

**NOVEMBER 15, 2022**

# Save on Energy Workshop: Efficient Building Electrification for Municipalities

**Presented by the Save on Energy Team**



# Agenda

1. Introduction
2. Electrification in the Ontario municipal sector
3. The Efficient Electrification Toolkit
  - Building Electrification Interactive Fact Sheet
  - Building Electrification RETScreen Tools
4. What's next?

# About the IESO



Reliably operate Ontario's Province-wide system 24/7



Purposefully engage to enable informed decisions



Plan for Ontario's future energy needs



Support innovation



Enable competition and create efficient electricity markets



Cybersecurity leadership



Enable province-wide energy efficiency



Smart Metering Entity

# New Program Launches in 2023

The IESO also continues to develop new programs in response to customer feedback. The following programs will be launched in 2023:

- **Strategic Energy Management program**, an evolution of the Energy Manager program that provides training, resources and enhanced technical support to companies with a dedicated energy management team.
- **Existing Building Commissioning program**, to help companies find opportunities to optimize operations and improve energy efficiency based on their current facility requirements.
- **Commercial Midstream Lighting program** with lighting incentives for lighting distributors to increase sales of energy-efficient lighting through point-of-sale discounts
- **Additional local initiatives** in targeted areas of the province where electricity constraints exist.

# 2021 Energy Manager Awards

**Come celebrate with the  
Energy Manager community!  
Thursday, November 24**

**8:30 a.m. to noon**

**International Centre, Mississauga**

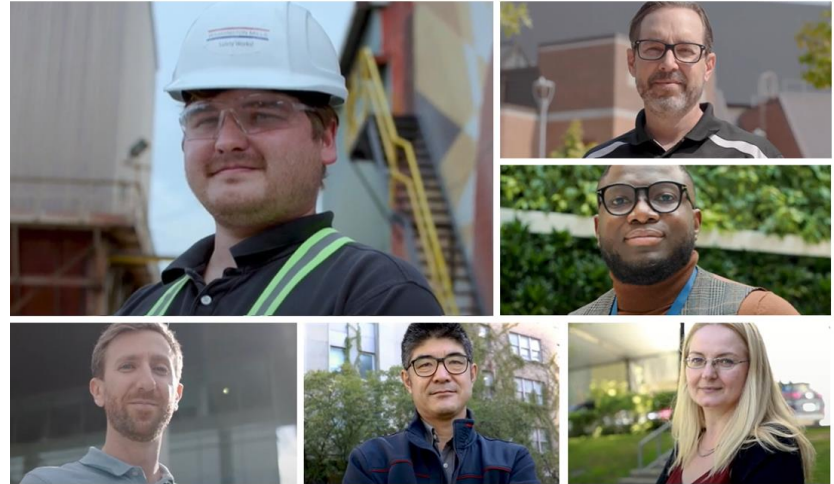
- In-person networking with your peers
- Interactive panel discussion with award winners on their key success factors
- Free to attend; continental breakfast provided

For more information, please email  
[admin@energymanagerprogram.ca](mailto:admin@energymanagerprogram.ca)

