



Natural Resources
Canada

Ressources naturelles
Canada

Canada

IEA HPT COUNTRY REPORT: CANADA OVERVIEW OF HP POLICY & RD&D ACTIVITIES

CanmetENERGY
In Varennes

PRESENTATION OVERVIEW AND OBJECTIVES

Purpose: **Understand current landscape** for heat pumps in Canada
 Showcase work to **address market needs and support adoption**



Policy

Policy Drivers
 HP related policies, programs



Context

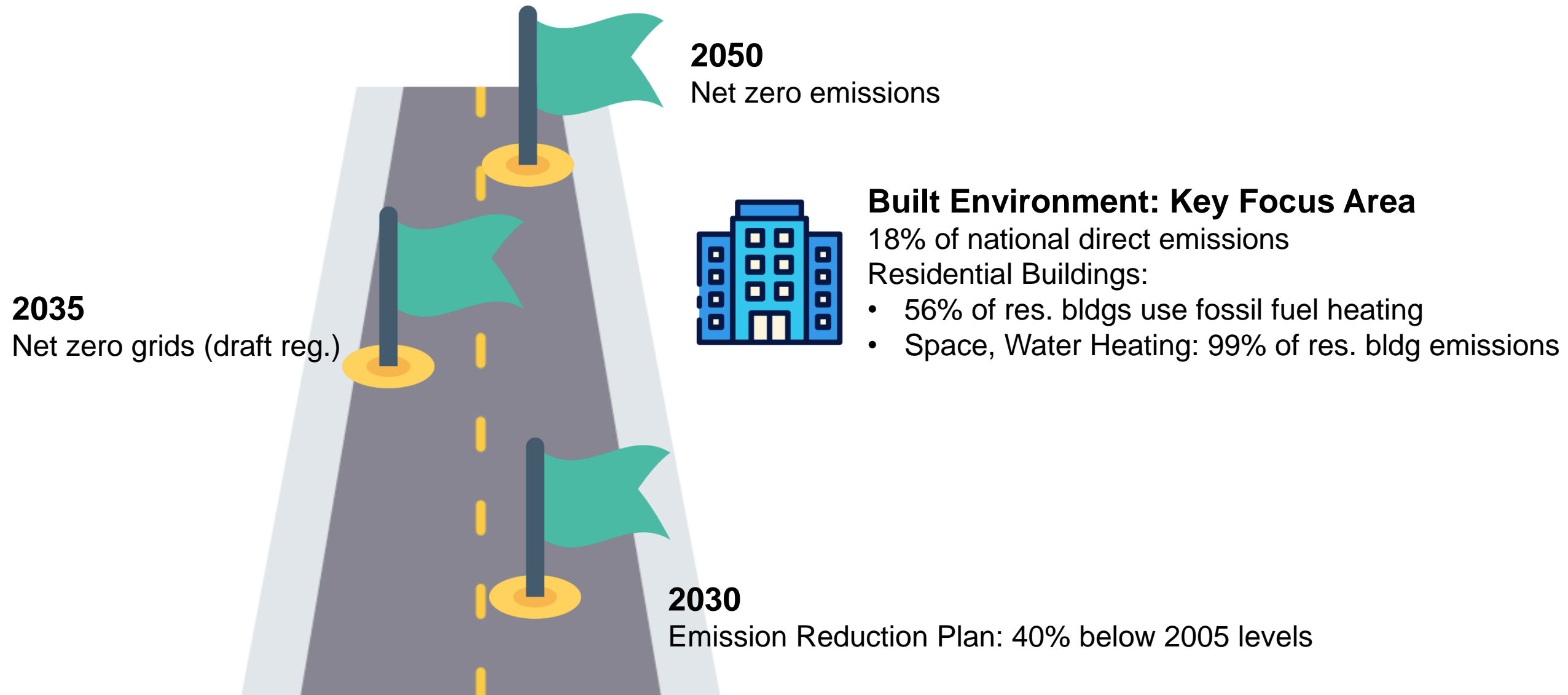
Climate, energy markets
 Snapshot: ASHP potential



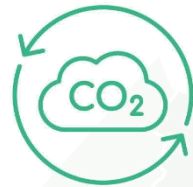
HP RD&D

Supporting adoption across Canada

CANADIAN CONTEXT: POLICY DRIVERS



CANADIAN CONTEXT: SUPPORTING POLICY



Canada's 2030 Emission Reduction Plan

“Regulatory standards, incentive framework to support **transition off fossil fuels for heating**”



Current National Policy & Programs

Canada Greener Homes Program: HP Incentives (HPs #1 upgrade under program)

