Natural Resources Canada | Ressources naturelles Canada

Canada

IEA HPT PROJECT 60 WEBINAR JUNE 2026
A CANADIAN PERSPECTIVE

Frédéric Genest, Research Engineer
CanmetENERGY in Varennes
Natural Resources Canada

CANADIAN ENERGY AND HVAC CONTEXT

- Climate
- Energy mix and costs
- Provincial regulations
- HP performance rating standards
- HVAC systems statistics
- Current R&D activities in support of greater HP adoption

CANADIAN CONTEXT: CLIMATE

Whitehorse, YK

- Climate: Subarctic (CZ 7B)
- HDD: **6580**
- CDD: 10
- T_{design}: -41°C

Yellowknife, NWT

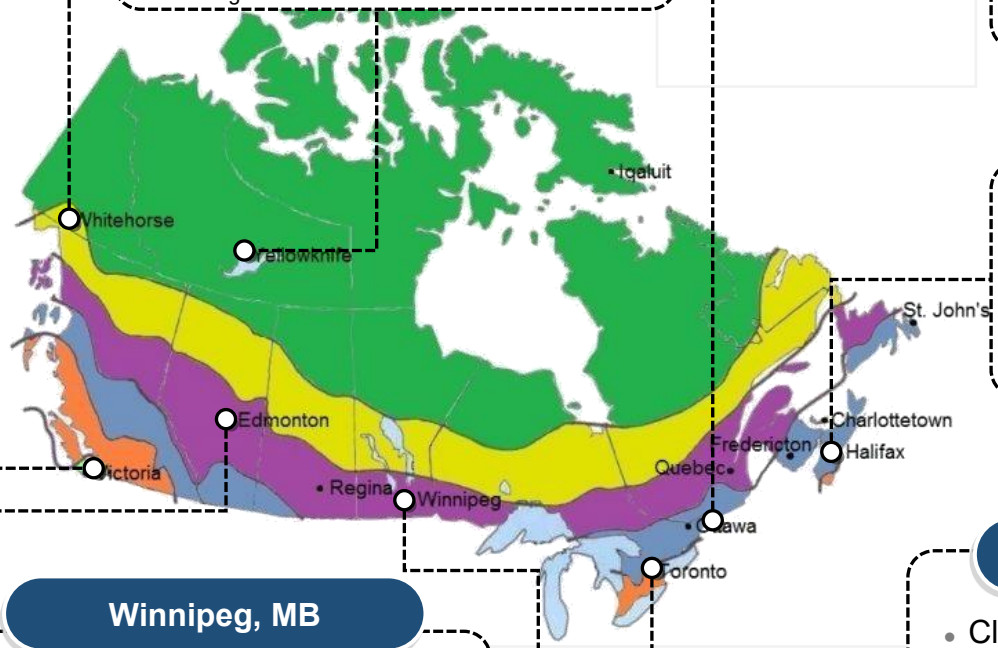
- Climate: Arctic (CZ 8)
- HDD: **8170**
- CDD: 46
- T_{design}: -41°C

Montreal, QC

- Climate: Cold-Humid (CZ 6A)
- HDD: **4200**
- CDD: 299
- T_{design}: -23°C

Vancouver, BC

- Climate: Marine (CZ 4C)
- HDD: **2825**
- CDD: 61
- T_{design}: -7°C



Halifax, NS

- Climate: Cold-Humid (CZ 6A)
- HDD: **4000**
- CDD: 131
- T_{design}: -16°C

Edmonton, AB

- Climate: Very Cold (CZ 7A)
- HDD: **5120**
- CDD: 29
- T_{design}: -30°C

Winnipeg, MB

- Climate: Very Cold (CZ 7A)
- HDD: **5670**
- CDD: 183
- T_{design}: -33°C

Toronto, ON

- Climate: Cold-Humid (CZ 5A)
- HDD: **3520**
- CDD: 348
- T_{design}: -17°C

HDD = Heating Degree Days below 18°C
CDD = Cooling Degree Days above 18°C
T_{design} = January 2.5%