**Register now →  
Space is limited!**



## 2020 Award Winners



# Electrification Overview

Combustion Heating



Resistance Heating



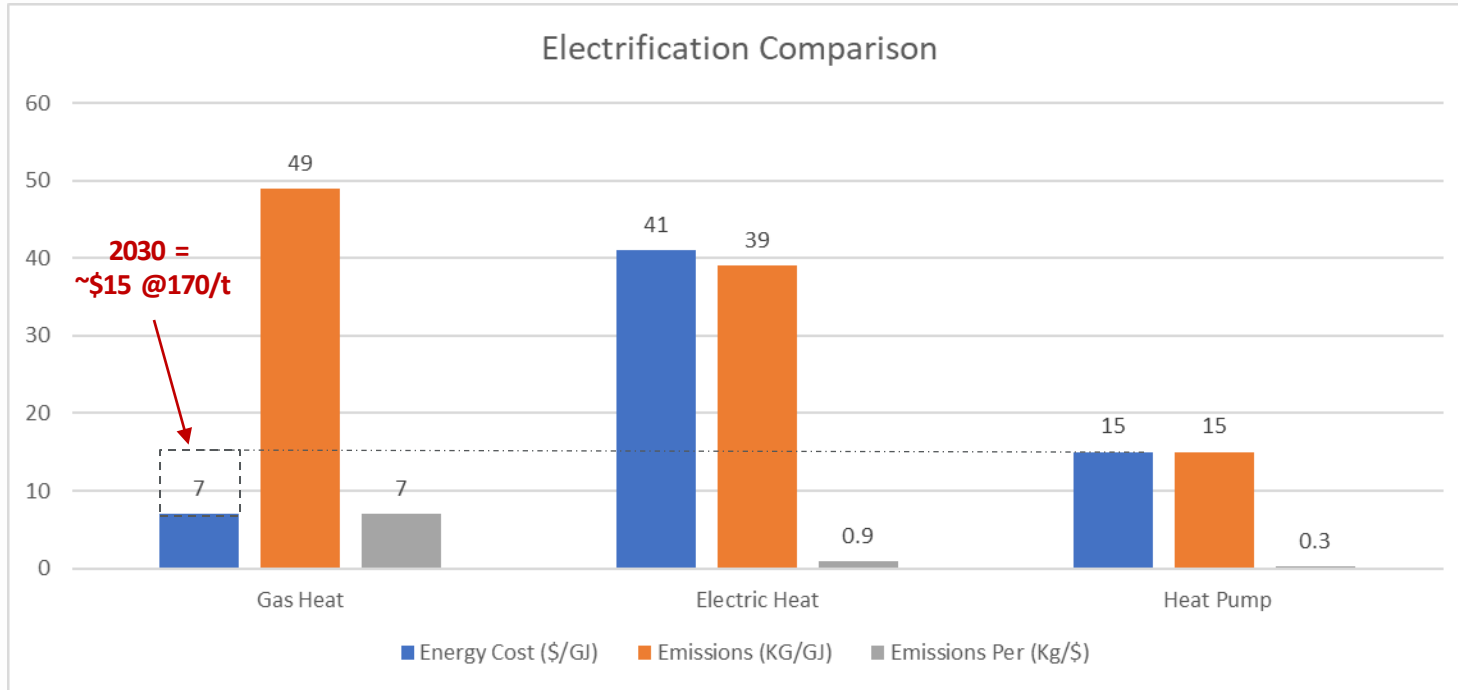
Heat Pump Heating/Cooling



All values approximate

<b>Efficiency</b>	80% – 98%	Close to 100%	2.5 - 4.0 Coefficient of Performance (COP)
Energy Cost	\$0.27/m <sup>3</sup>	\$0.15/kWh	\$10GJ - \$20/GJ
Emissions	1900 gCO <sub>2</sub> e/m <sup>3</sup>	134 gCO <sub>2</sub> e/kWh	10 – 20 kg CO <sub>2</sub> e/GJ

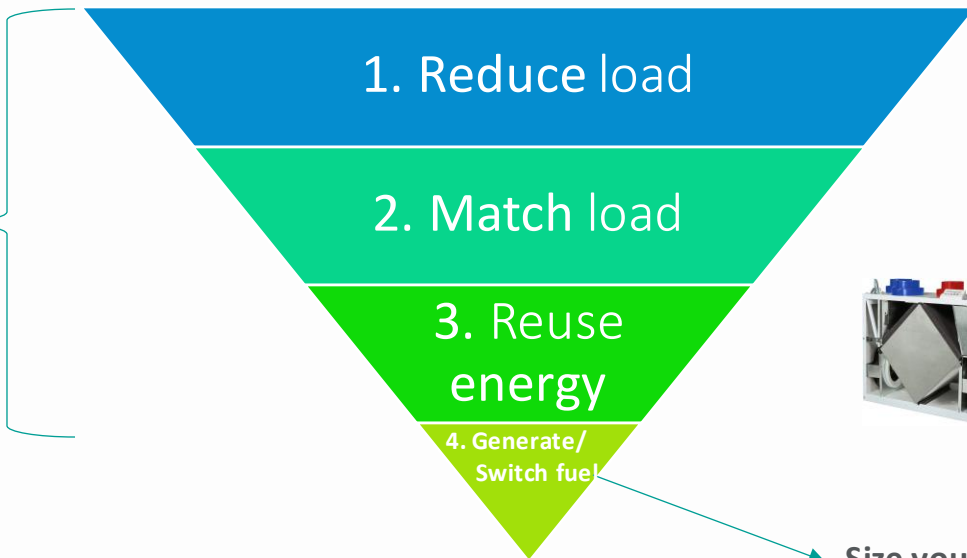
# Electrification Cost and Carbon Overview



