Residential Heat Pumps 101
Webinar
February 28, 2020

Presented by:
Toronto and Region Conservation Authority

Environment & Energy Division
Overview

1. TransformTO
2. What is a heat pump?
3. Why consider it?
4. Options
5. Next steps
6. Financing your heat pump project
7. Resources

Environment & Energy Division
Climate Emergency

On October 2\textsuperscript{nd} 2019, Toronto City Council unanimously voted to declare a climate emergency and accelerate its efforts to mitigate and adapt to climate change.

TransformTO will now aim to achieve \textbf{net zero emissions} by 2050, or sooner.
What does it mean?

Toronto’s Community-Wide Greenhouse Gas Emissions (GHG)

- **Reported GHG Emissions**
- **Required GHG Emission Reduction Pathway**
- **TransformTO Targets**

Year:
- 1990
- 2000
- 2010
- 2020
- 2030
- 2040
- 2050

(GHG) Emissions (MT eCO₂):
- 30
- 25
- 20
- 15
- 10
- 5
- 0
Toronto’s Emissions

- Buildings: 52%
- Waste: 10%
- Transportation: 38%

Toronto’s Greenhouse Gas Emissions 2017
Sustainable Technologies
EVALUATION PROGRAM
Supported by Toronto and Region Conservation Authority

- Non-profit
- Collaborative
- Research
- Demonstration

- Low-carbon Technology
- Buildings
- Renewables

Environment & Energy Division
What is a Heat Pump?

• Heat is lost from your home whenever it is colder outside.
What is a Heat Pump?

- Heat pumps can extract and “upgrade” heat energy from cold outdoor temperatures.

Large Temperature Difference

Cold Outdoors

Heat Pump

Heat Energy

Warm Indoors
What is a Heat Pump?

- Heat pumps are more efficient when pushing against smaller temperatures differences.
What is a Heat Pump?

- It’s not magic; it’s refrigeration!
- Consider a fridge
- Heat pumps are everywhere
- “Scaled up” versions can heat & cool homes
What is a Heat Pump?

- It’s not magic; it’s refrigeration!
- Consider a fridge
- Heat pumps are everywhere
- “Scaled up” versions can heat & cool homes
Why Consider a Heat Pump?

- They consume much less energy than other options
- Lower carbon footprint

Energy Required to Heat a Home

- Furnace OR Boiler
- Heat Pump

Carbon Emissions from Home Heating

- Furnace OR Boiler
- Heat Pump

30%

10%
The Issue

- Natural gas is currently inexpensive
- Heat pumps typically use electricity
- Switching from gas to heat pump can often be financially unattractive
- They can save energy but not necessarily utility costs
- Need to choose the option that works for you

*Icon made by Pause08 from www.flaticon.com*
Where do you fit?

- **The Green Go-getters**
  You want the “greenest” options possible and are less concerned about additional costs

- **The Wallet Watchers**
  You need a cost-effective investment

- **The Sky-High Electricity Bill Payers**
  You heat with electric baseboards and need relief from high bills

*Icons made by Freepik from www.flaticon.com*
The Green Go-getters
You want the “greenest” options possible and are less concerned about additional costs

What is it?

• Absorbs heat energy from the ground during winter
• Rejects it to the ground during summer
• Ground is at more moderate temperatures
• In Toronto, usually requires multiple deep boreholes extending hundreds of feet into the ground
# Geothermal

## The Green Go-getters
You want the “greenest” options possible and are less concerned about additional costs.

<table>
<thead>
<tr>
<th>Installed Cost</th>
<th>Efficiency</th>
<th>Operating Cost</th>
<th>Carbon Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (Can be ~$30,000)</td>
<td>Best of any technology</td>
<td>Small savings possible vs. natural gas (or on par)</td>
<td>High (vs. natural gas)</td>
</tr>
</tbody>
</table>

- Other considerations
  - Long system lifetime
  - Better cost-performance away from natural gas network
  - Excellent option for larger buildings (multi-unit, commercial)
Central Air-source Heat Pump

The Green Go-getters
You want the “greenest” options possible and are less concerned about additional costs

What is it?

• Absorbs/rejects heat energy from/to the outdoor air
• Looks very similar to a conventional A/C & furnace
• Connects to ductwork
• Modern versions incorporate high-performance features
Central Air-source Heat Pump

The Green Go-getters
You want the “greenest” options possible and are less concerned about additional costs

- Installed Cost: Medium ($10 to $15k)
- Efficiency: Medium
- Operating Cost: No savings vs. natural gas
- Carbon Savings: High (vs. natural gas)

Other considerations
- Not all air-source heat pumps are created equal (discussed later)
- Small form factor makes it viable for most homes with a furnace
- Better cost-performance away from natural gas network
Dual Fuel Heat Pump

The Wallet Watchers
You need a cost-effective investment

- ASHP efficiency increases in warmer outdoor temperatures
- At some outdoor temperatures, efficiency is high enough to be more cost-effective than natural gas!
Dual Fuel Heat Pump

The Wallet Watchers
You need a cost-effective investment

What is it?