CANADIAN CONTEXT: ENERGY MIX AND COSTS

Whitehorse, YK

- Electricity: $39/GJ
  19 gCO_{2e}/GJ
- NG: N/A
- Fuel Oil: $57/GJ

NG

Yellowknife, NWT

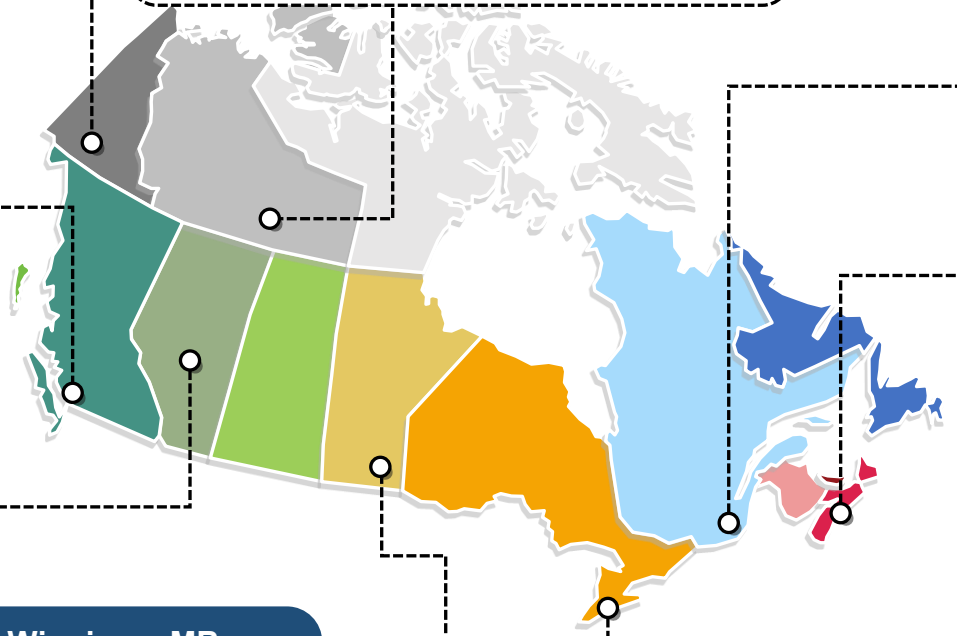
- Electricity: **$106/GJ**
  50 gCO_{2e}/GJ
- NG: N/A
- Fuel Oil: $47/GJ

Montreal, QC

- Electricity: **$28/GJ**
  0,3 gCO2e/GJ
- NG: $17/GJ
- Fuel Oil: **$60/GJ**

Vancouver, BC

- Electricity: $39/GJ
  4 gCO_{2e}/GJ
- NG: $15/GJ
- Fuel Oil: $57/GJ



Halifax, NS

- Electricity: $50/GJ
  183 gCO2e/GJ
- NG: **$34/GJ**
- Fuel Oil: $54/GJ

Edmonton, AB

- Electricity: $50/GJ
  131 gCO2e/GJ
- NG: **$8/GJ**
- Fuel Oil: $57/GJ

Toronto, ON

- Electricity: $44/GJ
  10 gCO_{2e}/GJ
- NG: $15/GJ
- Fuel Oil: **$64/GJ**

Winnipeg, MB

- Electricity: **$31/GJ**
  0,4 gCO2e/GJ
- NG: **$12/GJ**
- Fuel Oil: $57/GJ

Utility Rates as of cerca 2022

CANADIAN CONTEXT: PROVINCIAL REGULATIONS

Yukon

- National Building Code 2020
- National Energy Code for Buildings 2020 (*)

NWT / Nunavut

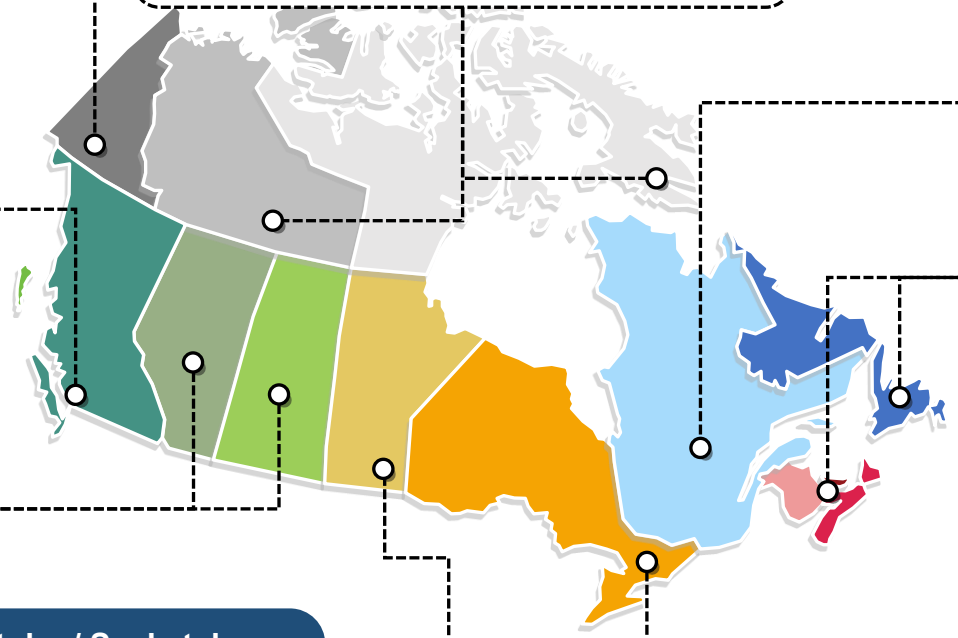
- National Building Code 2020
- National Energy Code for Buildings 2020 (*)

