HRV and ERV ENERGY STAR Specification Development

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WELCOME

WEBINAR

ENERGY STAR Spec

August 12, 2009 1PM Eastern

Brian Killins
Peter Edwards

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Webinar Etiquette

Please mute your phone by pressing *6

Un-mute by pressing #6

Identify yourself each time you speak

“Chat” is available for comments or questions

Written comments – please forward to Peter Edwards and NRCan. (Contact info at end of presentation.)

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Vision

One of a number of initiatives to improve the energy efficiency and air quality in housing.

Need for Ventilation

- Significant work in past – started with R2000 and other LE housing
- Required in new houses – specifically addressed in building codes
- Ongoing work - ASHRAE 62.2

Air Tightness of Canadian Houses

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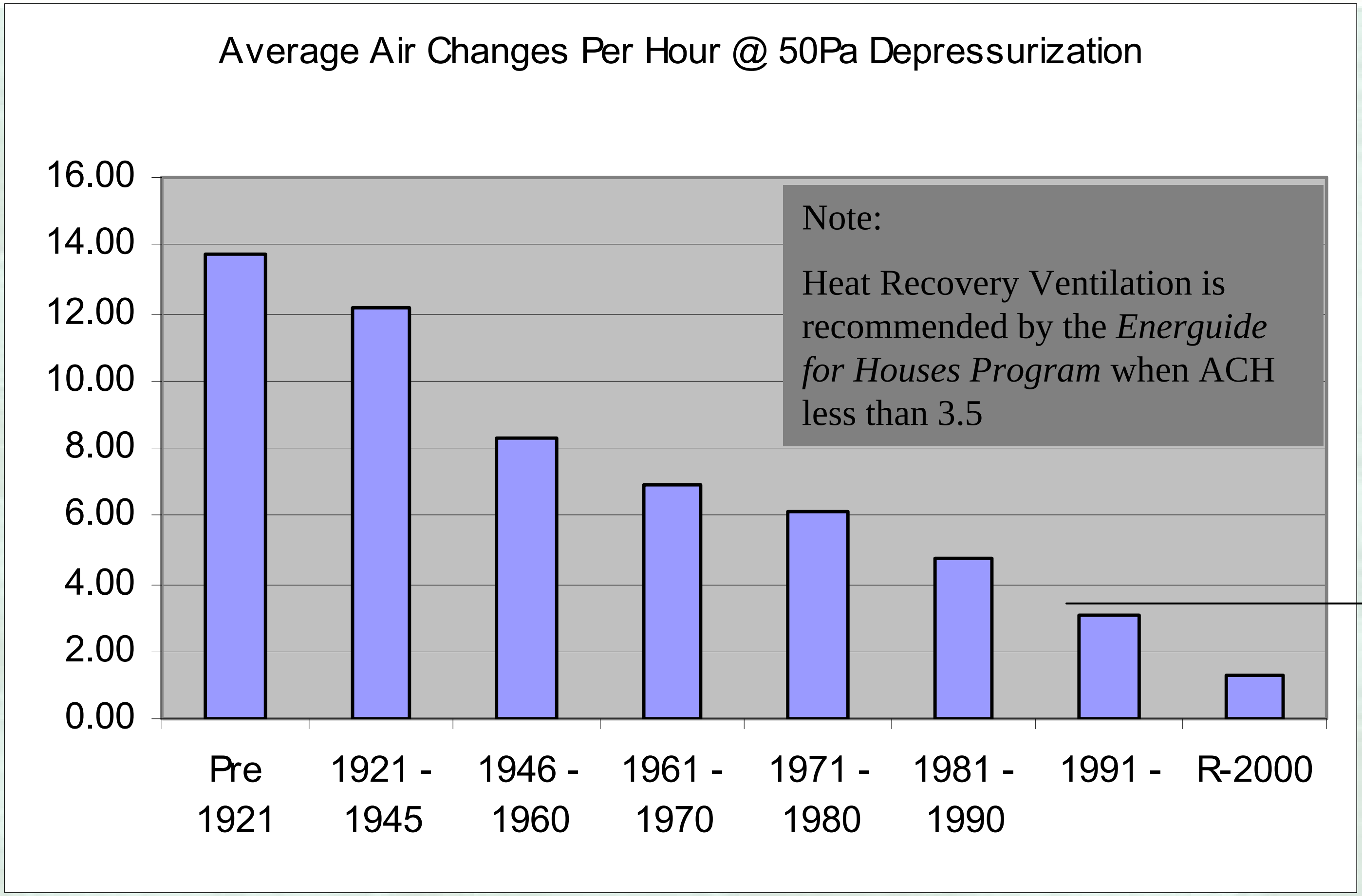

Thermal load for ventilation

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<u>United States:</u> The US National average heating season is 5200 HDD in deg F (source: ASHRAE 103-93 referenced in USDOE 10CFR Part 430 Appendix N AFUE test procedures) (5200 HDD (F) is 2889 HDD (C))

- **30 l/s ventilation flow with 2889 degree days (C) per year produces a sensible heating load of 2493 kWh/y**
- **55 l/s ventilation flow with 2889 degree days (C) per year produces a sensible heating load of 4570 kWh/y**

Thermal load for ventilation

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<u>Canada:</u> The Canadian population-weighted average heating season is 4345 HDD in deg C (source CSA P.10-07)

- 30 l/s ventilation flow with 4345 degree days (C) per year produces a sensible heating load of 3750 kWh/y
- 55 l/s ventilation flow with 4345 degree days (C) per year produces a sensible heating load of 6875 kWh/y

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Purpose of Meeting

Update on status and history

Gather further stakeholder input, especially:

- Spec expansion to include US
- Issues, opportunities, and questions

Next Steps

Agenda

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- Introduction and history
- Review Canadian (cold climate) draft spec
- Introduce southern & intermediate specs
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- Labelling
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Responses to the initial HRV/ERV E-Star Questionnaire (Feb. 2008)

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- 100% recommended a minimum SRE @ 0°C (suggested ENERGY STAR level ranges from 50 to 75%)
- 75% recommended a minimum net air flow / W
- 60% recommended a minimum SRE @ -25°C (suggested ENERGY STAR level ranges from 50 to 65%)
- 33% recommended a maximum standby power
- Little support for installation-related items or annual electrical use ratings
- Initial input was primarily from industry - No input from utilities or regulatory bodies

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Final Draft Canadian Specification

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Table 1: ENERGY STAR Criteria for Qualified Heat/Energy Recovery Ventilators - Minimum SRE and Fan Efficacy – Effective July 1, 2009 to June 30, 2012

Minimum SRE	
@ 0°C supply temperature	60 %
@ -25°C supply temperature	55 %
Minimum Fan Efficacy with 0°C supply temperature	
less than 75%	1.0 cfm/W (.028 m^3/min/W)
75% or greater	Any

Final Draft Canadian Specification

Table 2: ENERGY STAR Criteria for Qualified Heat/Energy Recovery Ventilators - Minimum SRE and Fan Efficacy – Effective July 1, 2012

Minimum SRE	
@ 0°C supply temperature	65 %
@ -25°C supply temperature	60 %
Minimum Fan Efficacy with 0°C supply temperature	
less than 75%	1.2 cfm/W (.034 m^3/min/W)
75% or greater	0.8 cfm/W (.023 m^3/min/W)

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Draft 2 Reqs. & Pass Rates

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Tier 1: Proposed climate zone test requirements and pass rates (all products must be independently tested by an accredited laboratory)

Zone	Requirement	Count		Pass Rate	
Neutral Zone	0C, 65% ≤ SRE < 75%, cfm/W ≥0.9	22			
	0C, SRE ≥ 75%, any cfm/W	12			
		34	→	48%	of 71 base models
Heating Zone	- Neutral Zone reqs.	15	→	21%	of 71 base models
	- SRE ≥ 60% at -25C			26%	of 58 base models tested at both 0C and -25C
	- Airflows at 0C and -25C within 10% of each other			36%	of 42 base models with airflows at 0C and -25C within 10% of each other
Cooling Zone	-Neutral Zone 2 reqs.	9	→	13%	of 71 base models
	- TRE ≥ 35% at 35C			27%	of 33 base models tested at both 0C and 35C
	- Airflows at 0C and 35C within 10% of each other			27%	of 33 base models with airflows at 0C and 35C within 10% of each other

Draft 2 Reqs. & Pass Rates

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Tier 2: Proposed climate zone test requirements and pass rates (all products must be independently tested by an accredited laboratory)

Zone	Requirement	Count		Pass Rate	
Neutral Zone	0C, 70% ≤ SRE < 75%, cfm/W ≥1.2 0C, SRE ≥ 75%, cfm/W ≥0.8	12	→	17%	of 71 base models
Heating Zone	- Neutral Zone reqs.	4	→	6%	of 71 base models
	- SRE ≥ 65% at -25C			7%	of 58 base models tested at both 0C and -25C
	- Airflows at 0C and -25C within 10% of each other			10%	of 42 base models with airflows at 0C and -25C within 10% of each other
Cooling Zone	-Neutral Zone reqs.	3	→	4%	of 71 base models
	- TRE ≥ 50% at 35C			9%	of 33 base models tested at both 0C and 35C
	- Airflows at 0C and 35C within 10% of each other			9%	of 33 base models with airflows at 0C and 35C within 10% of each other

Different climate zones

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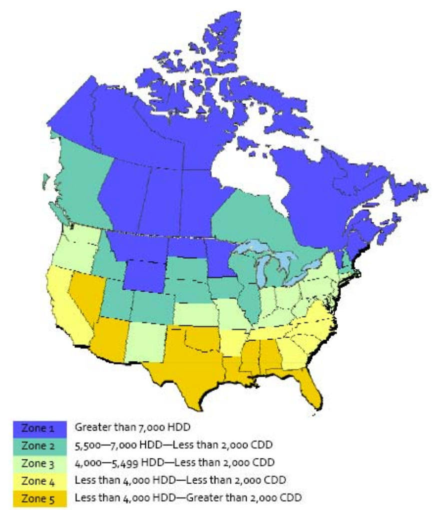
EPS Insulation Environmental Profile