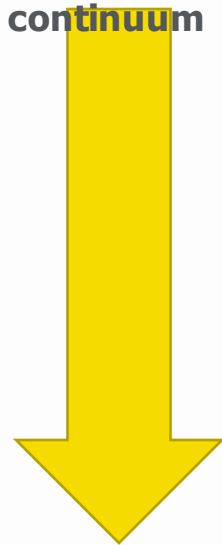
# Energy Efficiency Is the First Fuel

Electrification must be an extension of the EE continuum

Your energy-efficiency game has to be on point!



Size your new heat pump only after 1,2,3 are done!





# Electrification in Ontario Municipalities: Your Feedback



Based on 2021 workshops and interviews:

- Climate targets are a near-term priority
- Many projects are already underway
- Replacement of gas RTU with ASHP is the most common retrofit measure
- Cost of abated carbon a key screening metric
- Electrical service constraints a common challenge
- Lack of tools for early-stage project analysis



# What's in the Toolkit?

- **Interactive Fact Sheet MS Excel tool**
- RETScreen Expert whole building model templates using building archtypes from the RETScreen Expert Virtual Energy Analyzer:
  - Small Office (600m<sup>2</sup>)
  - Laboratory (2250m<sup>2</sup>)
  - Fire Station (600 m<sup>2</sup>)
- RETScreen Expert Heating/Cooling model templates – created based upon the archetypical buildings with conversion from natural gas to ASHPs:
  - Small Office (600m<sup>2</sup>)
  - Laboratory (2250m<sup>2</sup>)
  - Fire Station (600 m<sup>2</sup>)
- Overview & Guidance



## EFFICIENT ELECTRIFICATION INTERACTIVE FACT SHEET

This Interactive Fact Sheet allows users to view the financial and carbon emissions impacts of electrifying building heating and cooling by replacing a rooftop unit (RTU) with an air-source heat pump (ASHP).

### DID YOU KNOW...?



Replacing an aging rooftop unit (RTU) with an air-source heat pump reduces carbon emissions and may deliver a return on investment?

Adjust the parameters in bold below to quickly estimate the costs and benefits for your situation.

Static Parameters	
Floor area (m <sup>2</sup> )	1000
Existing RTU efficiency:	70%
New equipment COP* (cooling):	6
New equipment seasonal efficiency (heating)	200%

Adjustable Parameters	
<b>My RTU fuel is:</b>	Natural Gas
<b>New equipment type:</b>	ASHP
<b>I am located in:</b>	Ottawa
<b>My building insulation condition:</b>	Medium
<b>Energy efficiency measures</b>	Demand Control Ventilation and Heat Recovery

### PROJECT OUTCOMES

 Annual operating cost savings	\$9,732
 Carbon emissions impact	-97%

### FINANCIAL METRICS

Savings to investment ratio:	1.2
Internal rate of return:	8%
Net present value:	\$18,909
Simple payback (years):	10.3
\$/ton carbon avoided:	\$127