Quebec

- National Building Code 2020 (*)
- National Energy Code for Buildings 2020 (*)
- **Montreal GHG BEPS**
- **Provincial energy/GHG BEPS**

British Colombia

- National Building Code 2020 (*)
- National Energy Code for Buildings 2020 (BC Step Code)
- **Vancouver energy/GHG BEPS**



NB / NS / PEI / NFL

- National Building Code 2020
- National Energy Code for Buildings 2020

Alberta

- National Building Code 2020 (*)
- National Energy Code for Buildings 2020 (*)

Ontario

- National Building Code 2020 (*)
- National Energy Code for Buildings 2020 (*)
- **Toronto Green Building/BEPS**

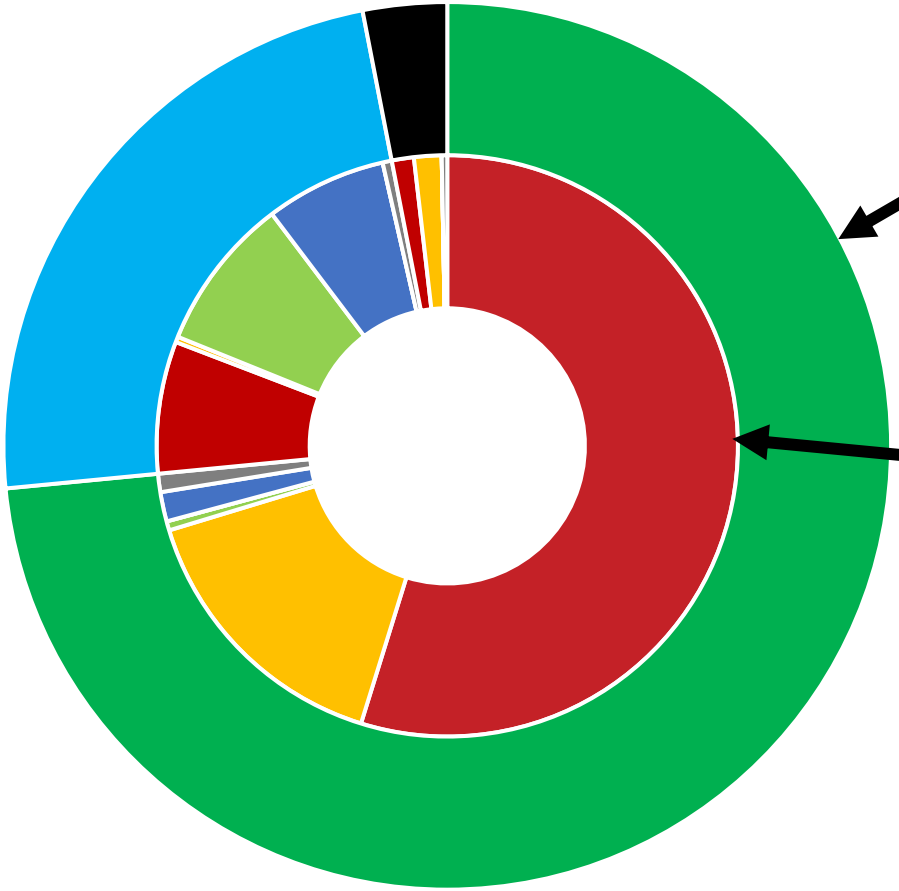
Manitoba / Saskatchewan

- National Building Code 2020
- National Energy Code for Buildings 2020

* With provincial modifications/variances

CANADIAN CONTEXT: PRIMARY HEATING SYSTEMS IN C/I

HVAC and heating energy source distribution



Qualitative distribution

Primary heating energy source		Proportion
Natural gas		72%
Electricity		23%
Fuel oil and other		5%