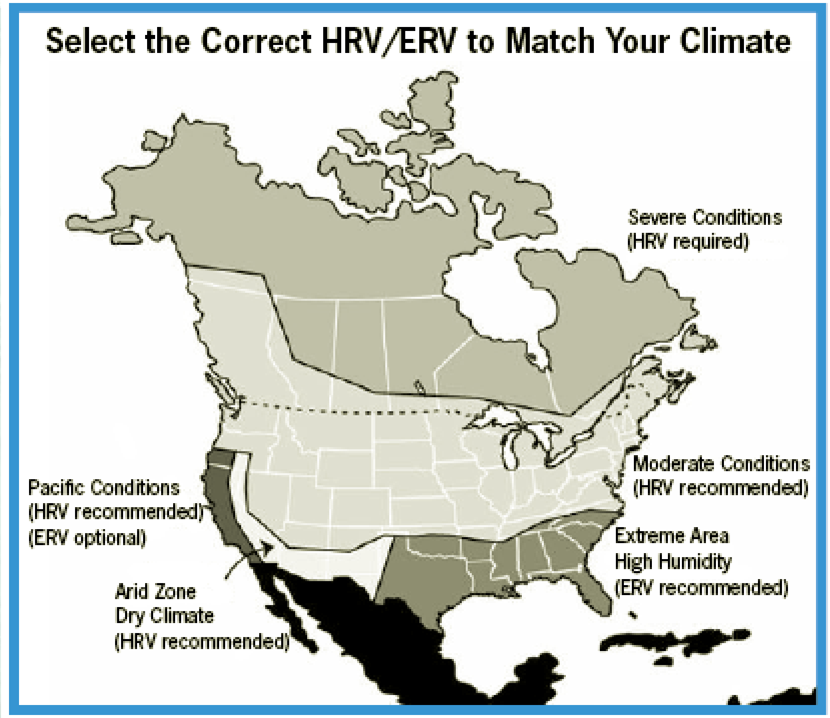
CLIMATE MATTERS

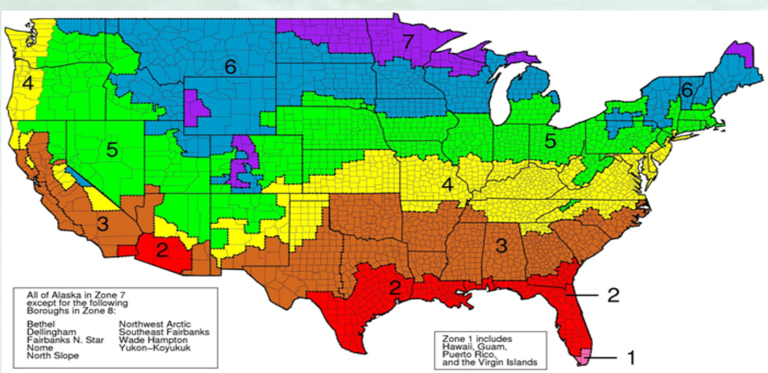


The benefits of insulation vary with the climate and are generally more pronounced in colder regions where significant energy is used to heat a home. A common method used to distinguish climate zones in North America is by measuring a region's Heating Degree Days (HDD) and Cooling Degree Days (CDD) using a base temperature of 65°F. The annual HDD for a region is the sum of the daily differences between 65° and the average daily temperature (ADT) when it falls below that target.

For example, if the ADT on March 14 is 58° it would be assigned a value of 7 HDD. This calculation would be made for each day that falls below 65° and the sum would be the HDD for that region. The same calculation is made for CDD for those days when the ADT is over 65°. The average performance for a **U.S.** home was determined by weighting each climate zone by the number of building permits issued in 2006 for single-family homes in that region. This method provides an average weather condition based on where homes were actually constructed.

For the calculations in CANADA, each of the Provinces and Territories was identified as a separate region and no calculation was done for CDD as the energy used for cooling is less than 1% of total energy use to heat homes in Canada. The average performance for a Canadian home was weighted by building activity in the same manner and method used in the U.S.





Other examples - climate zones

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- HRV or ERV? – Check the map below.
  - If you live in a colder climate with a longer heating season such as Canada or the northern US, the HRV will provide the most comfort and efficiency.
  - In the midwest and southern states, where humidity removal is needed for the incoming air, an ERV provides year-round efficiency.

Climate Map for Energy and Heat Recovery Ventilators

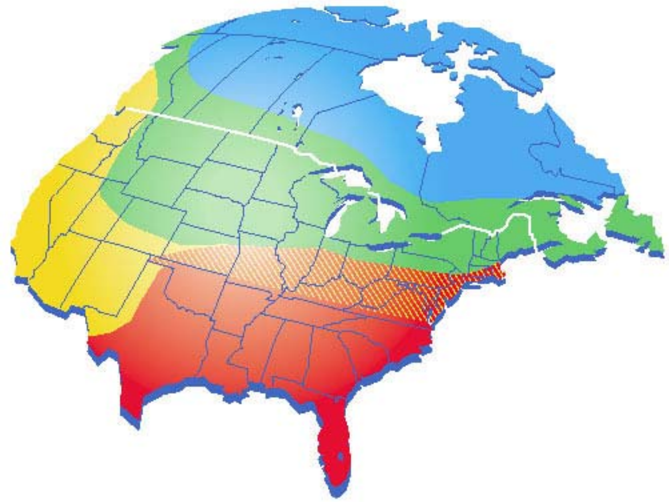
Selecting The Right Unit

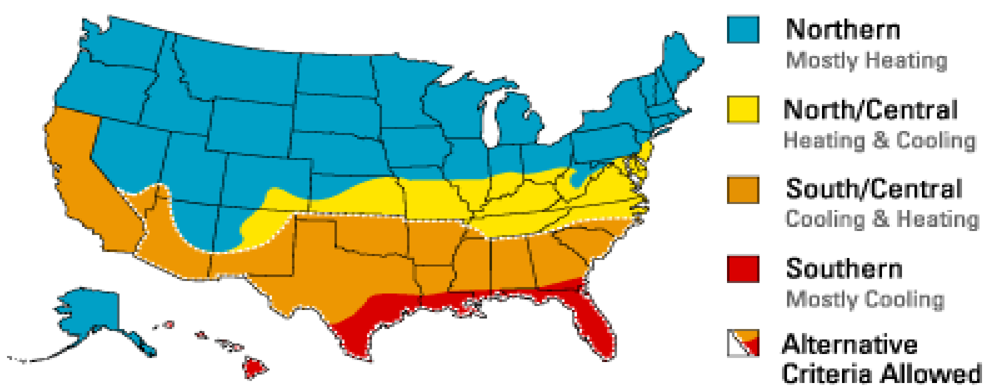
The climate conditions where you live will determine whether you need a Heat Recovery Ventilator or an Energy Recovery Ventilator.