# Efficient Electrification Interactive Fact Sheet



# Efficient Electrification RETScreen Expert Tools

# Using RETScreen Expert for Natural Gas Heating to Electric ASHP Conversion Analysis – A Toolkit

Overview & Guidance

# Toolkit Approach

- This toolkit is built upon the feasibility models of the RETScreen Expert analysis software and thereby relies upon the user to possessing RETScreen navigation and feasibility modelling skills.
- Guidance is provided for two situations:
  1. Whole facility where historical data is available for electricity and natural gas with a heating/cooling consumption breakdown by end-use and an estimate of efficiency improvement measures.
  2. For a partial facility or whole facility where historical data is not available for electricity and natural gas but there is no breakdown by end-use for heating/cooling or efficiency measures. In this case we present a building (energy) model to represent a base case buildings fuel consumption, a breakdown by end use and efficiency measures to represent a proposed case.
- For both cases, a heating/cooling (load) model to analyze the conversion of the building with efficiency measures heated with gas to a building heated with an ASHP.
  - Building archetypes, from the Virtual Energy Analyzer, for three building types, are used to represent an existing building and as a source of data to populate and calibrate a Power/Heating/Cooling model.
- The Power/Heating/Cooling model is then used to size a heat pump systems and determine energy cost and carbon reductions thereby facilitating an informed decision to convert to air source heat pumps (ASHPs).

# What's in the Toolkit?

- RETScreen Expert whole building model templates using building archtypes from the RETScreen Expert Virtual Energy Analyzer:
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  - Laboratory (2250m<sup>2</sup>)
  - Fire Station (600 m<sup>2</sup>)
- Overview & Guidance
- RETScreen Expert Help
  - [https://www.youtube.com/channel/UCyFMjG\\_OXXGtRVnsTIm0IQ](https://www.youtube.com/channel/UCyFMjG_OXXGtRVnsTIm0IQ)

