

The Place for Air Source Heat Pumps

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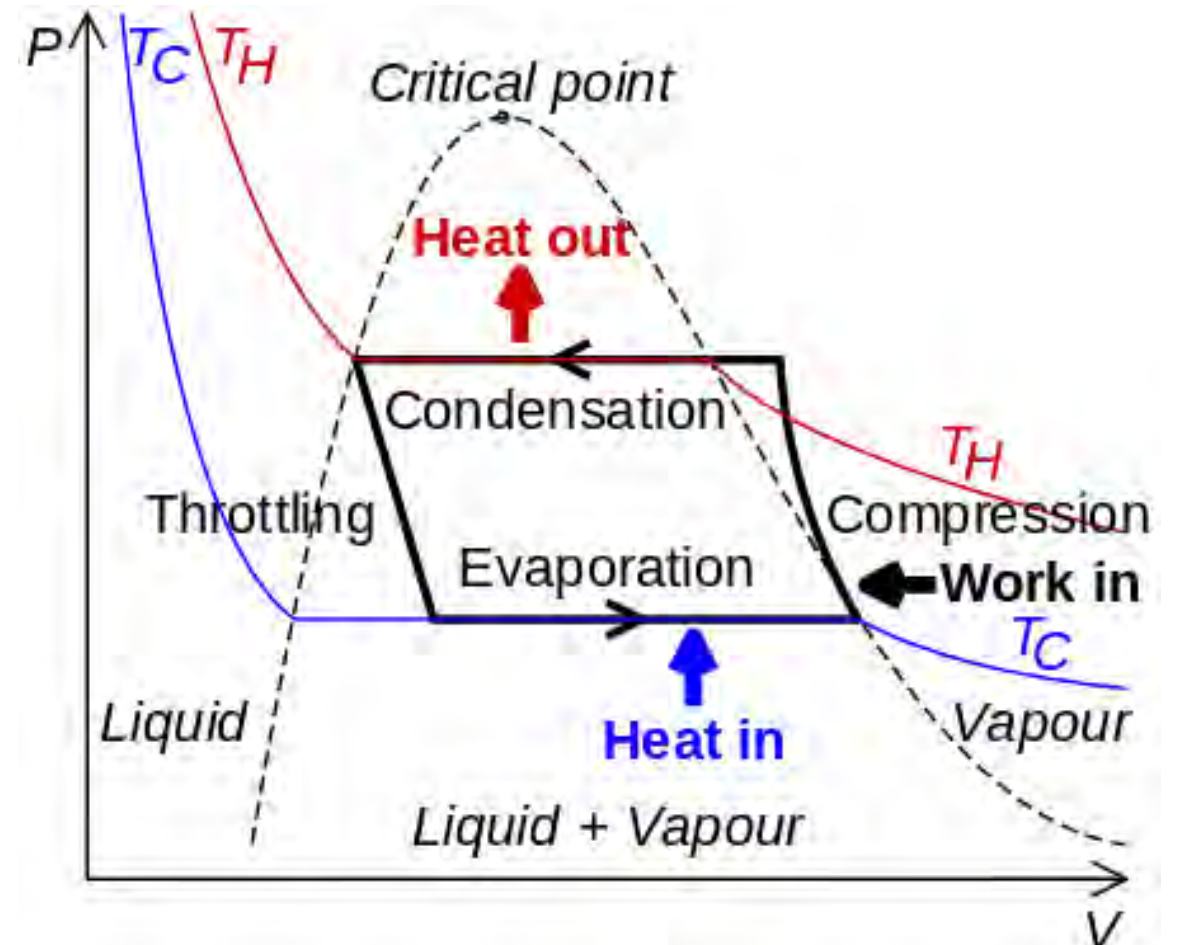
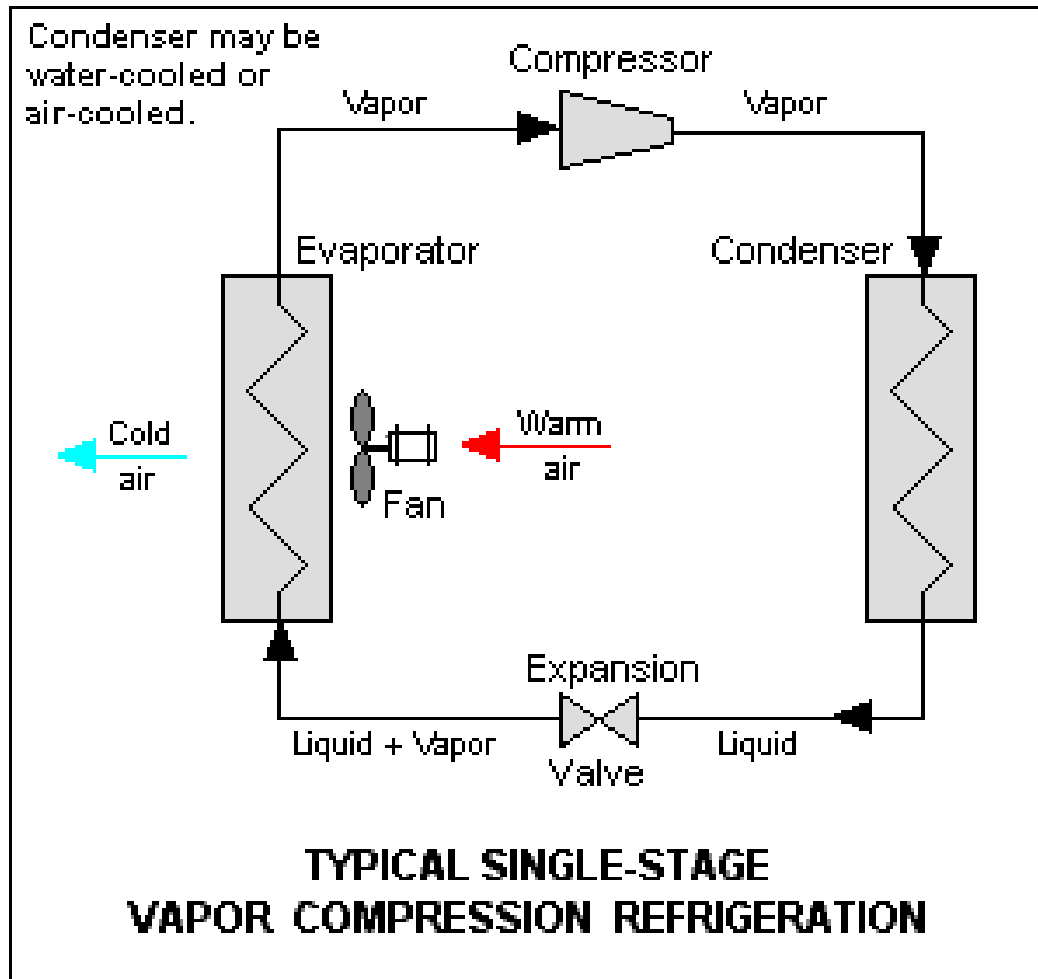
2018 Feb 07 – EMTF