HRVs are usually recommended for colder climates with longer heating seasons. ERVs are used for warmer more humid climates with long cooling seasons. Use map for reference.

- HRV Required
- HRV Recommended
- HRV Recommended
- HRV or ERV* w/Defrost Recommended
- ERV* Required

*Note: When installing ERVs (in ERV areas according to the map), and the outdoor temperature falls below 23°F (-5°C) for more than 2 consecutive days, it is recommended that a defrost option be installed on the equipment.





Other examples - climate zones

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Severe Conditions
HRV required

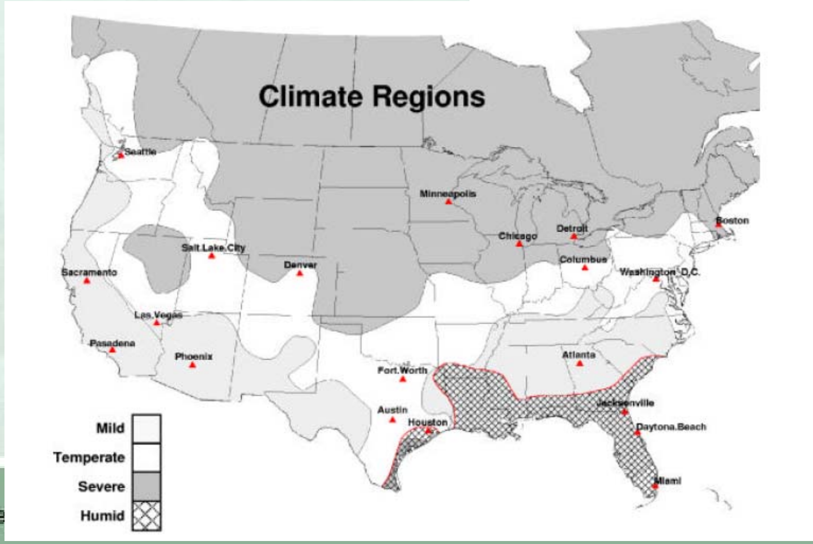
Pacific Conditions
HRV recommended
ERV optional*

Extreme Area - High Humidity**
ERV recommended*

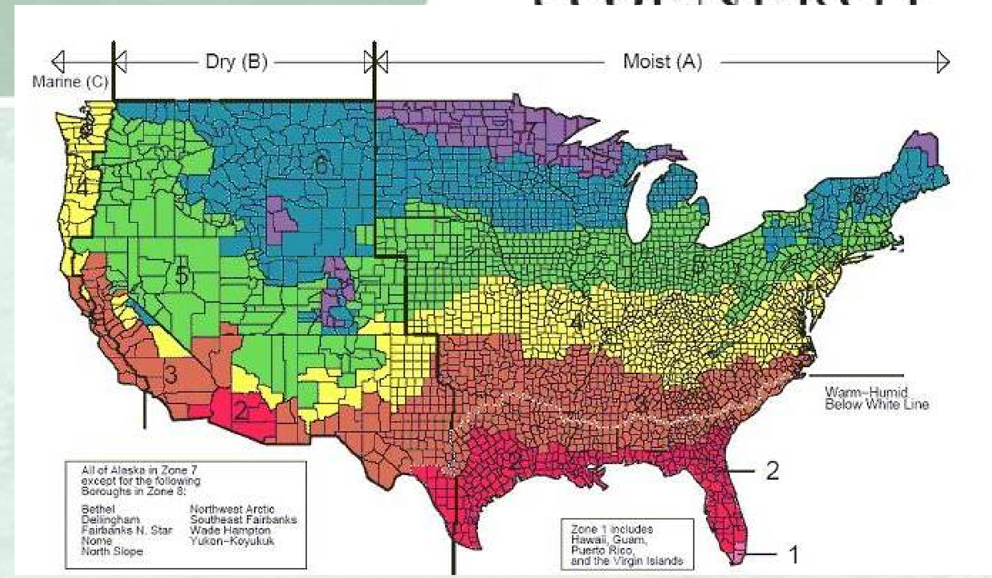
Moderate Conditions
HRV recommended

Arid Zone - Dry Climate
HRV recommended

* ERV not recommended where temperatures fall below 25°F (-4°C) continuously for more than 5 days.
** ERV's are recommended in regions where high outdoor humidity is cause for operating air conditioning/dehumidification more frequently than heating system



Other examples - climate zones



Selecting The Right Unit

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HRV's are usually recommended for colder climates with longer heating seasons. ERV's are used for warmer more humid climates with long cooling seasons. Use map for reference.