Oil to HP Affordability Grant

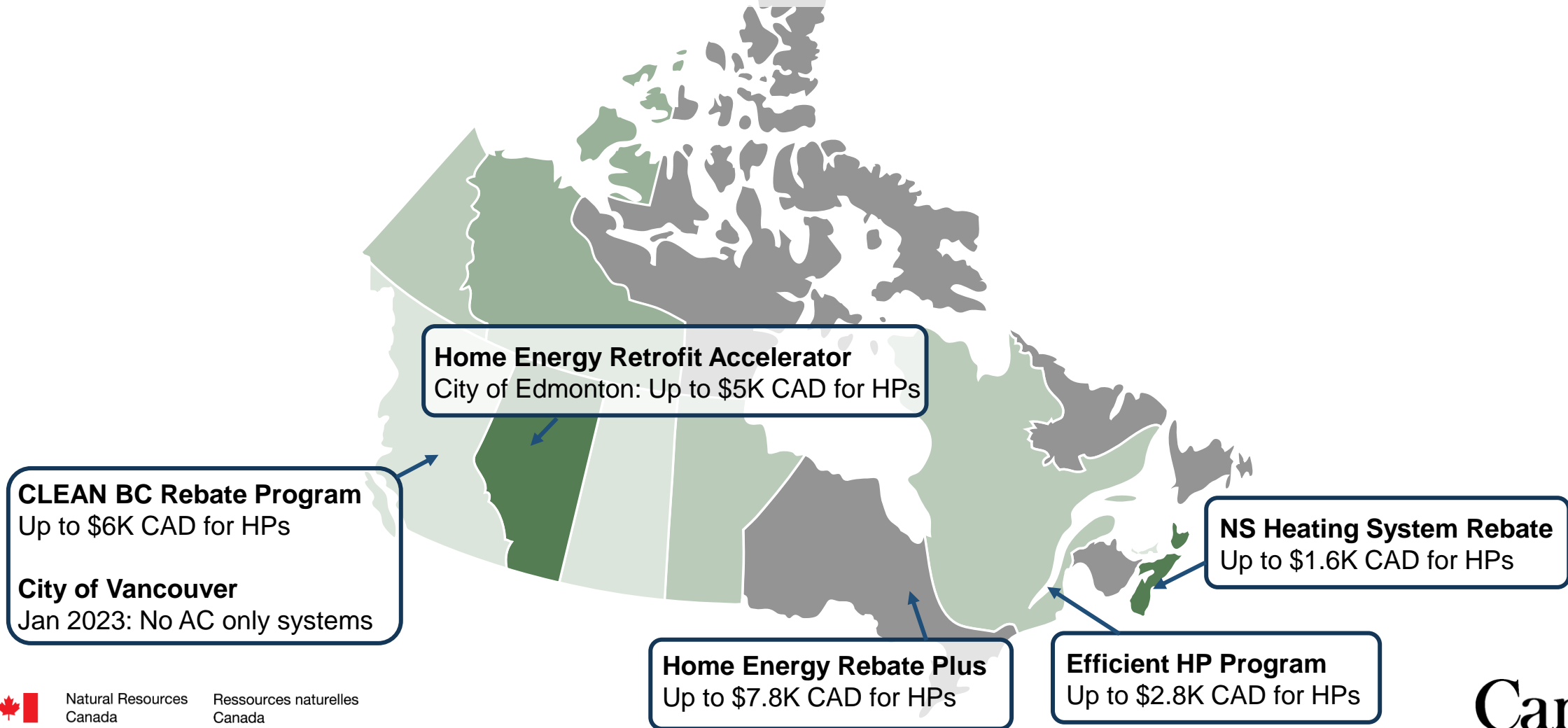
Canada Green Buildings Strategy (in development)

- Standards, incentive framework for transition off fossil fuels for heating



CANADIAN CONTEXT: SUPPORTING POLICY

Select Regional Policies



CANADIAN CONTEXT: CLIMATE

Whitehorse, YK

- Climate: Subarctic
- HDD: 6580
- CDD: 10
- T_{design} : -41.1°C (-42°F)

Vancouver, BC

- Climate: Marine
- HDD: 2825
- CDD: 40
- T_{design} : -7.2°C (19°F)

Edmonton, AB

- Climate: Very Cold
- HDD: 5120
- CDD: 20
- T_{design} : -30.0°C (-22°F)

Winnipeg, MB

- Climate: Very Cold
- HDD: 5670
- CDD: 170
- T_{design} : -32.8°C (-27°F)

