

## ECPM Motors for Single Phase HVAC Fan Applications - ET #101

Summary	
Energy savings	3.7
Non-energy benefits	2.8
Tech readiness	3.4
Ease of adoption	2.6
Value	2.9
<b>AVERAGE</b>	<b>3.1</b>

### ENERGY SAVINGS: How significant and reliable are the energy savings per unit?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	3	18%	6
3	Good	3	18%	9
4	Very Good	7	41%	28
5	Excellent	4	24%	20
Total		17	100%	63
<b>Average Rating</b>				<b>3.71</b>

Comments:

- There seem to be reliable savings.
- Few independent field tests have been performed for reliable savings. Every application will have different savings; a guide for screening cost-effective applications would be helpful. There are a few cost effective, niche applications.
- Fan laws.
- This is a highly reliable technology that provides great savings.
- Based from manufacturers statements and factual use experience from off shore use experience. As a direct comparative in most applications of real world use it appears to be consistently significant.

### NON-ENERGY BENEFITS: How great are the non-energy advantages for the end user adopting this technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	1	6%	1
2	Okay	7	44%	14
3	Good	3	19%	9
4	Very Good	4	25%	16
5	Excellent	1	6%	5
Total		16	100%	45
<b>Average Rating</b>				<b>2.81</b>

Comments:

- Low power factor, programming difficulties are greater than any soft starting benefit.
- Quieter and more reliable air flow.
- Opportunities for control and feedback are helpful, including delays for moisture/ventilation control. But the potential for automatic speed ramp-up with system friction buildup requires additional alarms to ensure energy savings.
- Often going to variable speed provides the option for improved capacity control. Care must be taken with DX cooling.
- technical requirements must be in place to recognize the average advantages
- Can be connected to digital controls

## ECPM Motors for Single Phase HVAC Fan Applications - ET #101

### TECH READINESS: How ready are the product(s) and providers to scale up for widespread use in the Pacific NW?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	2	12%	2
2	Okay	1	6%	2
3	Good	6	35%	18
4	Very Good	4	24%	16
5	Excellent	4	24%	20
Total		17	100%	58
Average Rating				3.41

Comments:

- Difficulties programming make them a difficult retrofit measure.
- It's been around.
- I believe there are several opportunities where this technology could be used, but most involve retrofitting the fan as a component into an existing system (PTACs, FCUs, EFs), which might not find an eager market, compared with replacement of the existing units.
- The cost is still on the high side, the motors are limited in size.

### EASE OF ADOPTION: How easy is it for the end user to change to the proposed technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	3	18%	3
2	Okay	7	41%	14
3	Good	3	18%	9
4	Very Good	2	12%	8
5	Excellent	2	12%	10
Total		17	100%	44
Average Rating				2.59

Comments:

- Difficulties programming make them a difficult retrofit measure.
- "This will depend in part on the willingness of the contractors to fully inform the client and do the programming well, so that the improvements not only work well, but continue to provide the energy savings.
- This is a difficult retrofit item, and while widely adopted in fan powered boxes. For new product markets, inclusion in packaged HVAC units will require manufacturers to put them in their product line--difficult if it will add cost in a low-bid market sector.
- Main barrier is cost - these ECPM VAV motors are important for the ZNE goals
- I don't know how easy retrofits are.

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

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	2	12%	2
2	Okay	4	24%	8
3	Good	5	29%	15
4	Very Good	5	29%	20
5	Excellent	1	6%	5
Total		17	100%	50
Average Rating				2.94

Comments:

- Difficulties programming make them a difficult retrofit measure.
- It is better with utility rebates.
- May have limited availability. Unfortunately not a good retrofit candidate.
- CBoR on required action is high enough on an incremental basis....not so as an action on the front 40% of the expected life use as a retrofit.
- The payback is probably not great with realistic labor costs included.
- I agree with Harvey that these motors are best introduced into the market as OEM products unless they are specifically designed and manufactured to be a drop-in replacement for specific end-use (residential furnace fans) by the manufacturer.