Cold Dry Climate
HRV Required

Variable Conditions
HRV Recommended

Pacific Conditions
HRV Recommended

Hot Dry Climate
HRV Recommended

High Humidity
ERV Required

HLH and CLH for the US

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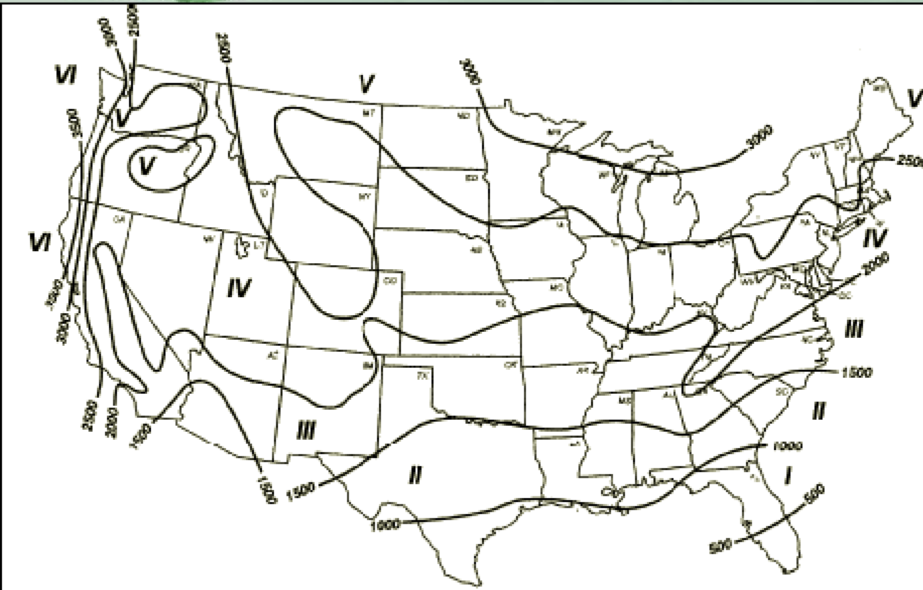

Figure 2 Heating Load Hours (HLH_s) for the United States

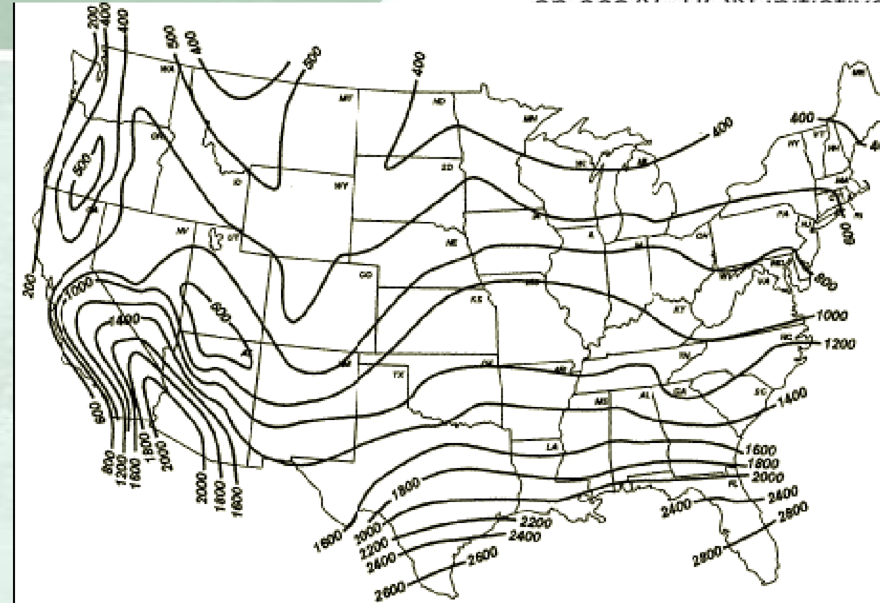

Figure 3 Cooling Load Hours (CLH_s) for the United States

Table 19—Representative Cooling and Heating Load Hours for Each Generalized Climatic Region

Region	CLH_R	HLH_R
I	2400	750
II	1800	1250
III	1200	1750
IV	800	2250
V	400	2750
VI	200	2750

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Further Questions

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- How many zones are required? 2 zones? Are 3 enough?
- Boundary locations?
- Are ENERGY STAR specs required for intermediate and southern humid zones?
- Any uncertainty re equipment included?

Further Questions

- **How can proper selection of equipment be ensured? Preferred ways to describe where HRV and ERV should be used.**
- **Maintenance – what steps to maintain performance?**
- **Other alternatives? Would spec preclude other desirable equipment? (Overall and geographically)**

More Questions

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- What guidance can be provided to assist end-users to decide when to choose an HRV over an ERV or vice versa (or an alternative ventilation system)
- What types of controls are used with
  - HRVs
  - ERVs
  - Alternatives
- Are HRVs and ERVs equally effective in controlling indoor humidity levels in homes in:
  - Cold regions
  - Intermediate Regions
  - Hot, Humid regions
- What are representative operating flows for each type
- What are the energy implications

Further Questions

- **How can optimal installation practices be encouraged?**
- **Target markets? New housing and problem houses?**
- **Sales data required. Present assumptions are that 65,000 per year are sold in Canada and the same in US. What is breakdown by:**
  - **Efficiency level**
  - **HRV vs. ERV**
  - **Geographic Zone**

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H/ERV label – Part 1

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- “This product earned the ENERGY STAR® by meeting strict energy efficiency guidelines set by the US EPA. It meets ENERGY STAR requirements only when used in climate zones *x* on the adjacent map.” *OR*
- “ENERGY STAR® qualified in climate zones…”

