ANNEX 58
CANADIAN HT HP INDUSTRY, MARKET POTENTIAL & PERSPECTIVES
April 25, 2023
CanmetENERGY RESEARCH CENTRES IN CANADA

VARENNES (QC)
- Buildings
- Industrial processes
- Renewable energy integration
- RETScreen International

OTTAWA (ON)
- Communities & infrastructure
- Industrial processes
- Clean electricity
- Bioenergy
- Renewables
- Transportation

HAMILTON (ON)
- Transportation (materials)
- Clean energy production
- Pipelines
- Manufacturing sector

DEVON (AB)
- Fossil fuel decarbonization, extraction, upgrading, refining and biofuels
- Environmental studies and remediation
- Oil spill science
Over 200 scientists, engineers, technologists, managers and support staff

R&D programs aimed at developing efficient science and technologies for a low-carbon future

Pilot plants equipped to develop, test and demonstrate clean energy solutions applicable to the buildings, smart grids and industrial sectors
BUILDINGS GROUP – R&D PROGRAM

**Low Carbon Heating & Cooling Systems**
- Efficient and Affordable Heating & Cooling Systems (focus on ground source thermal energy systems)
- LGW potential refrigerant-based HPs (focus on CO₂)
- Integrated Systems for Building Flexibility and Resilience (heat pumps with energy storage solutions)

*Synergies with Industrial Processes group*

**Optimization of Building Operation**
- Data-Driven Building Operation for Energy Efficiency, Flexibility and Resilience
- Smart Control Strategies
- Model Predictive Controls (MPC)

**Knowledge and Technology Transfer**
- Collaborations with, academia, utility companies, industry
- IP licensing
- Development of sizing and decision support tools
CANADIAN HT HP INDUSTRY AND MARKET

- HP industry in general is very limited in terms of equipment manufacturers or assemblers (integrators)
- Mostly in the residential and light commercial sectors
- No local products that can deliver heat above 80°C; potential end users have to rely on imported products
- Future technological developments expected to come from refrigeration equipment manufacturers (commercial and industrial)
  - Among them, some have been leading the path in North America for systems using CO$_2$
The industrial sector currently accounts for about 37% of Canada’s GHG emissions

Several very energy intensive subsectors: Pulp & Paper, Mining, Oil & Gas rely heavily on fossil fuel to meet high-temperature process requirements

Departmental analysis on the Canadian industrial sector’s potential to integrate different electrification technologies shows that:

✓ Heat pumps could reduce GHG emissions by 75 million tonnes of CO₂, corresponding to 27% of total reduction resulting from process electrification (cumulative over the next 30 years)

✓ Sectors to adopt HPs in short term: P&P (TMP), food processing including dairy, other light industries

✓ Applications: steam production, hot air drying, washing sterilization, distillation and concentration

✓ The usage of HPs for steam production only is estimated to contribute to 16.5% of the total electrification potential
FACTORS INFLUENCING THE UPTAKE OF HTHPs

Policy and regulation
- Canada pledged to achieve a net-zero electricity system by 2035 and net-zero economy by 2050
- Policies and funding programs developed at national and provincial levels
- Carbon tax: in effect since 2019; 65$ per tonne this year; Canada’s approach is flexible (any province or territory can design its own pricing or choose the federal pricing system)
- Grant programs from utility companies as well
- No more funding for research on fossil fuel-driven energy systems

Price of fossil fuel vs. electricity and grid mix
- Strong regional variation in utility rate, structure: Electricity can be up to 6 times more expensive (per unit of energy) vs. natural gas in some regions
- Grid mix varies greatly by regions; Government pushes for greening electricity generation
- Provinces where clean electricity (mostly hydropower) is abundant: British Columbia, Manitoba, Quebec, and more recently Newfoundland and Labrador
- Developments in thermally-driven heat pumps can play a role in sectors where waste heat is available
Several projects at evaluation stage, but still few implementations

Examples:

- **Diageo’s Distillery in Valleyfield (QC)**
  - Targets to become carbon neutral by 2025
  - Implemented projects include: VMR evaporator, electric boiler

- **Greenfield Global in Varennes (QC)**
  - Canada’s largest ethanol producer and a world leader in high-purity specialty alcohols
  - Committed to reducing the carbon intensity of production through installation of electric boilers and MVR at distillery plant