Primary HVAC for heating		Proportion
Forced air (RTU/furnace)		63%
Boiler / hydronic		17%
Heat pump		9%
Electric resistance		6%
District heat and other		5%

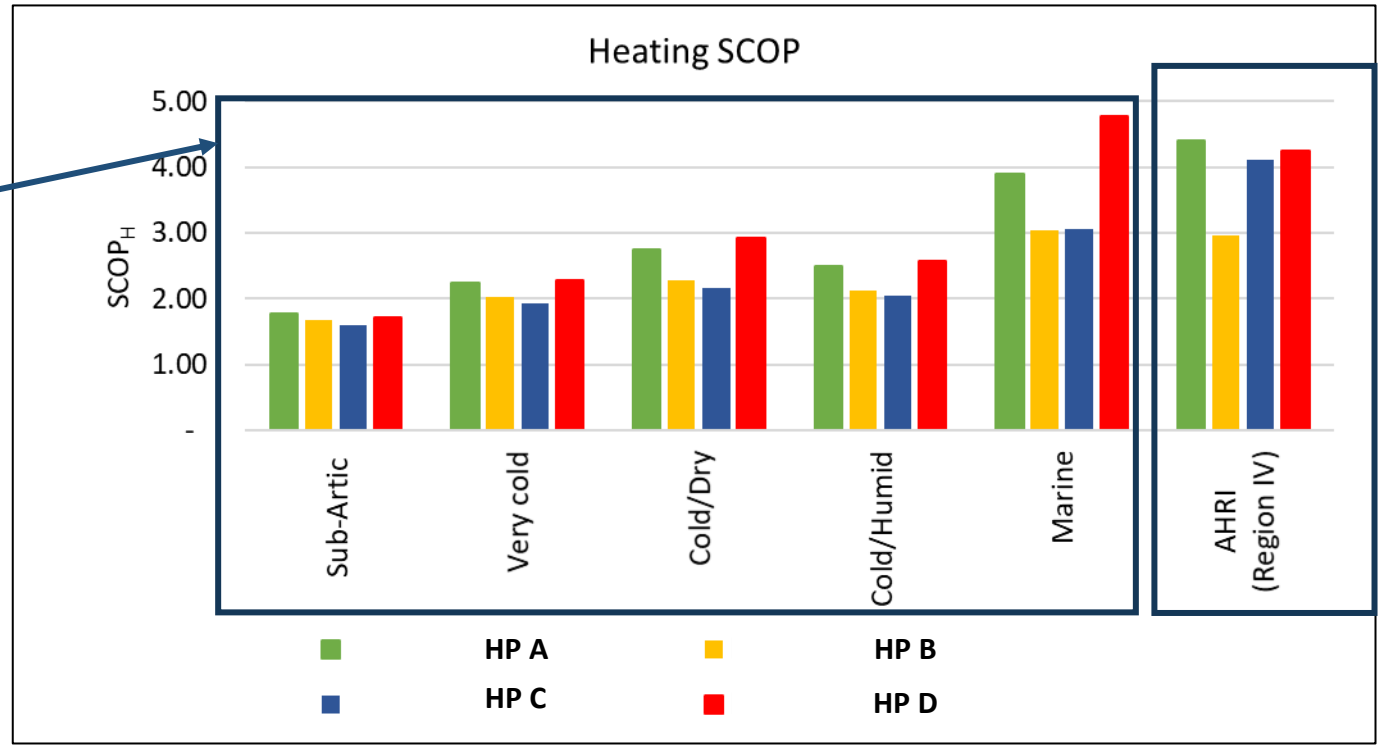
SUPPORTING ADOPTION: HP PERF. RATINGS

Collaboration between NRCan, other organizations
to support development of new test standards (below small residential ASHP)

Adapted to Canadian climates

CSA SPE-07:2023
Load-based testing and rating
Air-source A/C & HP (<19 kW)
More realistic perf. estimate

CSA C715:2026
New testing & rating standard
Air-to-water HP (<19 kW)
Combination space/DHW