$$\textit{Efficiency} = \frac{\textit{Output}}{\textit{Input}}$$

Vapour compression refrigeration cycle

Output = heat moved from evaporator coil to condenser coil (outside to inside, colder temperature to warmer temperature)

Input = compressor electricity

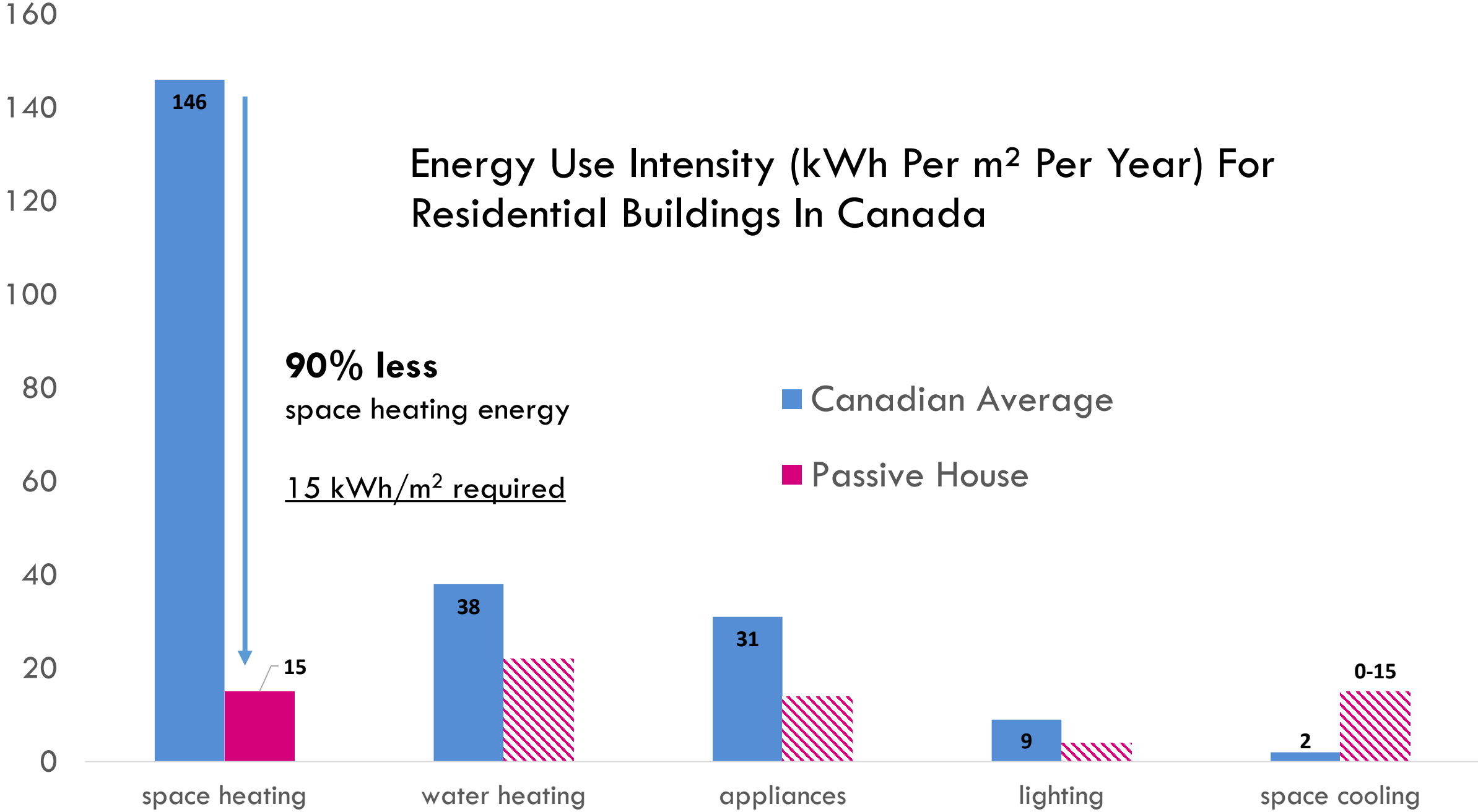


Heating Method	Efficiency
Electricity (resistance)	100%
Air Source Heat Pump	200%
Ground Source Heat Pump	300%
Gas	90%

Coefficient of Performance – similar to efficiency, COP of 2 = 200% efficiency

	Energy Cost (\$/kWh)
Electricity	0.150
Natural Gas	0.022

Energy Use Intensity (kWh Per m² Per Year) For Residential Buildings In Canada



90% less
space heating energy
15 kWh/m² required

■ Canadian Average
■ Passive House

source: NRCAN Energy Use Data Handbook 2010 and Energy Efficiency Trends in Canada 1990-2009, graphic: Nem

Cost to heat 150 m² home by various methods

(1600 sq ft)