Montreal, QC

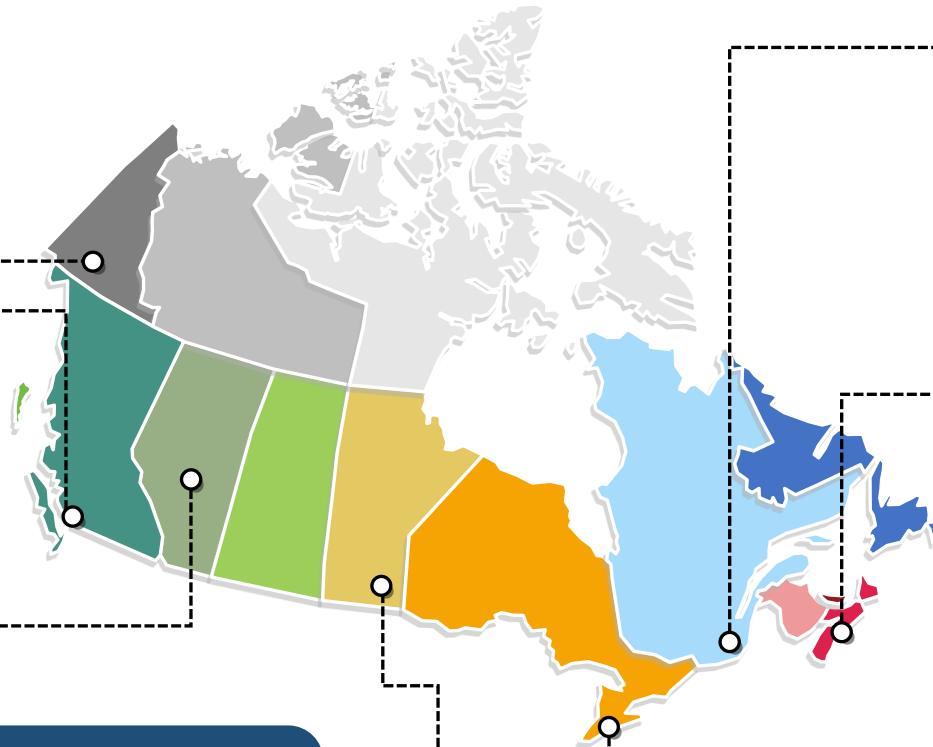
- Climate: Cold-Humid
- HDD: 4200
- CDD: 250
- T_{design} : -22.8°C (-9°F)

Halifax, NS

- Climate: Cold-Humid
- HDD: 4000
- CDD: 100
- T_{design} : -16.1°C (3°F)

Toronto, ON

- Climate: Cold-Humid
- HDD: 3520
- CDD: 280
- T_{design} : -17.8°C (0°F)



HDD = Heating Degree Days



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CANADIAN CONTEXT: ENERGY

* Utility Rates as of Nov. 2022, including carbon tax and rate riders

Whitehorse, YK

- Electricity: \$0.14/kWh
113 gCO_{2e}/kWh
- NG: N/A
- Fuel Oil: \$2.18/L



NG

Vancouver, BC

- Electricity: \$0.14/kWh
20 gCO_{2e}/kWh
- NG: \$15.31/GJ
- Fuel Oil: \$2.18/L



Edmonton, AB

- Electricity: \$0.18/kWh
670 gCO_{2e}/kWh
- NG: **\$8.27/GJ**
- Fuel Oil: \$2.18/L



Winnipeg, MB

- Electricity: \$0.11/kWh
1.3 gCO_{2e}/kWh
- NG: \$12.25/GJ
- Fuel Oil: \$2.18/L



Montreal, QC

- Electricity: **\$0.10/kWh**
1.5 gCO_{2e}/kWh
- NG: \$17.15/GJ
- Fuel Oil: \$2.27/L



Halifax, NS

- Electricity: **\$0.18/kWh**
760 gCO_{2e}/kWh
- NG: **\$33.96/GJ**
- Fuel Oil: \$2.07/L