Label Example
Window

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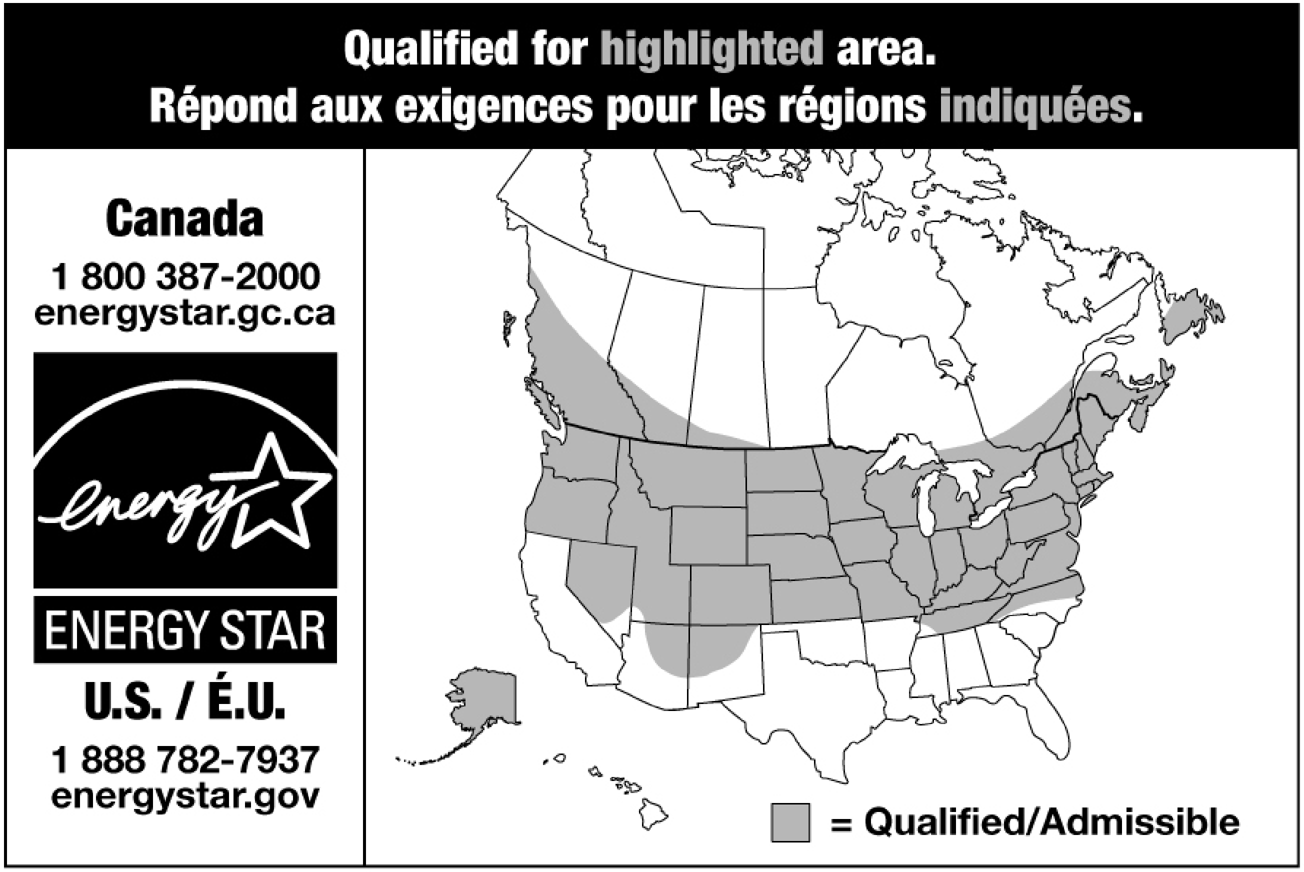

Alternate ENERGY STAR label

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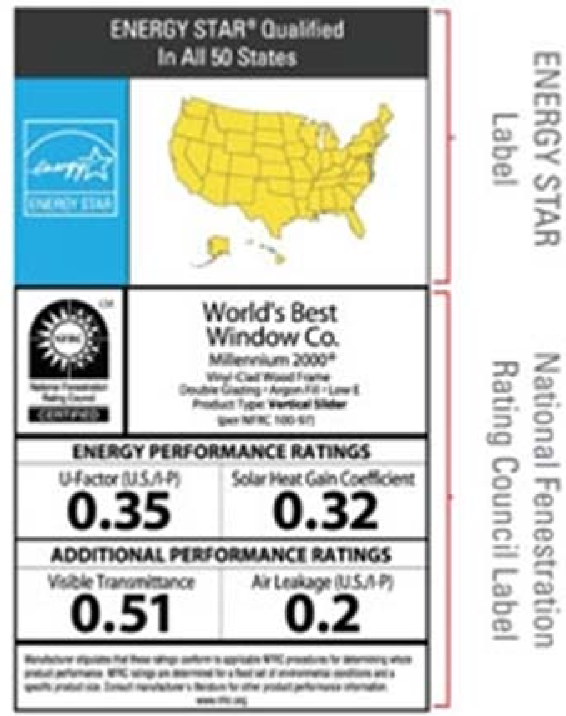
- Following Windows program (US):

LABEL	INSTRUCTIONS	CORRECT USE
Product Qualification Label 	Use an appropriate Product Qualification Label showing the Climate Zone(s) where the product qualifies.	
	Label must be placed on product or packaging adjacent to NFRC temporary label; separation between labels should be less than 1 inch.	
	Do not use any other ENERGY STAR marks on the product or packaging without	

H/ERV label – Part 3

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- Consumer Information (based on Ceiling Fans):

Performance and Energy Information

SRE at 32°F (0°C)	SRE at -13°F (-25°C)	TRE at 95°F (35°C)	Airflow (CFM)*	Power Use (watts)	Airflow Efficiency (CFM/watt)
#%	#% or N/A	#% or N/A			

* This product is ENERGY STAR® qualified at this airflow rate. Other airflow rates may be possible with this product.

Heat-Recovery and Energy-Recovery Ventilators measure efficiency in terms of Sensible Heat-Recovery Efficiency (SRE) and/or Total Energy-Recovery Efficiency (TRE), and Airflow Efficiency. Airflow is measured in cubic feet per minute (CFM). Power use is measured in watts. To maximize energy savings, choose a ventilator appropriate for your climate zone (see adjacent map). The product should have:

- **High *airflow efficiency* (CFM/watt).**
- **High *SRE*.**
- **High *TRE*.**

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Next Steps

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- Summary of today's meeting
- Written comments requested by August 28, 2009
- Email new draft and re-posting on EPA/DOE website with short comment period
- Final by end Sept

Summary

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- Quick review - Any further comments?
- Overall need and opportunity?