## Variable Refrigerant Flow (VRF) Heat Pumps - ET# 200

Summary	
Energy savings	3.3
Non-energy benefits	2.9
Tech readiness	3.9
Ease of adoption	2.9
Value	3.1
<b>AVERAGE</b>	<b>3.2</b>

## ENERGY SAVINGS: How significant and reliable are the energy savings per unit?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	3	25%	6
3	Good	4	33%	12
4	Very Good	4	33%	16
5	Excellent	1	8%	5
Total		12	100%	39
<b>Average Rating</b>				<b>3.25</b>

## Comments:

- There can be significant savings, but at this time limited applicability (new construction, major renovation).
- According to the presentation, as a stand alone measure, this one doesn't pan out. But, when integrated with other measures (including an HRV), it looks like it could be very appealing.
- Can be very good if well engineered, integrated, commissioned and if energy use is tracked.
- Can be significant, but are not reliable. Needs to be applied appropriately to yield any savings.

## NON-ENERGY BENEFITS: How great are the non-energy advantages for the end user adopting this technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	5	42%	10
3	Good	3	25%	9
4	Very Good	4	33%	16
5	Excellent	0	0%	0
Total		12	100%	35
<b>Average Rating</b>				<b>2.92</b>

## Comments:

- Smaller equipment footprint (smaller ducts, shafts, less space overall for mechanical). Possibility for better zoning - better control - comfort. Quiet.

## Variable Refrigerant Flow (VRF) Heat Pumps - ET# 200

### TECH READINESS: How ready are the product(s) and providers to scale up for widespread use in the Pacific NW?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	0	0%	0
3	Good	4	33%	12
4	Very Good	5	42%	20
5	Excellent	3	25%	15
Total		12	100%	47
Average Rating				3.92

Comments:

- Multiple manufacturer representatives aggressively market and specify systems
- It is ready. Many manufacturers to choose from. Contractors are trained. Distribution network available.

### EASE OF ADOPTION: How easy is it for the end user to change to the proposed technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	1	100%	1
2	Okay	4	33%	8
3	Good	4	33%	12
4	Very Good	1	8%	4
5	Excellent	2	17%	10
Total		12	192%	35
Average Rating				2.92

Comments:

- Cost as the major hurdle. And a big change for industry.
- This will be very different depending on if we're talking about new construction, major retrofit, or minor retrofit. This clarification is essential.
- I think that many HVAC contractors would consider this application to be outside their normal box for a commercial installation. Considerable education would be in order (maybe a task for the new TAN).
- Requires a major retrofit of the HVAC system, but relatively easier to run refrigerant lines, rather than ductwork. However, it may be very difficult to find and repair refrigerant leaks if they're in walls.
- Pre-engineered products. Easy to design with manufacturer support.

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

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	1	8%	1
2	Okay	2	17%	4
3	Good	5	42%	15
4	Very Good	3	25%	12
5	Excellent	1	8%	5
Total		12	100%	37
Average Rating				3.08

Comments:

- Again, depends on new/existing construction.
- Not so good for some and exceptionally good for others.
- A well-engineered, integrated system can be a good value.
- Must develop design guidelines to go along with this measure. VRF is not a measure without some important caveats. Must be mostly ductless or minimal ducts. Must be paired with dedicated outdoor air system (DOAS). Preferably utilizing heat recovery. Perhaps some metrics on W/CFM limitations, etc...

## Circulating Hot and Chilled Water Pumps with Variable Speed ECPM Motors - ET # 291

Summary	
Energy savings	3.9
Non-energy benefits	3.3
Tech readiness	3.4
Ease of adoption	3.2
Value	3.2
<b>AVERAGE</b>	<b>3.4</b>

### ENERGY SAVINGS: How significant and reliable are the energy savings per unit?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	2	13%	4
3	Good	2	13%	6
4	Very Good	7	47%	28
5	Excellent	4	27%	20
Total		15	100%	58
<b>Average Rating</b>				<b>3.87</b>

#### Comments:

- Few independent field tests have been performed for reliable savings. Every application will have different savings; a guide for screening cost-effective applications would be helpful.
- Pump laws.
- These have good savings potential, whether controlled internally or through normal DDC.
- In both VAV and CV energy savings available .