- Uses a lower-cost heat pump in conjunction with a natural gas option
- Heat pump used in warmer conditions (or when electricity is cheap)
- Natural gas used in colder conditions
- Looks same as furnace & A/C – think of it as an A/C upgrade
Dual Fuel Heat Pump

The Wallet Watchers
You need a cost-effective investment

<table>
<thead>
<tr>
<th>Installed Cost</th>
<th>Efficiency</th>
<th>Operating Cost</th>
<th>Carbon Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (+$1,000 over A/C)</td>
<td>Low (Uses simple HP)</td>
<td>Savings vs. natural gas-only are possible</td>
<td>Low to Medium</td>
</tr>
</tbody>
</table>

• Other considerations
  • Advanced controls to maximize savings are still on the way
  • May need to buy heat pump and furnace together as package
  • As gas & electricity rates change you choose which system to use!
  • Best option for most homeowners
Ductless Mini-split

The Sky-High Electricity Bill Payers
You heat with electric baseboards and need relief from high bills

What is it?

• Good retrofit option if there is no existing ductwork
• Simple and quick
• Provides high-efficiency cooling
• Makes sense to use in main living space and leave some baseboards in place in other areas
## Ductless Mini-split

**The Sky-High Electricity Bill Payers**
You heat with electric baseboards and need relief from high bills

<table>
<thead>
<tr>
<th>Installed Cost</th>
<th>Efficiency</th>
<th>Operating Cost</th>
<th>Carbon Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (Less than $5,000)</td>
<td>Medium</td>
<td>Savings are large vs. electric baseboards</td>
<td>Low (vs. electric baseboards)</td>
</tr>
</tbody>
</table>

**Other considerations**
- Not all air-source heat pumps are created equal
- Different indoor fan coils form factors available
- Can use more than one if desired
Mini-ducted

The Sky-High Electricity Bill Payers
You heat with electric baseboards and need relief from high bills

What is it?

• It’s also possible to use a mini-ducted heat pump with retrofitted ducting in an attic space
• Delivers heating and cooling to more than one zone
Pitfalls to Avoid

- Ducted heat pump retrofit may require upgrades to ducting
- Poor controls can make back-up heat turn on too frequently
- Poor indoor air quality can quickly clog filters – need to change frequently
- Obstruction of outdoor units
- Basic quality of work
  - Insulated refrigerant lines
  - Insulated wall penetrations
  - Etc.

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Other Heat Pumps

• Heat pumps are a family of technologies
• The options we’ve highlighted are all established technologies
• There are other options beyond those mentioned here
• Even options for producing hot water
Terminology

• All heat pumps are not created equal!

• **Coefficient of Performance (COP)**
  • Heating efficiency for a specific set of conditions

• **Heating Season Performance Factor (HSPF)**
  • Average heating efficiency over a season
  • Note: Uses different units than COP but higher is still better

• **Variable speed (or capacity; or frequency)**
  • Heat pump changes heating output to precisely meet the needs of your home
  • Improves efficiency and comfort
Terminology Cont’d

• **Seasonal Energy Efficiency Ratio (SEER)**
  - Seasonal average cooling efficiency
  - High-SEER units have Energy Star label

• **Cold-climate heat pump**
  - Operates in extreme cold (-25°C)
  - Note: Different terms used by different manufacturers

• **AHRI-Certified**
  - Heat pump has undergone third-party testing to verify manufacturer performance claims (directory online)
Next Steps

1. Ask: When are your heating & cooling systems due for replacement?

2. Do some background reading
   • The Natural Resources Canada (NRCan) website is filled with useful background information (note that it is a little out of date)
Next Steps

3. Research equipment options from different manufacturers (i.e. google “best heat pump manufacturers” or similar)

4. Find manufacturer-certified installers in your area (ideal) - can also look online for local contractors that are HRAI members

5. Get multiple quotes

6. Consider financing options

7. Make your decision
Final Thoughts

• Need to fuel switch away from natural gas to reduce GHGs and limit further global temperature rise
• In Toronto, heating buildings produces more carbon emissions than any other source
• To meet targets we need heat pump retrofits
• As a homeowner, what can you do? **Replace your A/C with a low-cost ASHP!**
  • Small capital cost
  • Insulates you from future utility rate changes
  • Utility bill savings
  • Significant carbon savings
Home Energy Loan Program (HELP)

• HELP offers low-interest loans to homeowners interested in undertaking energy efficiency, water conservation and renewable energy projects.

• Uniquely, the loan is attached to the property rather than the owner, and is paid through property tax.

<table>
<thead>
<tr>
<th>Terms</th>
<th>Interest Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years</td>
<td>3.55%</td>
</tr>
<tr>
<td>10 years</td>
<td>3.83%</td>
</tr>
<tr>
<td>15 years</td>
<td>4.04%</td>
</tr>
<tr>
<td>20 years*</td>
<td>4.15%</td>
</tr>
</tbody>
</table>

*Projects including solar, windows, geothermal, heat pumps are eligible for 20 year amortization.
Who is Eligible?

- Owners of detached, semi-detached, or row houses, as well as duplexes and triplexes
- Homes within the City of Toronto (postal codes starting with M)
- Get a Home Energy Evaluation before starting any project to qualify for HELP and Enbridge rebates
BetterHomesTO website & toolkits

- A one-stop shop for information on City & partner programs to support residents in more easily and effectively accessing programs & services.
For more information on HELP financing, visit the [website](#), or email [homeenergyloan@toronto.ca](mailto:homeenergyloan@toronto.ca)
Get Started With Help From the TRCA

Connect with our experts to answer any general questions

Email: step@trca.ca

Or ask to be put on our contact list for tours at the Archetype sustainable at the Kortright Centre
Thank You!

Questions?

www.sustainabletechnologies.ca