E3T Multifamily Technical Advisory Group
Scoring Results – HVAC
Technologies presented at the 9/22/2016 webinar

Ranking per criteria	Energy Recovery Ventilation	Heat Recovery Ventilation	Ducted Mini-Splits	Ductless Mini-Splits	Inverter-Driven Packaged Terminal Units
ENERGY SAVINGS	2	3	4	1	5
NON-ENERGY	1	2	4	3	5
READINESS	4	2	3	1	5
ADOPTION EASE	1	4	5	2	3
VALUE	2	3	4	1	5
TOTAL RANKING	**2**	**3**	**4**	**1**	**5**

Scores (average ratings)	Energy Recovery Ventilation	Heat Recovery Ventilation	Ducted Mini-Splits	Ductless Mini-Splits	Inverter-Driven Packaged Terminal Units
ENERGY SAVINGS	3.79	3.50	3.31	4.08	2.82
NON-ENERGY	4.42	4.33	3.31	3.69	2.83
READINESS	3.43	3.75	3.54	4.15	2.58
ADOPTION EASE	3.64	3.25	3.00	3.58	3.54
VALUE	3.86	3.58	3.31	3.92	2.91
TOTAL AVERAGE	**3.83**	**3.68**	**3.29**	**3.88**	**3.08**

ENERGY RECOVERY VENTILATION

Summary	
Energy savings	3.79
Non-energy benefits	4.42
Tech readiness	3.43
Ease of adoption	3.64
Value	3.86
AVERAGE	**3.83**

How significant and reliable are the energy savings per unit?

- Additional work is needed to better characterize and quantify ERV savings relative to the energy losses associated with makeup air required for conventional exhaust fans. More data would improve credibility and reliability of savings claims.
- Potentially higher than HRV due to latent heat capture. Same limitations HRV - need for a reasonably airtight residential unit / building.
- As we create better shells, this is a necessity.
- Energy use is reduced and may be better than straight ventilation methods do to preheating the makeup air entering the unit. Using ventilation only may cause residents to use heating more often.
- If highly efficient (heat recovery and fan power).

How great are the non-energy advantages for the end user adopting this technology?

- Significant comfort and indoor air quality improvements = better health and quality of life.
- Adds opportunity for managing indoor humidity, in addition to IAQ.
- Big improvement in IAQ.
- Energy or enthalpy recovery ventilation is great for the east side of the mountains where we need humidity in our homes during the heating season. Most of the ideas of the speakers had nothing to do with the east side of the cascades however.
- Really increases the air quality within a unit by providing the fresh air in an otherwise very tight environment. Better health for occupant as well as easier maintenance for staff and resident.

How ready are the product(s) and providers to scale up for widespread use in the Pacific Northwest?

- Products are available; more education and training is needed to ensure that contractors understand the technology and proper installation and that maintenance staff understand the benefits of the technology as well as proper maintenance. Dan made a great point in his presentation about the importance of installing these without any option of occupant control -- I've heard about programs where occupants disabled ERVs because they didn't understand what they were or what purpose they served.
- They are necessary in tight homes and small homes.
- Cost is main challenge / obstacle.
- Need more variety and large US manufacturers to get engaged in highly efficient product development.

How easy is it for the end user to change to the proposed technology?

- Should be relatively straightforward and simple for maintenance personnel.
- The example of a single unit in the living room seemed very practical.

- There are still some training issues for homeowners according to some Habitat for Humanity builders I have talked to who have had the owners shut them down assuming they cost them money and then they get smells and mold.
- More difficult for retrofits.

Considering all costs and all benefits, how good of a buy is this technology for the owner?

- Health/comfort benefits will impart to tenants and may justify additional incentives for building owners. As noted above, more documentation of energy savings would help make the case.

HEAT RECOVERY VENTILATION

Summary	
Energy savings	3.50
Non-energy benefits	4.33
Tech readiness	3.75
Ease of adoption	3.25
Value	3.58
AVERAGE	**3.68**

How significant and reliable are the energy savings per unit?