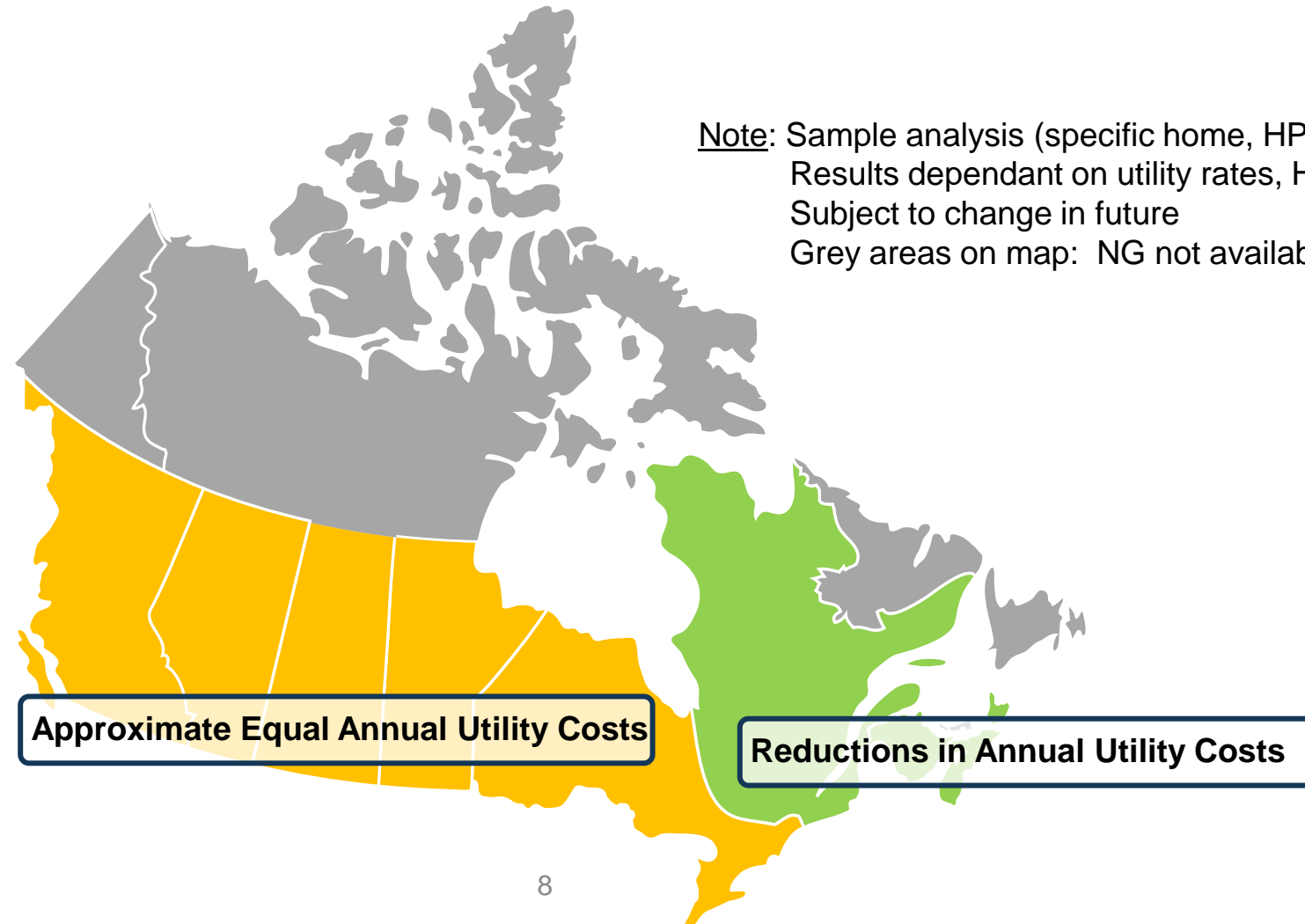
Toronto, ON

- Electricity: \$0.16/kWh
30 gCO_{2e}/kWh
- NG: \$15.00/GJ
- Fuel Oil: \$2.42/L



CANADIAN CONTEXT: TRANSITION TO HP

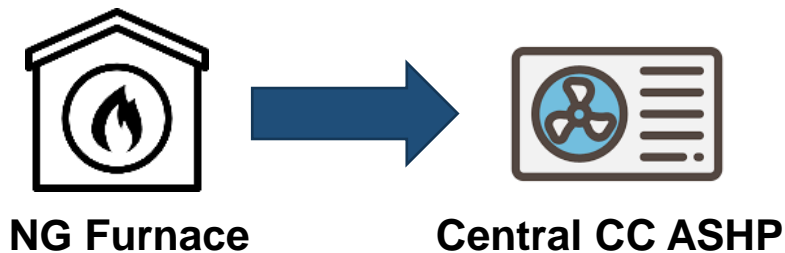
Transition NG Furnace to Air-Source (air-air) HPs: Utility Rates (2022 snapshot)