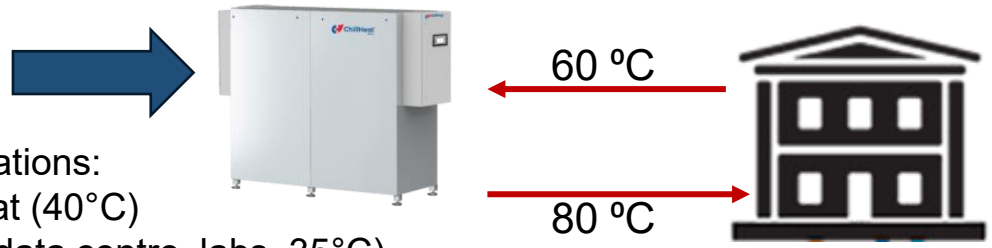


AHRI 210/240
Common Standard
Struggles to reflect in-field perf. in Canada

Region IV is “CZ 4”
Region V is “CZ 5-6”

SUPPORTING ADOPTION: HIGH-TEMPERATURE HP

High Temperature HPs (HTHP) as Retrofits in C/I Buildings



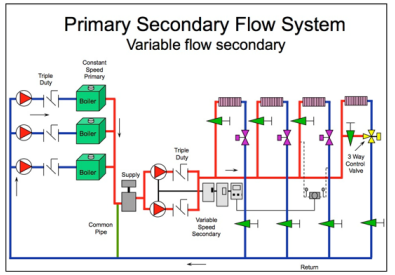
Source

Sample applications:

- District Heat (40°C)
- HR CHW (data centre, labs, 35°C)
- Geothermal (-5°C to +5°C)

Existing Water-Side HVAC

Hot Water (HW)		
Plant		
Plant Design	Automatic	-
Type of Boiler(s)	Electric boiler(s)	-
Number of Boiler(s)	1	-
Total Boiler(s) Capacity	2	kW
Boiler(s) Efficiency	100	%Et
Oversize Ratio	20	%
Loop		
Loop Design	Automatic	-
Design HW supply temp.	180	°C
Design HW ΔT	16	°C
HW supply temp. Control	Fixed	-
Supply Temp. Setpoint	82	°C
OA Low Temperature	-16	°C
OA High Temperature	0	°C
Supply Temp. @ OA Low	82	°C
Supply Temp. @ OA High	60	°C
Equipment Control Sequences	80	%PLR
Primary Pump Flow	4	l/s
Primary Pump Power	19	W/GPM
Primary Pump Control	Riding the Pump Curve	-
Secondary Pump Flow	0	l/s
Secondary Pump Power	0	W/GPM
Secondary Pump Control	Riding the Pump Curve	-



HTHP: Strong potential as C/I HP retrofit solution

Connect to HT heating sys. w/o need for costly renovation

Enables low-T DH, heat recovery, renewable integration

Our Work: Testing, modelling, assessment tool development

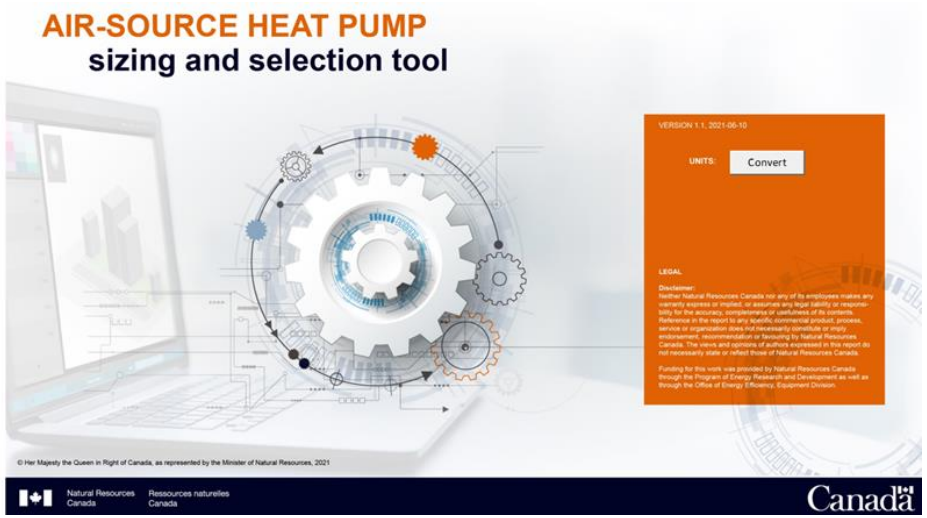
HTHP Assessment Tool (Under development)