- Energy savings from expelled ventilation air is reliable, but it may increase the total energy use of the building.
- Depends on many factors such as airtightness of building, placement of unit, ducting (if any). It is important to consider an "apples-to-apples" baseline to technology comparison - the presenter showed a comparison to "exhaust only ventilation", as opposed to comparing to a baseline with bathroom fan only (for an ERV case study).
- Proper commissioning is pretty important to achieve the intended result, but overall very good reliability.
- Very dependent on climate. In low heating/cooling demand climates, savings are low.
- Additional fan energy from adding heat recovery ventilation can often overwhelm the reduction in heating energy required. This is especially true if heat pumps are used for space heating. Heat recovery ventilation only makes sense if paired with air tightness measures.

How great are the non-energy advantages for the end user adopting this technology?

- This technology is "the right thing to do." Better indoor air quality is sometimes more important than energy savings or cost payback.
- This addresses a perennial issue of lack of ventilation, indoor relative humidity, condensation, and mold. Indoor air quality can be improved dramatically, without a major energy penalty.
- Balanced, distributed, filtered ventilation is the only way to get decent ventilation in sleeping areas. NEEA and WSU did a study on this in single family homes and the findings were very conclusive.
- In tight homes, provides reliable ventilation.
- Argument that balanced flow ventilation is needed in very tight construction.

How ready are the product(s) and providers to scale up for widespread use in the Pacific Northwest?

- Another technology that needs a trained installation workforce.
- Primary obstacle / barrier is cost.
- Many products are available. Installers may need training.

How easy is it for the end user to change to the proposed technology?

- It's not that easy
- Will require some redesign to incorporate into multifamily.
- Can be difficult to integrate in small apartments.

Considering all costs and all benefits, how good of a buy is this technology for the owner?

- in the NW, I would think only in the coldest climates and with the highest utility rates would this be cost effective.
- This is not a large energy measure. Maybe a significant indoor air quality measure.
- Cost is the reason I did not give a higher score for value.

DUCTED MINI-SPLITS

Summary	
Energy savings	3.31
Non-energy benefits	3.31
Tech readiness	3.54
Ease of adoption	3.00
Value	3.31
AVERAGE	**3.29**

How significant and reliable are the energy savings per unit?

- Addition of ducts impacts this relative to ductless.
- Compared to an all-electric baseline; if installed in an appropriate condition/configuration and operated properly.
- Ductless Mini-splits are more efficient, but not as versatile for some installations.

How great are the non-energy advantages for the end user adopting this technology?

- Seems that noise might be an issue for these systems, especially in smaller apartments where it is harder to install units far from sleeping areas. This has to be balanced with aesthetics for those that take issue with wall-mounted ductless units.
- Distributed air to bedrooms compared to ductless.
- Cooling, good comfort, air filtration, etc. Good stuff.
- It's a quieter system.

How ready are the product(s) and providers to scale up for widespread use in the Pacific Northwest?

- The products are there, but it seems there is still a significant learning curve for proper installation. Higher installation costs and more complicated design/installation may outweigh benefits relative to ductless heat pumps in applications other than high-end new construction.

- Issue is that installation design is a bit hit or miss.
- Products available. Cost is high
- As far as providers go, I can't answer this because I don't have first hand knowledge of the market.

How easy is it for the end user to change to the proposed technology?
- Need a designated space (attic or otherwise) for the unit and the ducts.
- Duct systems will require redesign for generally lower static pressure systems; multiple systems may need to replace single traditional systems.
- It's easier if we are talking about ductless systems that have a limited portion of ducting.

Considering all costs and all benefits, how good of a buy is this technology for the owner?
- Between OK and good?
- More expensive than DHPs, so there are challenges for multifamily. Hard sell, but a good buy.
- Based on improved efficiency compared to baseline, it's good.
- Would prefer using ductless systems over any type of ducted system.