### NON-ENERGY BENEFITS: How great are the non-energy advantages for the end user adopting this technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	6	40%	12
3	Good	1	7%	3
4	Very Good	6	40%	24
5	Excellent	2	13%	10
Total		15	100%	49
<b>Average Rating</b>				<b>3.27</b>

#### Comments:

- Better pressure control and easier calibration are difficult to quantify and probably not widely appreciated.
- Quieter.
- The auto-calibrate function will speed commissioning, and the availability of operating data will likely help with selling projects.
- May have less motor wear and better control. Individual valve control is improved when it is not necessary to "ride the pump curve"
- longer life

## Circulating Hot and Chilled Water Pumps with Variable Speed ECPM Motors - ET # 291

### TECH READINESS: How ready are the product(s) and providers to scale up for widespread use in the Pacific NW?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	5	31%	10
3	Good	4	25%	12
4	Very Good	3	19%	12
5	Excellent	4	25%	20
Total		16	100%	54
Average Rating				3.38

Comments:

- There are a few commercial products, but since each application is different, custom design will be required. Also, a guide for screening out non-cost-effective applications would be helpful.
- I haven't had any contractors propose these yet, but from the E3T presentation, it seems that the technology is mature enough.
- Only drawback is limited in size based on motor availability.

### EASE OF ADOPTION: How easy is it for the end user to change to the proposed technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	1	7%	1
2	Okay	2	14%	4
3	Good	6	43%	18
4	Very Good	3	21%	12
5	Excellent	2	14%	10
Total		14	100%	45
Average Rating				3.21

Comments:

- Since each application is different, custom design will be required. Also, it probably won't be cost effective to replace a working pump, but may be cost effective, based on incremental cost, to replace upon burnout or with new HVAC systems.
- Requires education in the design community.
- Trade Ally network will need some support and training to optimize installation of these smart circulators

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

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	2	13%	2
2	Okay	3	19%	6
3	Good	3	19%	9
4	Very Good	6	38%	24
5	Excellent	2	13%	10
Total		16	100%	51
Average Rating				3.19

Comments:

- It may be cost effective, based on incremental cost, to replace upon burnout or with new HVAC systems; better pressure control and easier calibration are difficult to quantify.
- Cost effective in the long term, but there is a significant cost premium.
- As on all of these technologies at initial or required replacement it seems to be a very good financial decision, less so progressively depending on the life expectancy of the existing materials.
- For ZNE goals these kind of "plug/miscellaneous " loads will need to be efficient and controllable - these are important

## Ducted Variable-Speed Split System Heat Pump - ET# 332

Summary	
Energy savings	2.9
Non-energy benefits	2.4
Tech readiness	3.8
Ease of adoption	3.9
Value	2.4
<b>AVERAGE</b>	<b>3.1</b>

### ENERGY SAVINGS: How significant and reliable are the energy savings per unit?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	1	8%	1
2	Okay	4	33%	8
3	Good	3	25%	9
4	Very Good	3	25%	12
5	Excellent	1	8%	5
Total		12	100%	35
<b>Average Rating</b>				<b>2.92</b>

#### Comments:

- Although the savings per unit might not be extraordinary, the market size for replacement is enormous.
- Better with construction...
- Not radically significant over code at current and savings are heavily weighted on current ducting system and design. That adds up to a suspect program for reliable end results.
- 20% heating savings, but these might need to be discounted for additional cooling loads, depending on the baseline system.
- Incremental improvement over code minimum heat pumps

### NON-ENERGY BENEFITS: How great are the non-energy advantages for the end user adopting this technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	1	8%	1
2	Okay	6	50%	12
3	Good	4	33%	12
4	Very Good	1	8%	4
5	Excellent	0	0%	0
Total		12	100%	29
<b>Average Rating</b>				<b>2.42</b>

#### Comments:

- Variable speed units are quieter than standard units.
- Really just a straight-across trade-out for standard equipment. Likely quieter.

**Ducted Variable-Speed Split System Heat Pump - ET# 332****TECH READINESS: How ready are the product(s) and providers to scale up for widespread use in the Pacific NW?**

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	1	8%	2
3	Good	3	25%	9
4	Very Good	5	42%	20
5	Excellent	3	25%	15
Total		12	100%	46
Average Rating				<b>3.83</b>

## Comments:

- Drop-in replacement.
- The availability is there, but these are far from cost effective which is a big barrier to the widespread adoption.
- Except for cost :)

**EASE OF ADOPTION: How easy is it for the end user to change to the proposed technology?**

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	1	8%	2
3	Good	4	33%	12
4	Very Good	2	17%	8
5	Excellent	5	42%	25
Total		12	100%	47
Average Rating				<b>3.92</b>

## Comments:

- Cost might be a little bit of an issue
- The ease of implementation is the primary factor for being this far along as a retrofit.