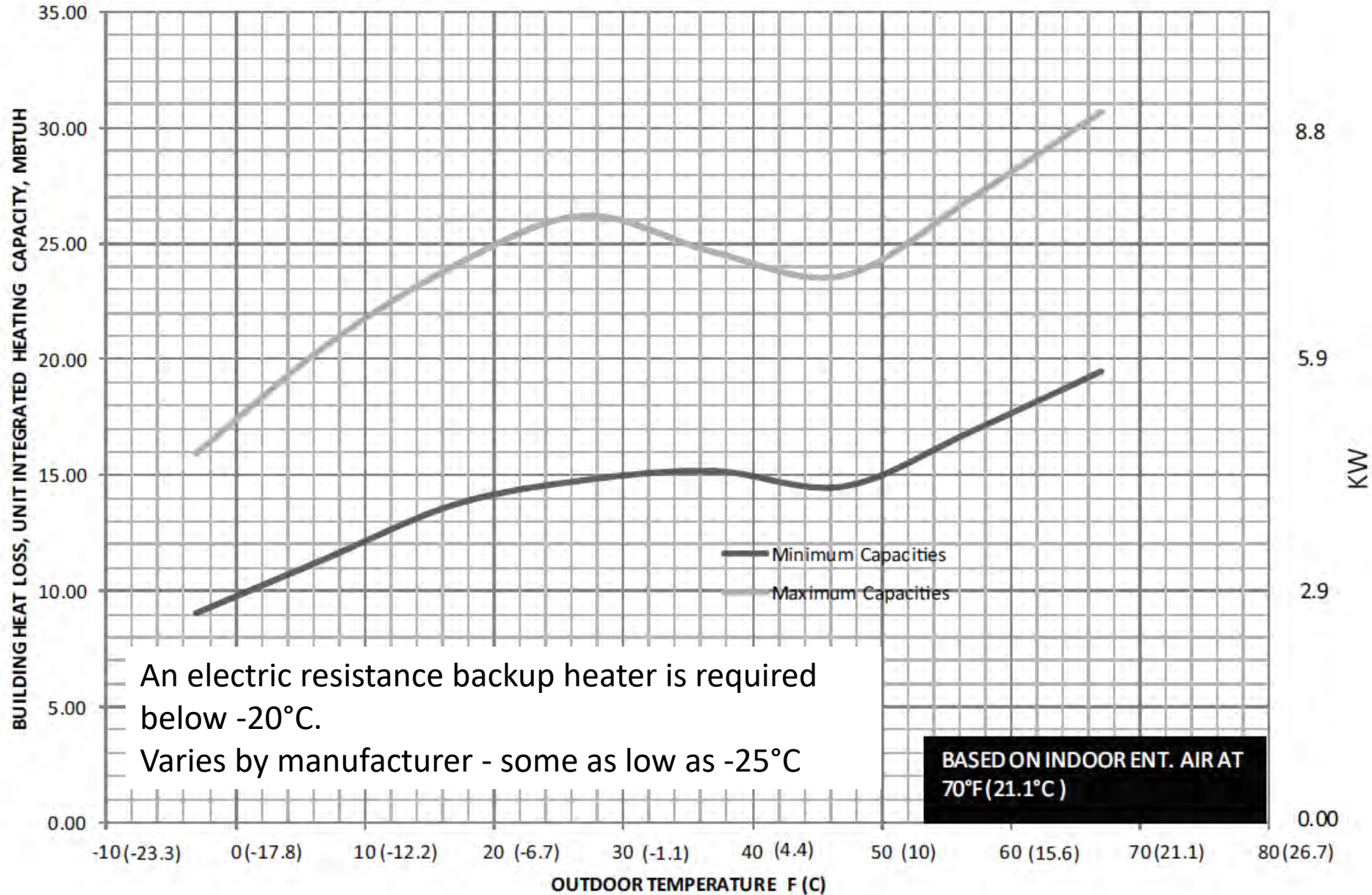
		Passivhaus	Low Energy Building	Typical New House	Canadian Average	Saskatchewan Average
	Wall R-Value	R60	R40	R20	?	??
	Annual Space Heating Energy (kWh/m ²)	15	30	114	150	300
	kWh per year	2,250	4,500	17,100	22,500	45,000
Annual Space Heating Cost	Electricity (Direct)	\$338	\$675	\$2,565	\$3,375	\$6,750
	Electricity (Heat Pump eff:200%)	\$169	\$338	\$1,283	\$1,688	\$3,375
	Gas	\$333	\$388	\$694	\$826	\$1,373
	Gas (w \$50/tonne Carbon Levy)	\$364	\$450	\$932	\$1,138	\$1,998

+\$278 Annual Basic Charge for Gas Service

	Cost of Energy (\$/kWh)
Electricity	0.15
Gas	0.022
	Seasonal Efficiency
Electricity	100%
ASHP	200%
Geothermal	300%
Gas	90%

Carbon Price	
0.25	kg/kWh natural gas CO ₂ emissions
50	\$/tonne carbon price
0.0125	\$/kWh

25VNA024 BALANCE POINT WORK SHEET (MINIMUM & MAXIMUM HEATING CAPACITIES)