Contact info

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Additional materials

ENERGY STAR Program Use in Canada

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- BC Hydro
- Terasen Gas
- Efficiency NB
- NWT gov't
- Ontario gov't
- Saskatchewan gov't
- BC gov't
- Yukon gov't
- Enbridge Gas
- Centra Windows
- Hydro Quebec
- Manitoba Hydro
- Fortis BC
- Gaz Métro
- City Victoria
- City Toronto

Principles guiding development of ENERGY STAR Specifications

- Significant energy & GHG savings
- Non-proprietary
- Maintain or enhance product performance
- Performance measurable & verified through testing
- Increased efficiency has reasonable payback
- Labelling with ENERGY STAR™ will effectively differentiate products and be visible to purchasers

Thermal load for ventilation

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Simplified calculation of the gross annual sensible thermal load for ventilation (per installation)

- **30 l/s** with **4345 DDC**
- 30 l/s * 3600 s/h * 24 h/d *.001 M^3/l = 2592 M^3/day *1.2kg/M^3 = 3110 kg /day
- 3110 kg/day * 1 kJ/kg-deg C * 4345 deg C days/y = 13514688 KJ/y
- 13514.7 MJ /y / 3.6 MJ/kWh = **3750 kWh/y**

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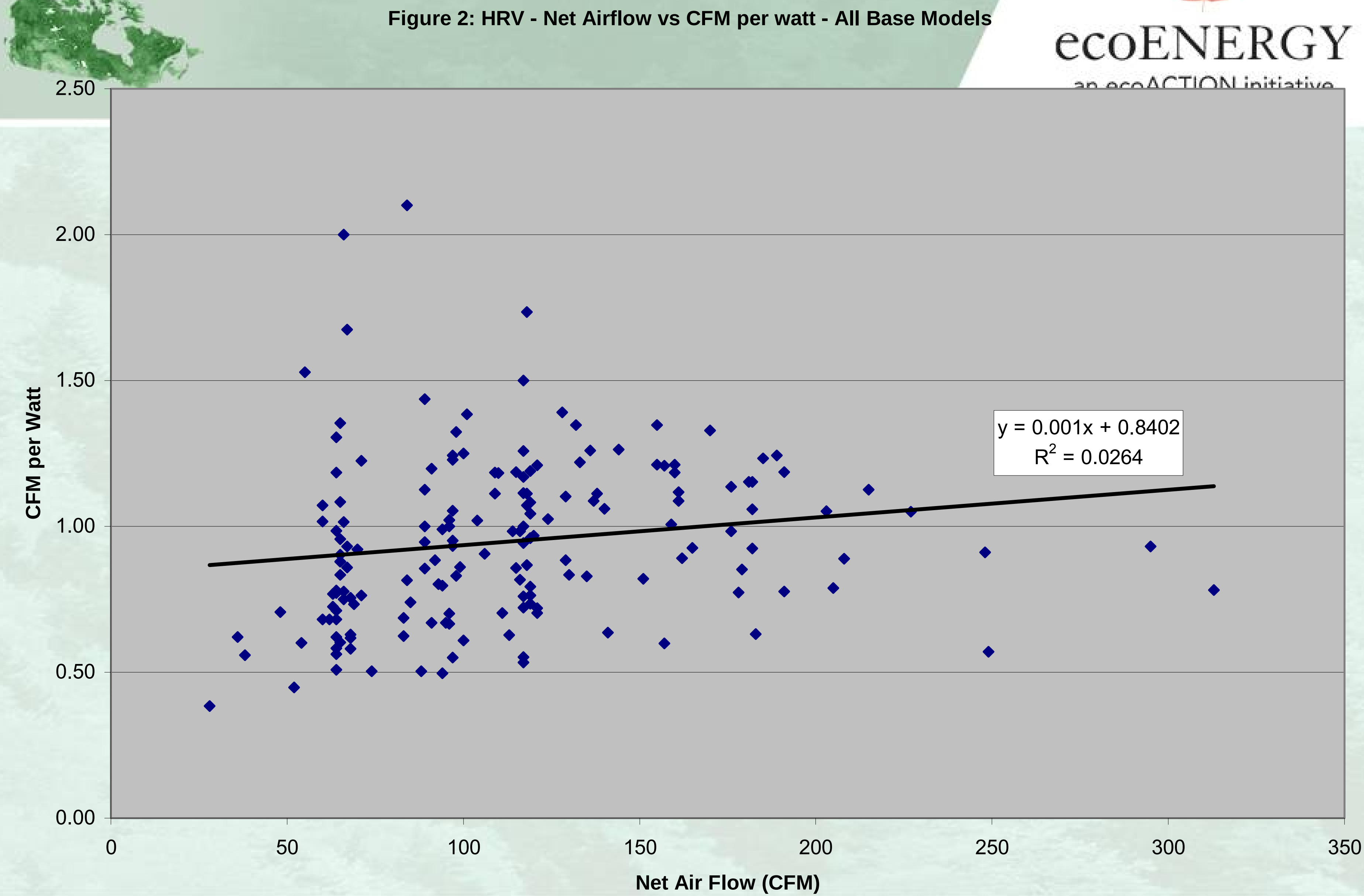
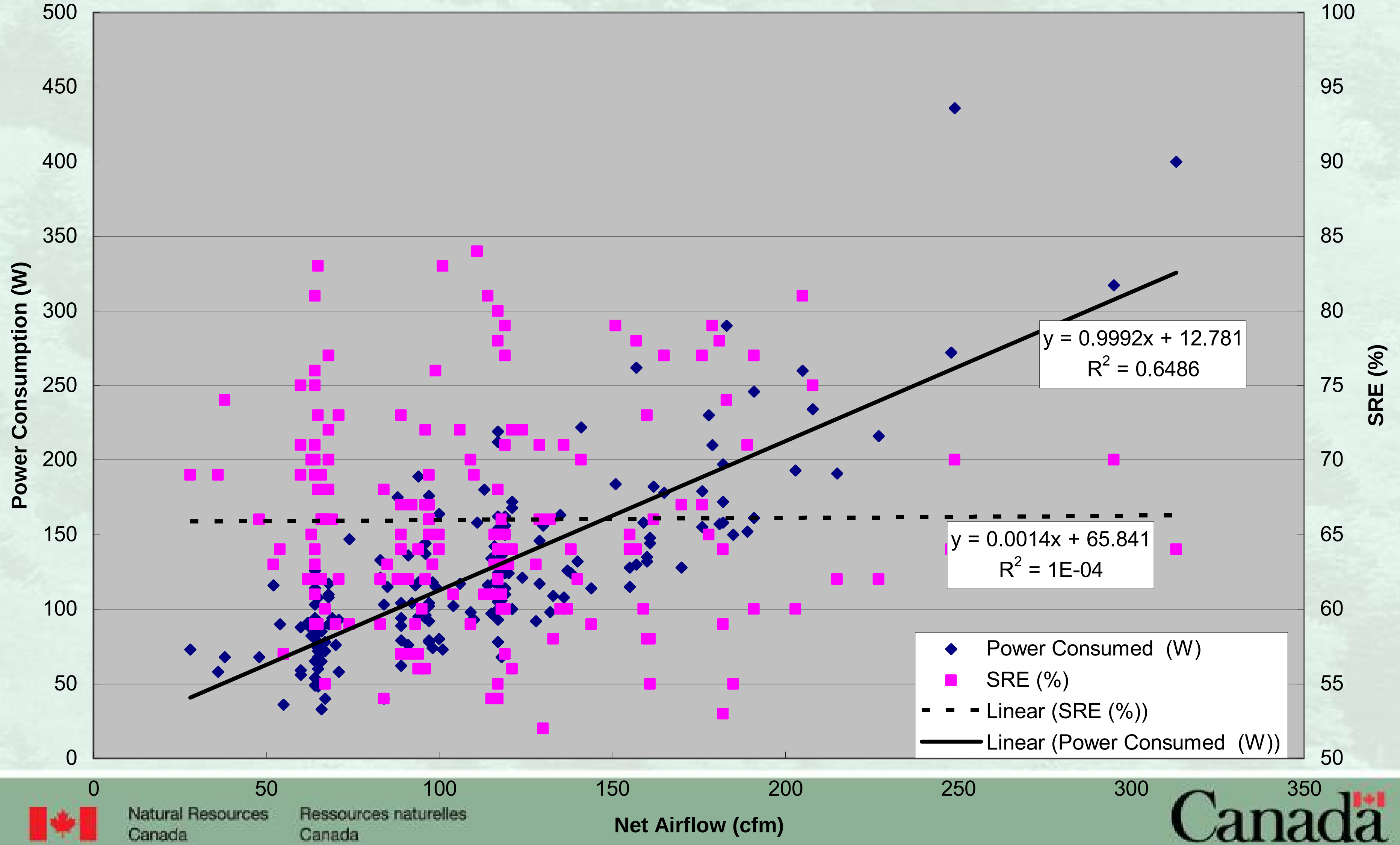