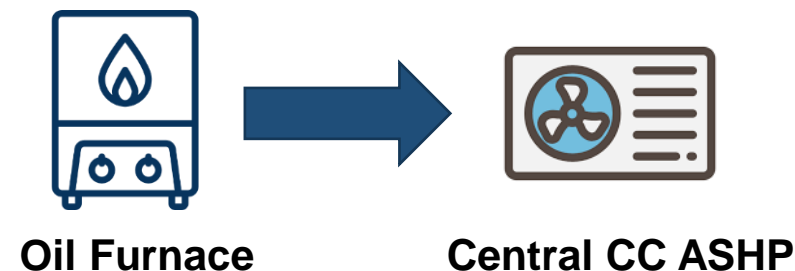
CANADIAN CONTEXT: TRANSITION TO HP

Air-source (air-air) HPs in Canada: Key element of space heating decarbonisation

Energy, GHG, cost impacts depend on regional, integration



Energy Use: Decrease in all cases ✓
GHG Emissions: Decrease in most regions* ✓
Utility Costs: Savings dependant on region ✓



Energy Use: Decrease in all cases ✓
GHG Emissions: Decrease in most regions* ✓
Utility Costs: Decrease in all regions ✓

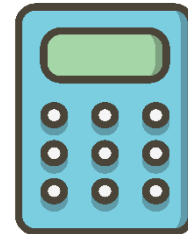
Transition from elec. BB to HP also yields energy, GHG, cost savings ✓

Note: Results dependant on utility rates & system costs used, and may change in future

* Fed Govt.: Target Net-zero electricity grids by 2035

WHAT OTHER BARRIERS EXIST?

Driving HP adoption also means considering other issues



How do systems actually perform?

Performance ratings for Canada

How can deployment be supported?

Training/guidance on HP integration

Support to codes, standards

Implications of large HP adoption

Grid impacts of HP adoption

Flexibility provided by HP sys.

SUPPORTING ADOPTION: HP PERF. RATINGS

Evolution of Air-source HP Regulations (min performance)



Prior to Jan 1, 2023
(Split Central HP)
HSPF (Region V) ≥ 7.1
SEER ≥ 14

Jan 1, 2023 – Dec 31, 2024
(Split Central HP)
HSPF2 (Region V) ≥ 6.0
SEER2 ≥ 14.3
(5F test point optional)

Jan 1, 2025 and later
(Split Central HP)
HSPF2 (Region V) ≥ 6.0
SEER2 ≥ 14.3
(5F test point required)

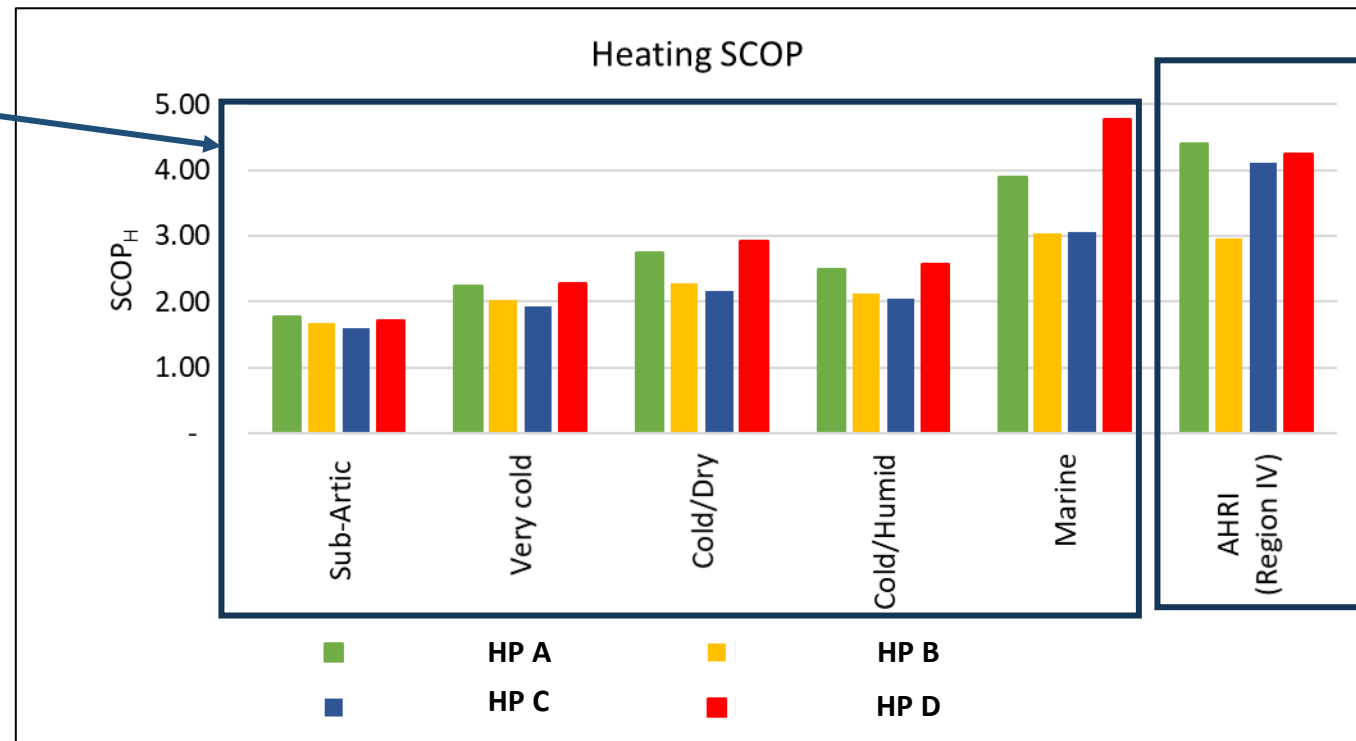
Additional work: Supporting development of new load-based test standard (EXP 07)