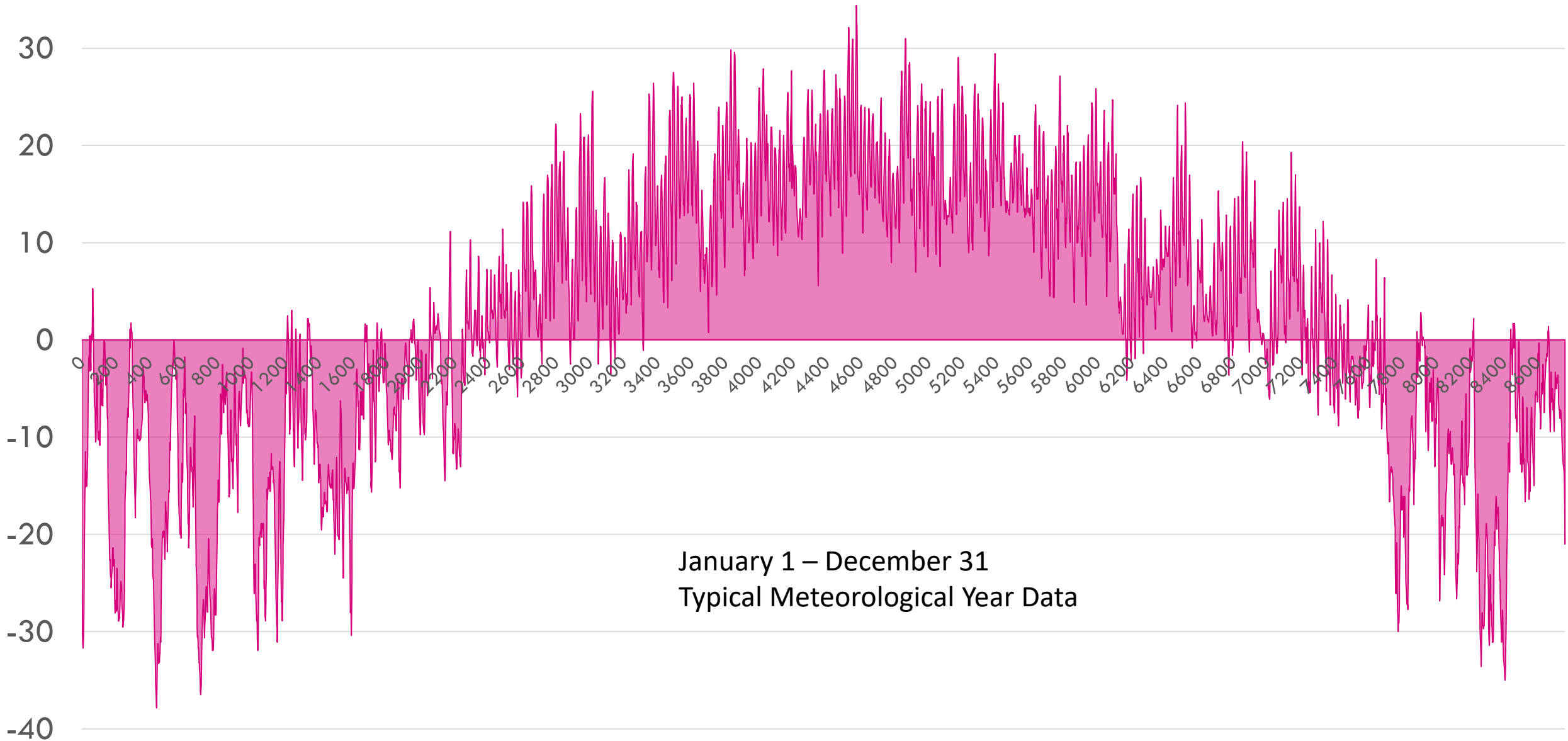


An electric resistance backup heater is required below -20°C.

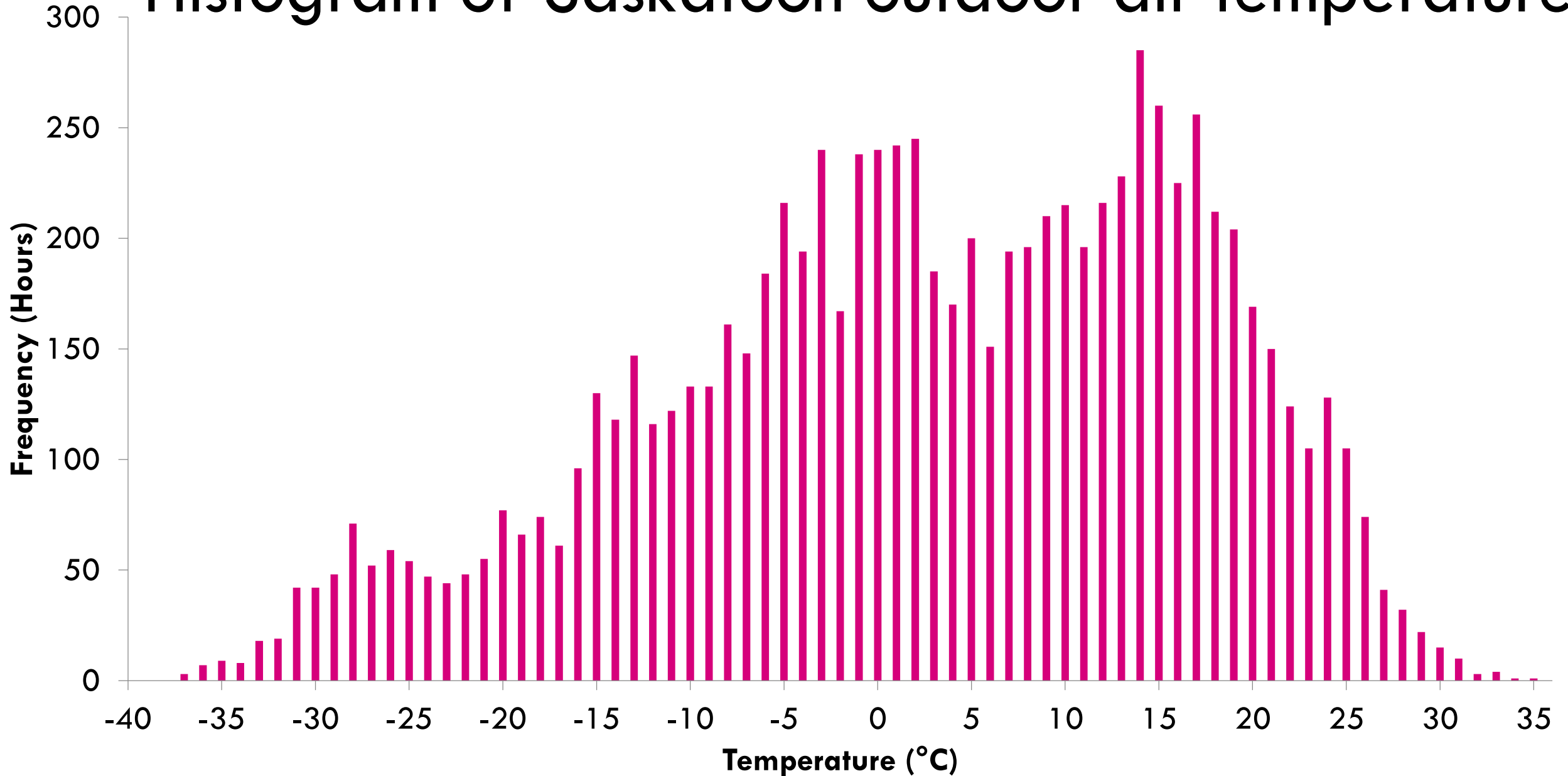
Varies by manufacturer - some as low as -25°C