DUCTLESS MINI-SPLITS

Summary	
Energy savings	4.08
Non-energy benefits	3.69
Tech readiness	4.15
Ease of adoption	3.58
Value	3.92
AVERAGE	**3.88**

How significant and reliable are the energy savings per unit?
- Well established in the market - partly attributable to NEEA market transformation efforts. The placement of outdoor units is important. Need for guidance to contractors - in addition to current list of approved contractors: https://goingductless.com/find-an-installer. Suggest developing a contractor best practice guide, if not already written (by NEEA, DOE, etc).
- These are excellent but need to be combined with HRVs for IAQ and efficiency.
- Proven and reliable performance/savings.
- When applied properly and used correctly and compares to an electric baseline.
- In the right application (retrofit, climate zone 2, large apartments, large envelope/floor area ratio.

How great are the non-energy advantages for the end user adopting this technology?
- Adds air conditioning option, albeit that increases electricity consumption (but less than a "window-shaker" air conditioner).
- Combined with HRVs these are best practice.
- Refer back to the cost of AC where it is not needed and the nature of the wall warts.
- Basically free cooling, good control over comfort, air filtration. All good.
- Very quiet

- Quiet, cooling, ease of use.
- Saves the cost of running ducts, plus no large holes cut into the building envelope.

How ready are the product(s) and providers to scale up for widespread use in the Pacific Northwest?
- Need more education of the building science for envelopes, IAQ, ventilation and DMSHP.
- This is becoming a very common installation across the country.

How easy is it for the end user to change to the proposed technology?
- Issue is that new units need to be installed in living spaces.
- Looks are a major obstacle.
- Once they accept the aesthetic. May not be cost effective in all floor plans/conditions because of the need for multiple units. For example, do you need one in every bedroom? Then it gets costly. Design (number of units) depends on thermal envelope integrity, presence of backup heat, climate, etc.

Considering all costs and all benefits, how good of a buy is this technology for the owner?
- Best investment for IAQ and efficiency.
- As long as natural gas is not available.
- Good value for most situations.

INVERTER-DRIVEN PACKAGED TERMINAL UNITS

Summary	
Energy savings	2.82
Non-energy benefits	2.83
Tech readiness	2.58
Ease of adoption	3.54
Value	2.91
AVERAGE	**3.08**

How significant and reliable are the energy savings per unit?
- Decent energy savings potential based on initial estimates, but much more research needed on actual energy use in the field under range of conditions. Didn't hear enough to say the savings are reliable.
- Compared to electric resistance but not to all fuels.
- Uncertain since product is new to market. It's too soon to tell.
- We need to do the lab testing on these products and follow with a pilot project with detailed M&V data before we can say much about energy savings.

How great are the non-energy advantages for the end user adopting this technology?
- Benefits relative to conventional PTACs, but hard to see much benefit (other than lower installation cost) relative to ductless HP alternative.
- Mostly just AC because the aesthetics and cost of AC are a non-energy cost, not benefit.
- Uncertain since product is new to market.

- Really just a better version of the PTAC.
- Cheapest reasonably efficient way to add cooling.

How ready are the product(s) and providers to scale up for widespread use in the Pacific Northwest?
- Not enough information to say; based on presentation seems premature.
- Looks like we should wipe out the standard single stage heat pump.
- Uncertain since product is new to market.
- IF proven in lab tests these appear to be ready and available.

How easy is it for the end user to change to the proposed technology?
- Seems like a very easy technology to sell to a hotel or multifamily given the lower cost.
- Uncertain since product is new to market.
- Easiest way to get heat pump heating into apartments.
- Adoption of this technology would be very similar to the standard type mini split if they were readily available.

Considering all costs and all benefits, how good of a buy is this technology for the owner?
- Too early to say with information available
- Good buy if there is not natural gas available. If there is gas, you are asking the customers to pay more for their heat.
- Uncertain since product is new to market. It's too soon to tell.
- The cost and less equipment outside (compared to a DHP) are what I consider the benefits of these units.