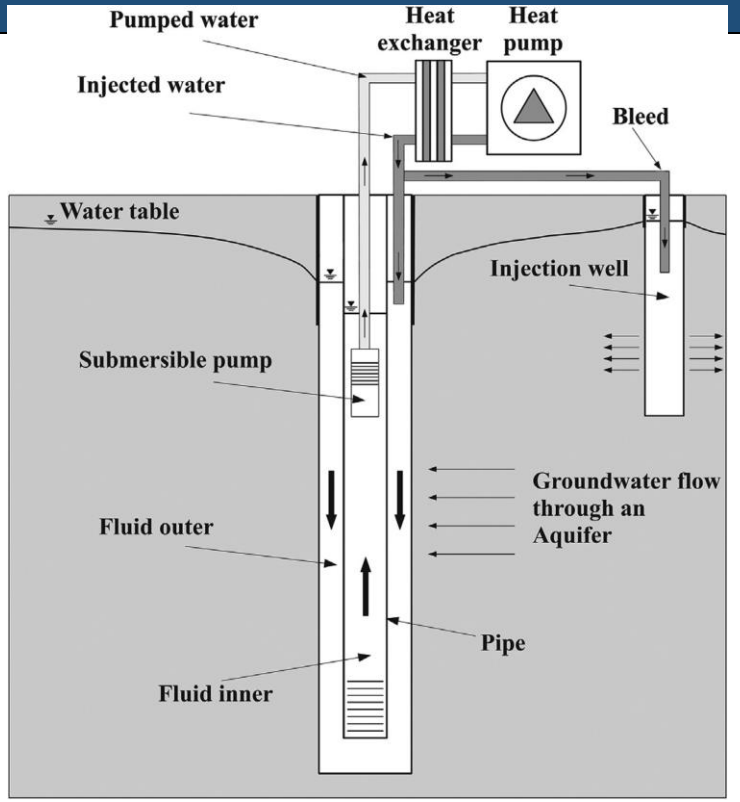
Comparison of various HVAC systems

- Boiler/chiller, conven. HP, HTHP (various config)
- GHG, energy, operational costs

SUPPORTING ADOPTION: HP SYSTEM SIZING

Maximizing HP Performance Benefits





NRCan ASHP Sizing & Selection Toolkit

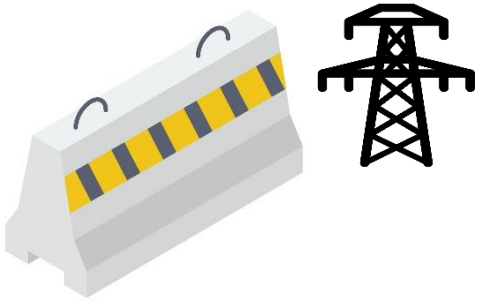
Framework for sizing, selecting air-source HPs in Canada

Webinars/training to support installers (Market need)

GSHP Guidance and GHE modeling/sizing tool

Optimization of GSHP systems and fast dynamic simulation of closed-loop vertical and SCW

CANADIAN R&D FOR NEXT GEN HP SYSTEMS



Elec Demand and Flexibility of HP Systems

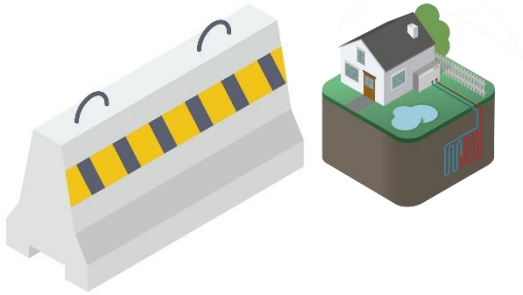
HPs must be optimized to support peak management

R&D Activity: HP + Thermal Storage systems (Grid Optimized HPs),
Advanced controls

Transition to Low-GWP Refrigerants

Transition to low-GWP refrigerants requires new solutions

R&D Activities: CO_2-based HP systems and thermal networks
Refrigerant mixtures for cold climates

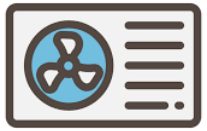


First Cost of GSHPs

GSHPs are an efficient solution, but have high first cost

R&D Activity: Compact ground heat exchangers
CO_2 DX GSHPS
Standing Column Wells

KEY TAKEAWAYS



Heat Pumps: A Key Element of Canada's Decarbonisation Strategy

Breakeven or savings on annual utility costs under most scenarios/regions

National & regional policy driving increased uptake

Market Support Activities Critical to Driving Uptake

Proper sizing and integration needed to capitalize on system potential

Training, industry support needed to broaden awareness of best practise

R&D for Next Generation Canadian Systems

Focus on affordable systems well adapted to Canada

Strong need for energy flexible HP systems, retrofit solutions