BASED ON INDOOR ENT. AIR AT 70°F (21.1°C)

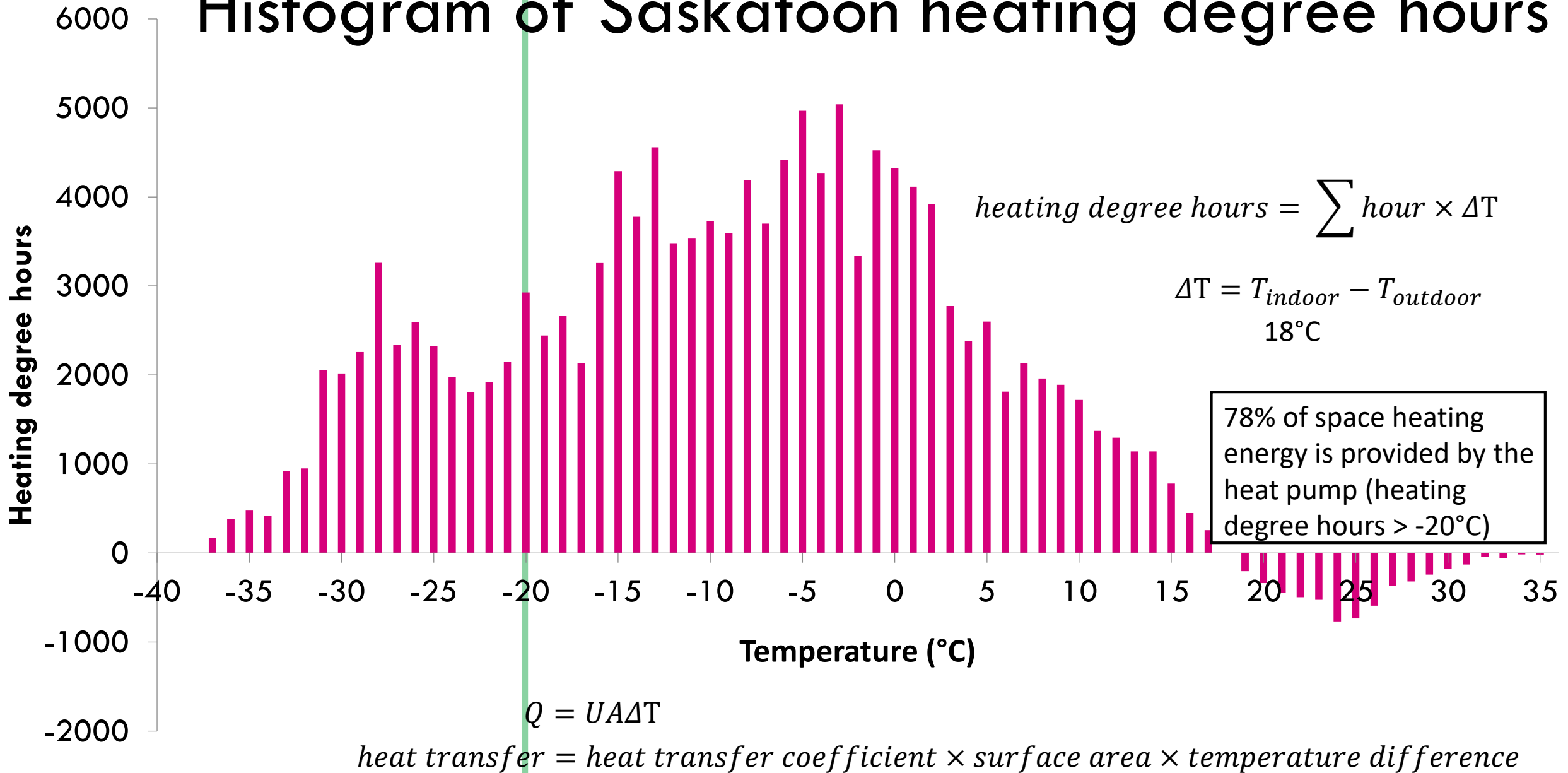
Hourly temperature Saskatoon (°C)