SUPPORTING ADOPTION: HP PERF. RATINGS

Collaboration between NRCan, other organizations to support development of new test standard (SPE- 07)

CSA SPE-07 (In development)

Load-based
More realistic perf. estimate
Identifies variation btwn HPs
Adapted to Canadian climates

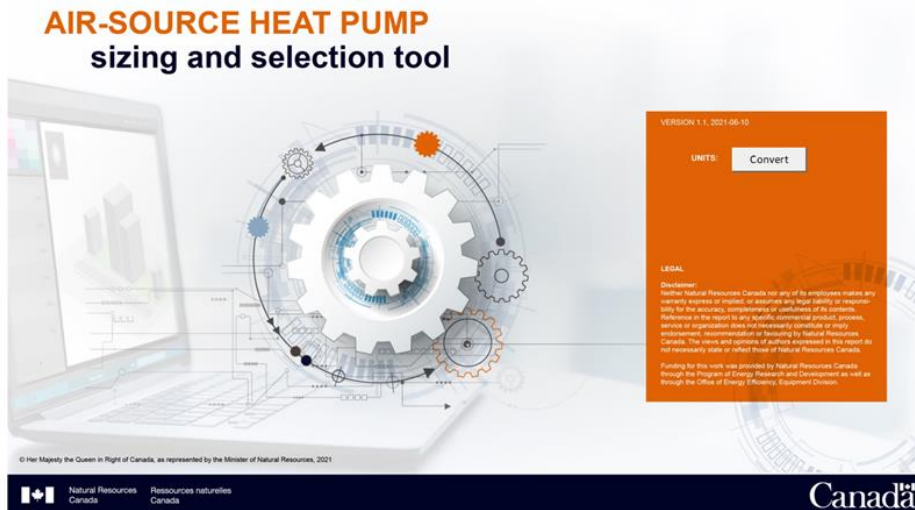


Current Standard
Struggles to reflect
in-field perf. in Canada

SUPPORTING ADOPTION: HP SIZING



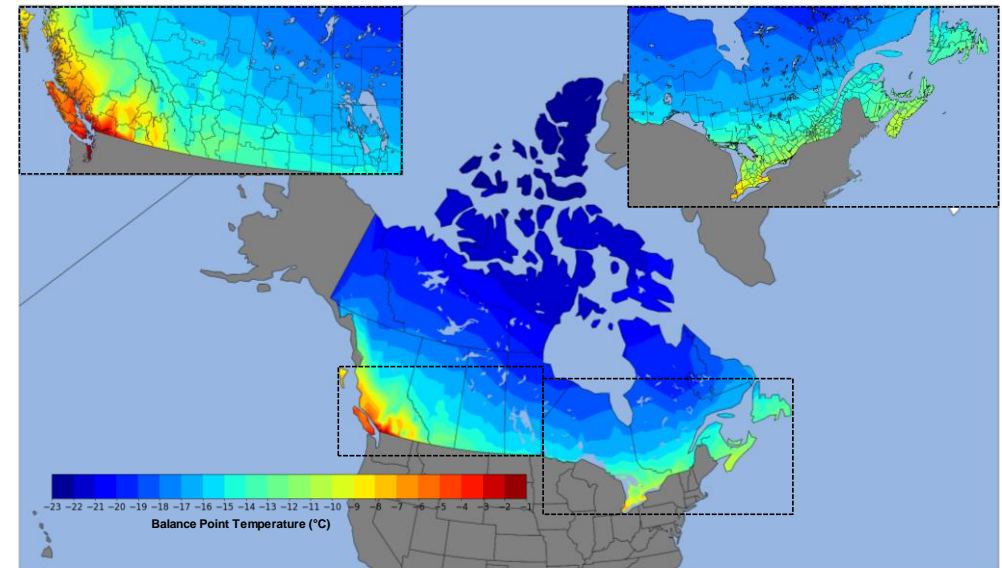
Improving HP Sizing: Maximizing HP Performance Benefits