Figure 1: Airflow vs Power Consumption and SRE (All HRVs)



Thermal load reduction using H/ERVs

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Ventilation at stated flow (CFM (l/s))	Canada - Annual Thermal Energy Savings per installation				
	Sensible heating load reduction (kWh/y)				
		SRE (Average during heating season)			
	Load	0%	55%	60%	65%
64 (30)	3750	0	2063	2250	2438
117 (55)	6875	0	3781	4125	4469

Ventilation at stated flow (CFM (l/s))	USA - Annual Thermal Energy Savings per installation				
	Sensible heating load reduction (kWh/y)				
		SRE (Average during heating season)			
	Load	0%	55%	60%	65%
64 (30)	2493	0	1371	1496	1620
117 (55)	4570	0	2514	2742	2971

Annual H/ERV Electrical Energy Use

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Net Continuous Ventilation Flow (CFM)	H/ERV Electricity Consumption (Kwh/y) with stated CFM/W		
	0.5	1	1.5
64	1121	561	374
117	2050	1025	683

Annual Electricity Use

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Combined Annual Electricity Use (kWh/y) for HRV and Distribution System

	HRV + Distribution (kWh/y)			
	Fully Ducted HRV	PSC Circ. Spd 316 W	ECM Matched 146 W	ECM Optimized 22 W
HRV fan efficacy (CFM per Watt)				
	Ventilation Flow 64 cfm			
HRV with 0.5 CFM/W	1121	3257	2108	1270
HRV with 1 CFM/W	561	2697	1548	709
HRV with 1.5 CFM/W	374	2510	1361	522
	Ventilation Flow 117 cfm			
HRV with 0.5 CFM/W	2050	4186	3037	2199
HRV with 1 CFM/W	1025	3161	2012	1174
HRV with 1.5 CFM/W	683	2819	1670	832

Assumes continuous (6760 h/y) operation of furnace fan at circulation speed for HRV installations that use the furnace blower for distribution

Furnace blower operation for space heating (2000 h/y) not included

CMX Discussion

- Partner agreements & commitments
- "Mechanics" of qualification, rating, labelling
- Process for updating specifications
- Next Steps

- Strategy for increasing sales
- Strategy for reducing electricity use
- Other issues / opportunities