Histogram of Saskatoon outdoor air temperature

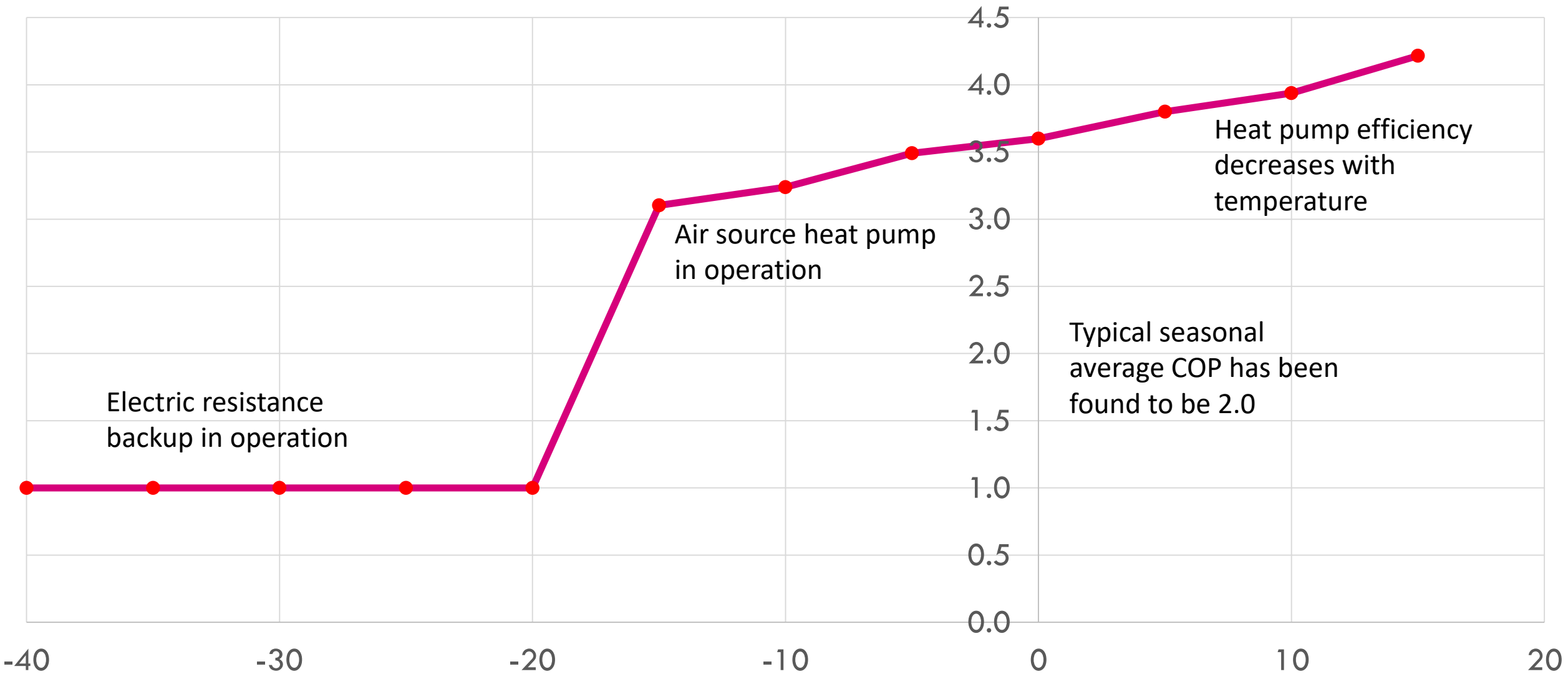


Histogram of Saskatoon heating degree hours

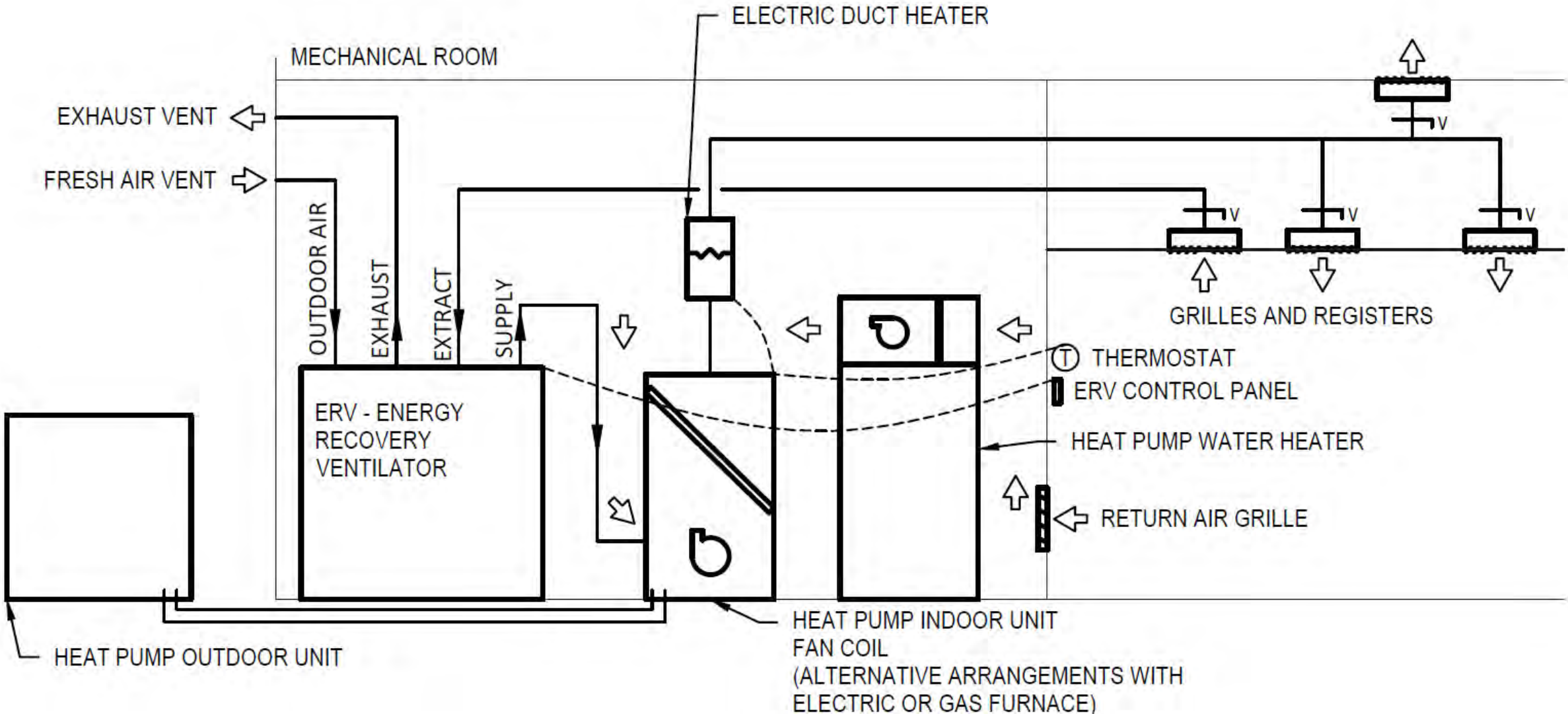


Heat pump efficiency vs temperature (°C)

(Coefficient of performance)



Air source heat pump HVAC schematic





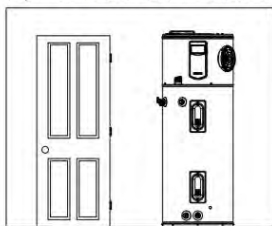
The new degree of comfort.*

Heat pump domestic hot water heater

Hybrid Water Heater Installation Guidelines to Provide Optimal Efficiency

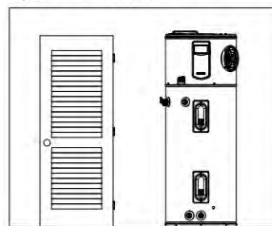
Heater: Not Ducted

Room size: Larger than 700 ft³ (e.g. 7' x 10' x 10').
Requirements: No additional ventilation needed.