NRCan ASHP Sizing & Selection Toolkit

Framework for sizing, selecting air-source HPs in Canada

Webinars/training to support installers (Market need)



Simulation-based Sizing Analysis

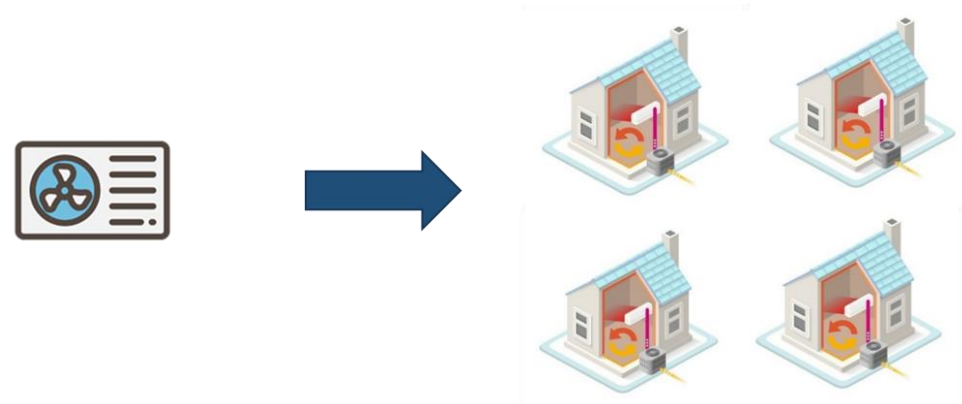
How should I size based on region, home?

Sample map of balance point temperatures



SUPPORTING ADOPTION: HP ELEC DEMAND

Understanding HP elec. demand critical for greater adoption



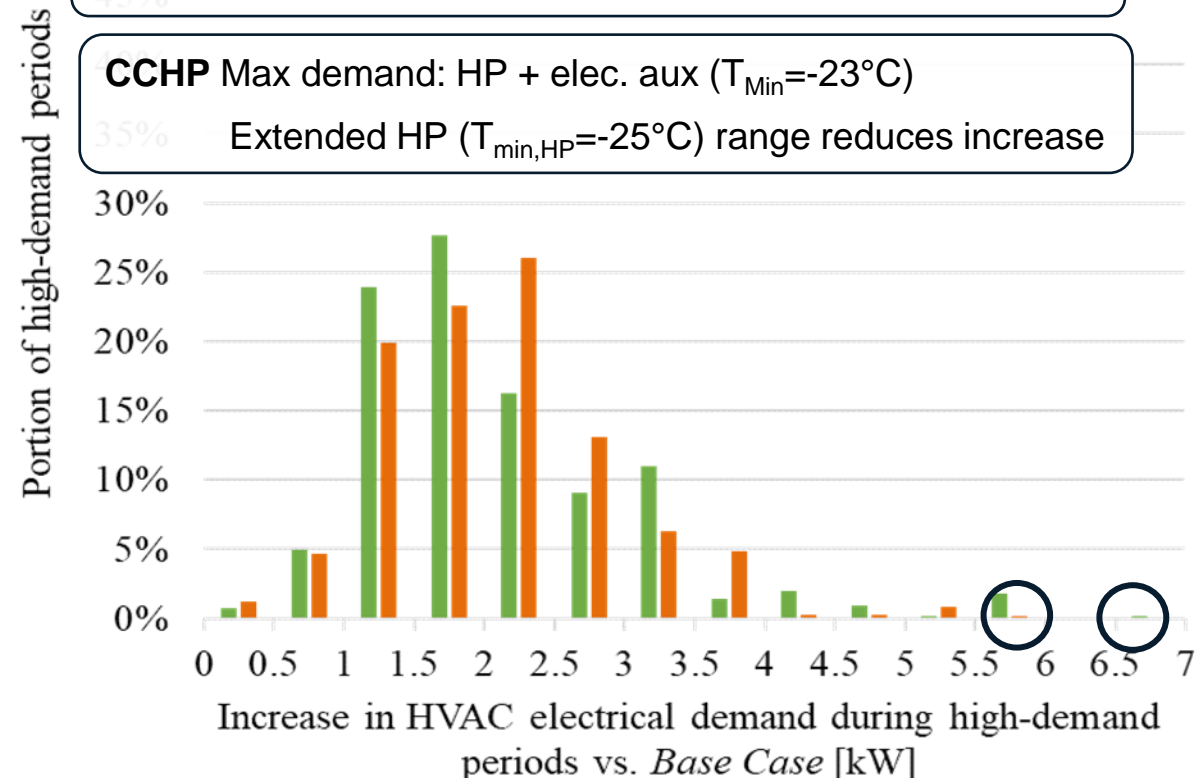
How do different ASHP tech. influence demand?
 How can HPs provide flexibility via controls, storage?