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

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	1	8%	1
2	Okay	7	58%	14
3	Good	2	17%	6
4	Very Good	2	17%	8
5	Excellent	0	0%	0
Total		12	100%	29
Average Rating				<b>2.42</b>

## Comments:

- If the old unit needs to be changed out anyway, replacement with a variable speed unit might not be too bad.
- Not cost effective.
- Some folks would just like it because the advanced technology. Certainly makes better sense in new construction.

## High-Volume, Low-Speed Fan Technology - ET #620

Summary	
Energy savings	3.5
Non-energy benefits	2.8
Tech readiness	3.6
Ease of adoption	2.6
Value	3.3
<b>AVERAGE</b>	<b>3.2</b>

### ENERGY SAVINGS: How significant and reliable are the energy savings per unit?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	4	24%	8
3	Good	3	18%	9
4	Very Good	8	47%	32
5	Excellent	2	12%	10
Total		17	100%	59
<b>Average Rating</b>				<b>3.47</b>

#### Comments:

- There seem to be significant savings, but perhaps not enough information to know savings reliable as a per unit value.
- Few independent field tests have been performed for reliable savings. Every application will have different savings; a guide for screening cost-effective applications would be helpful. There are probably a few cost effective, niche applications.
- Between destratification (winter) and increased airflow and evap cooling (summer), this technology has significant savings potential, though in limited applications.
- In specific stratified spaces, these fans can save.
- Particularly good with open space areas. Some new HVLS small fans are being developed and they would apply to office spaces
- Fans have value when paired with other systems such as DOAS systems.

### NON-ENERGY BENEFITS: How great are the non-energy advantages for the end user adopting this technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	7	41%	14
3	Good	7	41%	21
4	Very Good	3	18%	12
5	Excellent	0	0%	0
Total		17	100%	47
<b>Average Rating</b>				<b>2.76</b>

#### Comments:

- I think most installations are to improve comfort or correct inadequate airflow.
- Potential for reduced noise, and improved IEQ are good.
- May have aesthetics drawbacks that will limit to industrial type spaces.
- Better comfort and air quality

## High-Volume, Low-Speed Fan Technology - ET #620

### TECH READINESS: How ready are the product(s) and providers to scale up for widespread use in the Pacific NW?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	2	12%	4
3	Good	6	35%	18
4	Very Good	6	35%	24
5	Excellent	3	18%	15
Total		17	100%	61
Average Rating				3.59

#### Comments:

- There are a few commercial products, but since each application is different, custom design will be required. Also, a guide for screening out non-cost-effective applications would be helpful.
- This could be an easy New Construction product but it might be a little more complicated for retro fit. have to fit it around existing lighting duct work etc.
- Again, limited to specific space types. Energy savings difficult to quantify, and more case studies are needed.
- More field demos needed

### EASE OF ADOPTION: How easy is it for the end user to change to the proposed technology?

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	2	12%	2
2	Okay	6	35%	12
3	Good	5	29%	15
4	Very Good	4	24%	16
5	Excellent	0	0%	0
Total		17	100%	45
Average Rating				2.65

#### Comments:

- Installation may require seismic restraint and structural reinforcement.
- This is very dependent on the space and operation.
- Requires a significantly different approach.
- Not clear it's suitable for many applications, e.g. office, due to mounting with light fixtures, shadows etc.
- Retrofitting a facility seems pretty limiting when you are dealing with existing lighting, structural, and fire suppression issues. The market evaluation potential is most likely very inaccurate for truly viable applications.
- Very good for many major renovation projects
- The costs, including electrical connection and realistic labor costs are not low.

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

#	Answer	# Resp.	% Resp.	Total Rating
1	Poor	0	0%	0
2	Okay	3	19%	6
3	Good	7	44%	21
4	Very Good	4	25%	16
5	Excellent	2	13%	10
Total		16	100%	53
Average Rating				3.31

#### Comments:

- There are probably a few cost effective, niche applications.
- For the right open high bay applications.
- very good for the right applications only
- In the right circumstance on a retro and absolute if designed in initially on new construction. (combined in design with lighting, HVAC, envelope factors as a package this is cost effective)