Heater: Not Ducted

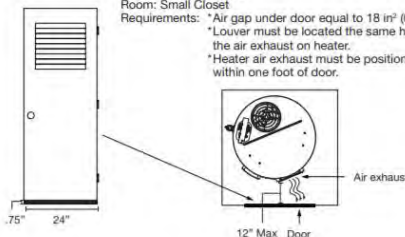
Room size: Smaller than 700 ft³ (e.g. 7' x 10' x 10').
Requirements: Full louvered door OR two louvers top and bottom. See below.



Heater: Not Ducted

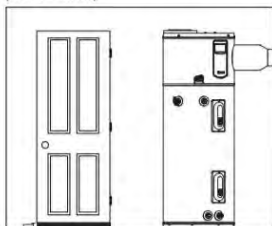
Room: Small Closet

Requirements: *Air gap under door equal to 18 in² (0.75" clearance).
*Louver must be located the same height on door as the air exhaust on heater.
*Heater air exhaust must be positioned towards louver within one foot of door.



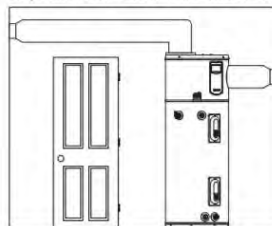
Heater: Ducted with inlet OR outlet duct

Room size: Any size room
Requirements: Air gap under door equal to 18 in² (0.75" clearance)



Heater: Ducted with inlet AND outlet duct

Room size: Any size room
Requirements: No additional ventilation needed.



Professional Prestige® Hybrid Electric

Efficiency

- High 3.50 EF reduces operating cost
- ENERGY STAR® rated

Performance

- Delivers hot water faster than most standard electric water heaters – 67 US gallons first-hour delivery for 50-US gallon model, 75 gallons FHD for 65-US gallon model and 89 gallons FHD for 80-US gallon model
- Ambient operating range: 37-145° F, offering more days of HP operation annually; designed to meet Northern Climate Spec (Tier 3)

Easy Installation

- Easy access side connections
- Quick access to electrical junction box
- Easily replaces a standard electric water heater

Integration

- LCD Screen with built-in water sensor alert with audible alarm



- Integrated EcoNet® WiFi-connected* technology and free mobile app gives users control over water systems, allowing for customizable temperature, vacation settings, energy savings and system monitoring at home or away. Visit Rheem.com/hybridsolutions
- Water sensor detects water outside of the unit and sends an alert via the free Rheem EcoNet® mobile app to the homeowner

Operation Modes

- Energy Saver
- Heat Pump
- High Demand
- Electric
- Vacation: 2-28 days (or placed on hold indefinitely)

Plus...

- Premium grade anode rod with resistor extends the life of the tank
- 3/4" NPT water inlet and outlet; 3/4" condensate drain connections
- Factory-installed heat trap nipples
- Incoloy stainless steel resistor elements
- Dry-fire protection
- Easy access, top mounted washable air filter
- 2" Non-CFC foam insulation
- Enhanced flow brass drain valve
- Temperature and pressure relief valve installed
- Low lead compliant

Warranty

- 10-Year limited tank and parts warranty
See Residential Warranty Certificate for complete information

*WiFi broadband internet connection required.



**Professional Prestige
Hybrid**
50, 65 and
80-US Gallon Capacities
208-240 Volt / 1 PH / 24 Amps
Electric



Manufacturers
Carrier – NuTrend
Lennox
Dettson
Mitsubishi Zuba

•••
multizone damper kits available



 greenspeed
INTELLIGENCE

The Infinity® heat pump system with Greenspeed™ Intelligence delivers unprecedented efficiency in heating and cooling, in the all-electric system or the gas-electric HYBRID HEAT® dual-fuel system.

 Infinity® Control

 Infinity® 20 Heat Pump

 Infinity® 98 Gas Furnace

2 **GAS-ELECTRIC**

 Heats, Cools, Saves.
HYBRID HEAT.

TWO SYSTEMS:

 Infinity® Control

 Infinity® 20 Heat Pump

1 **ALL-ELECTRIC**

 Infinity® Fan Coil

Mini-split systems (ducted/ductless)

Mitsubishi – Cypress Sales Installed at Ketilson Net-zero House

Daikin – HVAC Sales

Single ceiling-concealed split systems



Heat Pumps

Daikin heat pumps provide HSPFs up to 12.5, making Daikin systems efficient and effective even in extreme environments.



Optional accessories available.
Visit www.mrslim.ca for more information.

