materials standpoint, with one RTU manufacturer reporting that a double wall foam panel enclosure was actually *cheaper for them to produce* than a steel sheet metal and fiberglass insulation enclosure. However, increased insulation or adding double wall construction is rarely an option you can select to add to a single unit, and manufacturers usually make the switch to high performance enclosures full stop by re-tooling their manufacturing process for an entire product line. Re-tooling is an expensive and complex process upgrade for the manufacturer, even if the raw materials and per-unit incremental cost may be small.

Traditionally, the main reason a consumer chooses to install an RTU is because they're cheap and relatively simple to implement. NEEA has considered specification revisions to address costs and allow more standard equipment to make the compliant products list, but the tradeoff would be fewer energy savings which is out of alignment with NEEA's long-term market transformation goals.

Availability
Availability of products that include all three features of the specification (insulation, low leak dampers, and HRV/ERV) is low currently. However, certain features are more widely available than others.

- *Low leak dampers* are generally a more accessible upgrade option because some regions require them in energy code – all manufacturers offer low leak dampers as an option, and some manufactures make it a standard feature.
- *R12 insulation* is currently only available on double-walled, semi-custom, premium products, or DOAS[6] units (CEE 2023). And it's not a feature that's offered as an upgrade option because it requires manufacturers to retool their production lines (explained in Costs section above). It's an all or nothing decision for a product line.
- *Energy recovery* is a more common add on option than increased insulation – all RTU manufacturers offer this as an option on at least one of their product lines (though mostly on their premium and/or large tonnage products only). While energy recovery is an available option, uptake of this feature is still very low, less than 2% of RTU sales include HRV/ERV (CEE 2023). We learned in our field study that an HRV/ERV can add weight, installation complexity, and increase unit footprint. There is a perception that energy recovery is only for 100% OA equipment, and currently there is a knowledge barrier of commissioning, operation, maintenance, and installation – all of this likely contributes to the lower uptake of energy recovery in RTUs.

We want to see units with these features from multiple manufacturers at multiple price points, and especially in smaller capacity units since the majority of the RTU market is less than 15 tons (Grand View Research 2025). In the Next steps section of this paper, we'll talk more about what can be done to increase product availability.

Market segmentation
The RTU market is divided into two project types, replacement and plan and specifications (plan & spec). Replacement projects account for 70% of the RTU market because of the large existing installed stock of RTUs nationally (Grand View Research 2025). Replacement equipment is primarily selected based on the existing unit's cooling capacity followed by equipment availability and cost. The plan & spec segment is usually chosen for more complex building designs requiring tighter control or with unique loads (e.g., high ventilation rates). Plan & spec projects are mostly new construction with some being existing building remodels or upgrades. These segments differ in significant ways:

- Equipment sourcing: Distributors vs. equipment sales representatives

[6] Dedicated Outside Air Units (DOAS) are packaged rooftop equipment that is designed to condition 100% outside air.

- Design complexity/engineer involvement: Replacement projects rarely (if ever) involve an engineer
- Types and manufacturers of equipment that are selected: Unitary vs. applied equipment
- Equipment availability/project urgency: Replacement units are typically stocked vs built to order with plan & spec
- Overall project budget
- Product margin and seller compensation

If a manufacturer is in one lane or the other of the market, they generally stay in it. Currently advanced performance RTU equipment is almost exclusively selected for the plan & spec pathway for the aforementioned reasons. It's unlikely a customer will select an advanced performance RTU for replacement projects when so many real and perceived barriers stand in the way.

Market awareness

The final main barrier is a lack of knowledge about the energy saving features included in NEEA's spec. Generally, an "Efficient" RTU is perceived as having a high cooling efficiency rating (e.g., SEER or IEER), since this is how they're generally marketed. While some manufacturers advertise the features in NEEA's specification as energy saving, they are not known by the average customer or even some distributors and contractors.

Initial program strategy and lessons learned

Over the course of 2025, Energy 350 and NEEA (the team) worked together to develop an initial program strategy for the Northwest market. The strategy in Table 6 includes three market interventions to address the barriers identified above and increase uptake of advanced performance RTU.