Sample: Transitioning from NG Furnace to HPs in Toronto

■ VCHP Ducted ■ CCHP Ducted
 Median = 1.9 kW 2 kW

VCHP Max when full elec. aux, $T_{\text{Outdoor}} < T_{\text{Min,HP}} (-23^{\circ}\text{C})$

CCHP Max demand: HP + elec. aux ($T_{\text{Min}} = -23^{\circ}\text{C}$)
 Extended HP ($T_{\text{min,HP}} = -25^{\circ}\text{C}$) range reduces increase



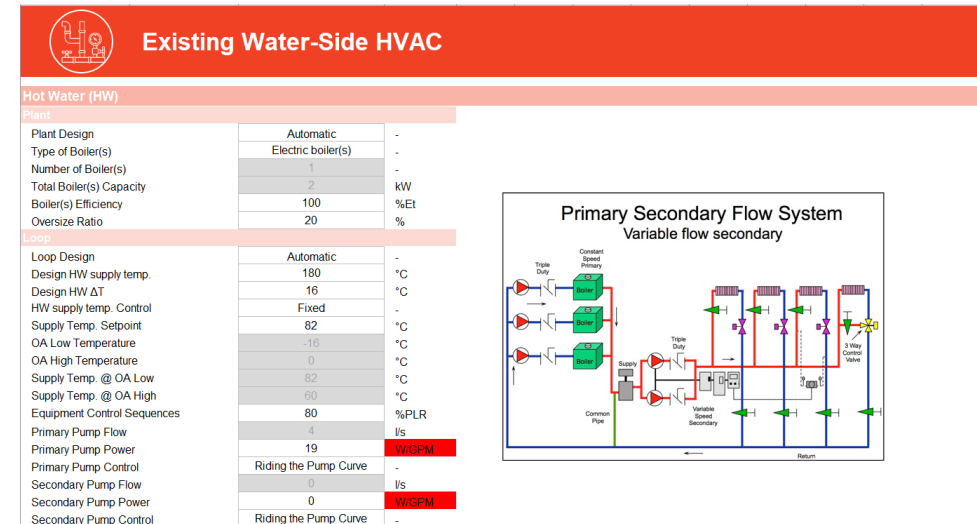
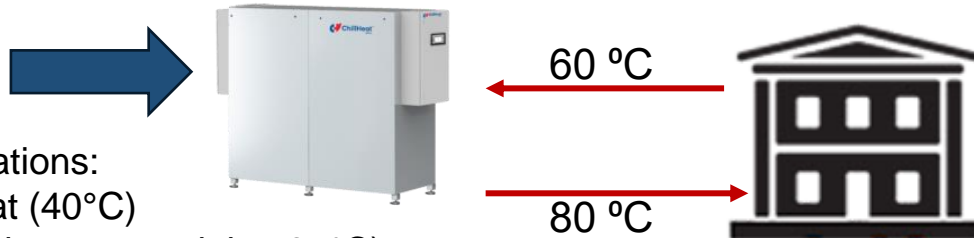
BEYOND RESIDENTIAL SECTOR: C/I SECTOR

High Temperature HPs (HTHP) as Retrofits in C/I Buildings (Annex 60 work)

Source

Sample applications:

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



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

BEYOND RESIDENTIAL SECTOR: INDUST. SECTOR

High Temperature HPs (HTHP) for Industrial Applications (Annex 58 work)

Source temperatures
up to 90°C



Sink temperatures
up to 150°C

Refrigerant Options:
R718, R744, others

Partners

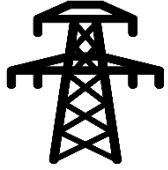


HTHP: Solution to support decarbonisation of industrial processes

Evaluation of HTHP potential in industrial processes

Understanding Canadian market and refrigerant options

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: CO₂-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
CO₂ DX GSHPs
Standing Column Wells

KEY TAKEAWAYS



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

ASHPs: 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

Canada 

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