Heat pump

- Variable Compressor Speed Inverter Technology
- Ozone-Friendly R-410A Refrigerant
- Significant Energy Savings (up to 30%)
- Auto Change Over Between Cooling & Heating
- Extreme Quiet Operation – as low as 23dB(A)
- Ultra-Thin Profile – only 7-7/8 in. high
- Adjustable ESP to meet different layouts
- Built-in High-Performance Drain Pump
- Long Pipe Runs – Up to 100 ft.
- Low Ambient Heating -20°C/-4°F
- Refrigerant Pre-Charged
- 5-Year Parts Warranty
- 7-Year Compressor Warranty

Model	Indoor Unit		SEZ-KD12NA4 ★	SEZ-KD15NA4 ★	SEZ-KD18NA4 ★
	Outdoor Unit		SUZ-KA12NA	SUZ-KA15NA	SUZ-KA18NA
Capacity (Rated)	Cooling	Btu/h	11,500	14,100	17,200
Capacity (Min. – Max.)		Btu/h	3,800 – 13,300	3,800 – 17,000	3,800 – 19,000
Capacity (Rated)	Heating @ 47°F	Btu/h	13,600	18,000	21,600
Capacity (Min. – Max.)		Btu/h	4,800 – 16,400	4,800 – 21,100	4,800 – 24,900

Commercial systems

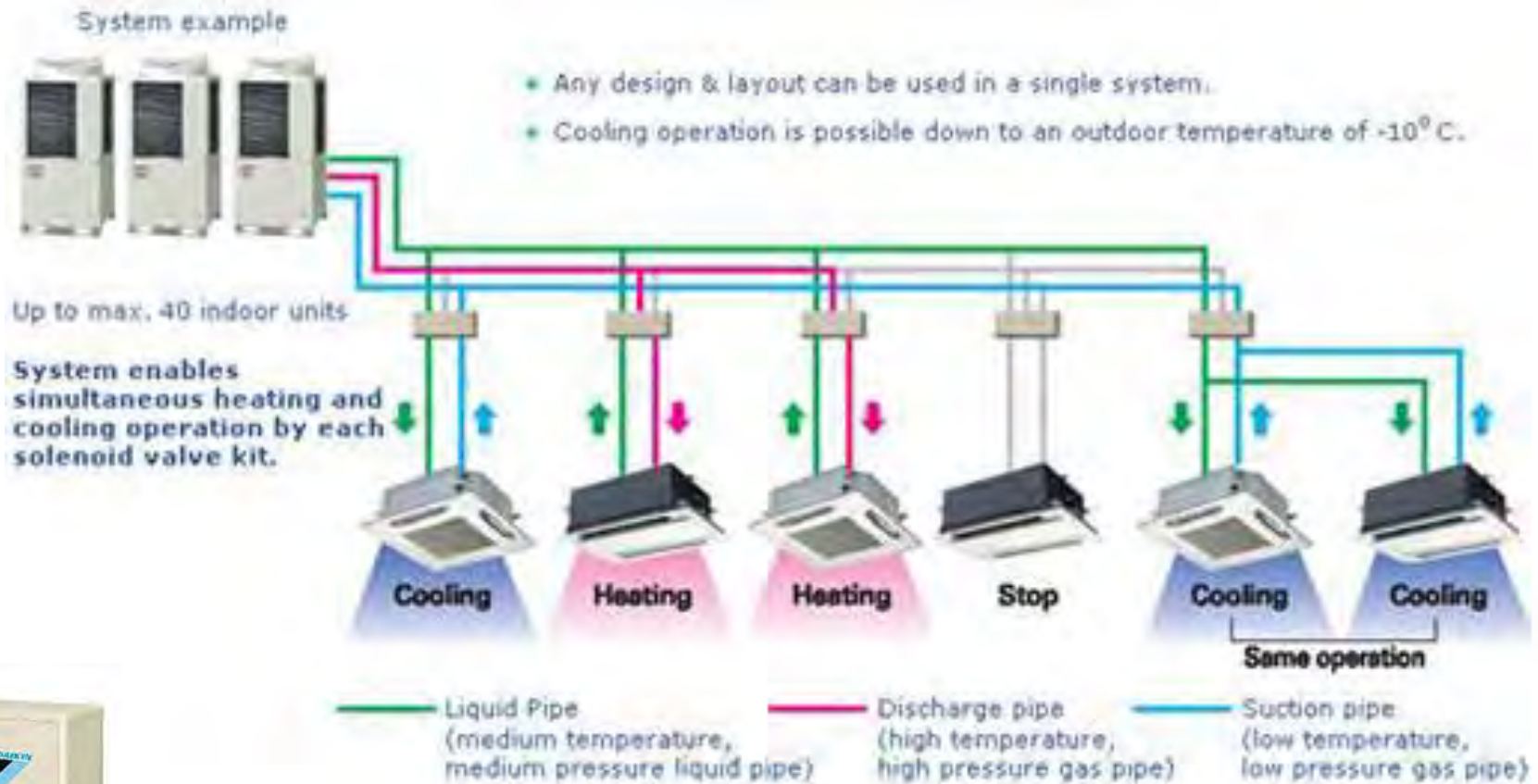
Variable refrigerant flow – VRF, multizone

<https://www.youtube.com/watch?v=-2Xp5xDXYM> 2:55

Often used as cooling only but have heat pump functionality

Used at:

- Holy Cross High School
- STARS Hangar Offices
- Radiance Cohousing
- Many others...



Further thoughts on Air Source Heat Pumps



- Cooling is a nice perk
 - Especially for overglazed and undershaded homes
 - Better resale value, mainstream appeal
- Air source heat pump complements domestic hot water heat pump with cascade effect
 - Domestic hot water heating can be integrated directly into refrigerant loop with VRF systems
- Size heat pump for capacity at shutdown temperature – size electric backup for full load
- Additional electrical demand on grid is small for low energy buildings – comparable to an EV
- Comfort in Passivhaus buildings is achieved through high quality components providing warm wall and window surface temperatures therefore infloor radiant heat is unnecessary / redundant
 - Low airflow forced air from a variable speed heat pump is quiet and comfortable
 - Indoor humidity is more of a question of envelope airtightness and ERV flow rate
 - Options available for infloor electric mat and cable e.g. in bathrooms or select areas
 - Can avoid baseboard heaters – all heating load can often be met by electric duct heater

Further thoughts on Air Source Heat Pumps



- It's not going to payback compared to gas, but it offers an option for a 100% renewably powered building – including heating – that's comparable in cost to operate.
- Similar economics to solar PV for reaching net-zero (but with efficiency first)
- With the solar panels to be installed by the SES Solar Coop, Radiance Cohousing is expected to be a net energy producer and the heat pumps assist with that by reducing our energy needs.
 - The cost for a geothermal field is avoided but most of the advantages of a heat pump remain.
 - Outdoor (condensing) units could one day be replaced by ground source units... so many options.