Table 6: Advanced Performance RTU program strategic interventions

Action	Barrier it addresses
Facilitate case studies/field demos of units that meet the spec	*Market awareness.* Field studies will help us validate the modeled energy savings and are more tangible evidence of the benefit of these products.
Buy down unit costs to get additional projects to happen	*Increased cost.* Our intent with the initial offering is to cover most or all of the incremental equipment cost.
Have conversations with manufacturers, distributors, and mfg. reps	*Product availability and market awareness.* We hope to learn more about barriers and understand "what it would take" to increase market uptake from their perspective

The team has been implementing this strategy in 2025 and 2026, and so far has had mixed success. There have been several challenges with the strategy, including:

- Identifying replacement projects where equipment is end of life but not yet failed.
- Sourcing projects through equipment reps that offer qualifying equipment.
    - Equipment reps that sell qualifying equipment focus more on plan & spec projects given the applied nature of their products.
- Incremental cost is larger than buy down offer.

- While the initial buy down offering was enough to pique interest with equipment reps, they do not cover the full incremental cost. In this cost-adverse market, these buy-down offers have not been applied successfully.

The team is pursuing case studies and field demos by taking an active role in identifying possible sites and offering additional data stipends to cover the coordination and admin time of participating. These case studies have not because it's difficult to find a site with planned RTU replacements. An ideal project is a planned replacement scenario where the site can accommodate baseline monitoring on the existing equipment. Even if baseline monitoring is not pursued, a planned replacement is still needed so that the site can manage the increased lead time of the current advanced performance RTU products.

The team has, however, had some great conversations with sales reps, manufacturers, and possible field demo sites that provided additional insight into market dynamics and barriers. These insights will help the team revise and tailor the program strategy to be more impactful.

Next steps

In 2026 the NEEA RTU team will continue working with sales rep partners to identify sites for field studies and continue trying to influence upgrades with equipment buy downs and data monitoring stipend. However, it may be necessary to adjust the approach to buy downs and monitoring offers (e.g., amount of money, how it's offered, or who it's offered to), both in the short term to get the first few projects started, and again in the long term once the program gains some traction.

Bigger picture, there is a need to expand advanced performance RTU product availability. In order to increase market adoption, there needs to be products from a variety of manufacturers, multiple product lines, and with accessible pricing. However, the team has identified over the last few years a big challenge with product development – there is missing motivation for manufacturers to offer standard products with these energy saving features. Manufacturers have recently been redesigning their products to meet new cooling efficiency regulations and to adjust for legacy refrigerant phase out. Any design change requires significant investment of time and money by the manufacturer. Voluntary upgrades for energy efficiency reasons are understandably lower priority than required upgrades to meet regulations.

Manufacturers look for established market demand before pursuing new features in their product R&D. If customers are asking for these features, manufacturers will see an opportunity to increase market share by offering them (or conversely a risk that they will lose market share by not offering them). The NEEA RTU initiative is working to generate that market demand in the Northwest, but we're seeing that equipment buy downs and current market awareness tactics may not generate enough market demand to make a strong business case for adding the efficient features. The barriers identified to date suggest that local interventions alone are not enough to achieve market transformation.

Because of this, NEEA is also taking steps to influence the market at a national scale through codes and standards advocacy. Locking in savings with a federal standard is always the end goal for market transformation, but the team has identified that getting involved early is key to market change for RTUs because it will address missing motivation from manufacturers to increase product availability. The short-term regulatory strategy is developing a structure that incentivizes voluntary adoption of efficient features rather than a requirement that they must be added. The intent is for manufacturers to be rewarded by ensuring the energy saving benefits of these features are captured in equipment test procedures and reported in ratings. If adding insulation to an RTU results in a similar rating increase to redesigning the compressor or switching to a new refrigerant, the insulation upgrade might be an simpler or lower cost path for manufacturers to meet code or federal standards. Long-term, the team will advocate for regulations that require these features in new RTU, but it starts with making sure all features that save energy are given credit in the efficiency ratings. RTU furnace regulations have only changed 1% in the last 25 years because condensing furnaces aren't cost effective for a standard, but they're the only energy saving feature being considered.

NEEA is also working with other energy efficiency organizations, the DOE advanced rooftop unit campaign, utilities, manufacturers, and advocacy groups to share research and discuss on how we can all move as one toward our goals for RTU energy efficiency. This group of stakeholders works to reach consensus on what the end goal is and what steps can be taken, so that there is one clear set of expectations for manufacturers rather than each region or organization developing their own ask. Bringing in industry voices also ensures that recommendations are grounded in reality and are more likely to happen.

In conclusion, commercial RTU remain a major opportunity for energy savings, but it's a tough market to change. Luckly, there are many groups working on this challenge and we're not starting from zero. Advanced performance RTU are commercially available now and more are on the way. We just need to work together to create the market demand for these energy-saving products.

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