RETScreen - Energy Model

Subscriber: T&S Dixon Inc - Professional

Commercial/Institutional - Laboratory - Other

Energy and fuels

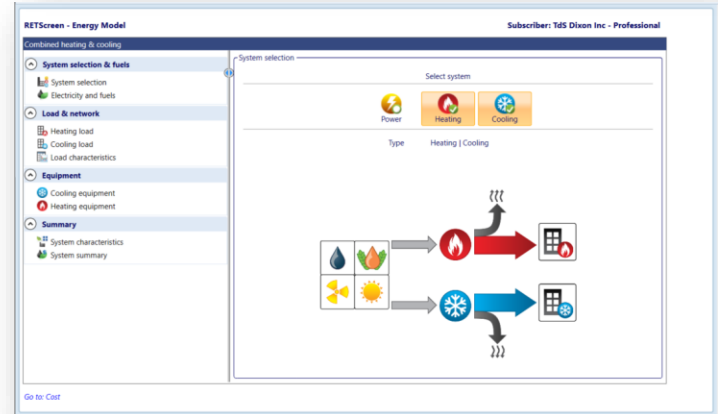
Equipment

End-use

Optimize supply

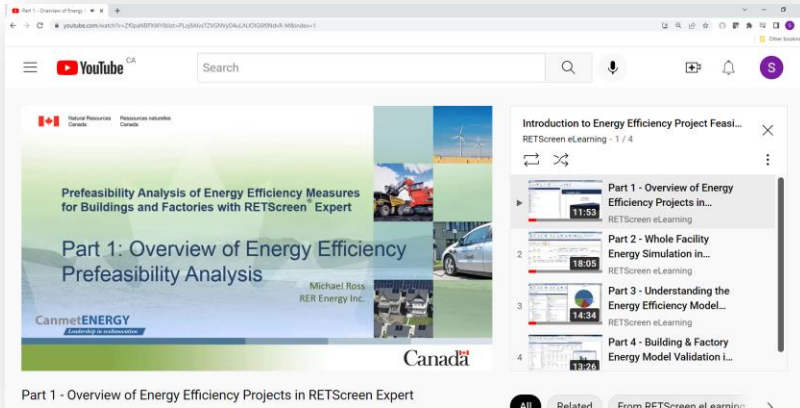
Summary

Show	Heating	Cooling	Electricity	Incremental initial costs	Fuel cost savings	Incremental O&M savings	Simple payback yr	Include measure?
Heating								
Space heating				0	8,205	0	Immediate	<input checked="" type="checkbox"/>
Water heater				0	0	0	0	<input checked="" type="checkbox"/>
Cooling								
Air conditioning				0	445	0	Immediate	<input checked="" type="checkbox"/>
Building envelope								
Building envelope	62,651	65,509		100	373	0	0.3	<input checked="" type="checkbox"/>
Ventilation								
Zone - 1 - Office	22,748	3,459		14,032	446	0	31.5	<input checked="" type="checkbox"/>
Zone - 2 - Office	31,756	4,826		17,350	622	0	27.9	<input checked="" type="checkbox"/>
Zone - 3 - Office	18,255	2,776		11,700	358	0	32.7	<input checked="" type="checkbox"/>
Zone - 4 - Office	27,242	4,143		15,848	534	0	29.7	<input checked="" type="checkbox"/>
Zone - 5, 6, 7 - Laboratory	1,061,595	161,434		112,500	26,525	0	4.2	<input checked="" type="checkbox"/>
Lights								
Office   Meeting room			13,403	3,360	670	0	5.0	<input checked="" type="checkbox"/>
Laboratory			31,202	6,400	1,844	325	3.0	<input checked="" type="checkbox"/>
Laboratory   Task lighting			2,127	5,200	106	0	11.3	<input checked="" type="checkbox"/>
Lobby   Cafeteria   Corridor			6,028	1,360	301	63	3.7	<input checked="" type="checkbox"/>
Sign - Exit			4,906	1,375	420	193	2.2	<input checked="" type="checkbox"/>
Exterior - Facade   Parking			14,104	4,244	963	42	4.2	<input checked="" type="checkbox"/>
Exterior - Sign			473	156	33.8	31	3.3	<input checked="" type="checkbox"/>
Electrical equipment								
Office			23,709	0	254	0	Immediate	<input checked="" type="checkbox"/>
Laboratory			34,403	0	0	0	0	<input checked="" type="checkbox"/>
Cafeteria			11,222	2,100	702	75	2.7	<input checked="" type="checkbox"/>
Standby losses			17,520	1,000	876	0	1.1	<input checked="" type="checkbox"/>
Hot water								
Hot water	9,935			2,100	112	1,002	1.7	<input checked="" type="checkbox"/>
Laboratory	9,935			0	0	0	0	<input checked="" type="checkbox"/>



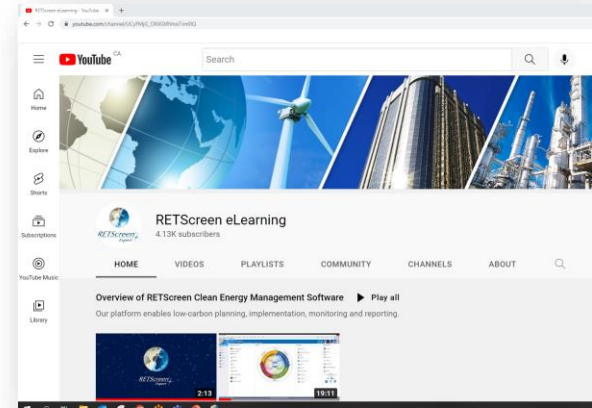
# HELP With RETScreen Use and Navigation

Creating RETScreen Expert  
Whole Building Modelling



<https://www.youtube.com/watch?v=Zf0paNBPXWY&list=PLoj8AlvsTZVGNVYD4uLAUOIG6f0NdvR-M>

RETScreen Expert eLearning  
Channel



[https://www.youtube.com/channel/UCyFMjG\\_OXXGtRVnsiTim0IQ](https://www.youtube.com/channel/UCyFMjG_OXXGtRVnsiTim0IQ)



# Two Paths

## 1. Whole Facility (with historical gas & electricity data)

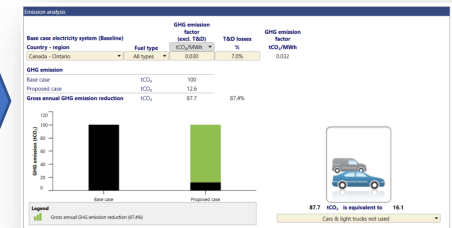
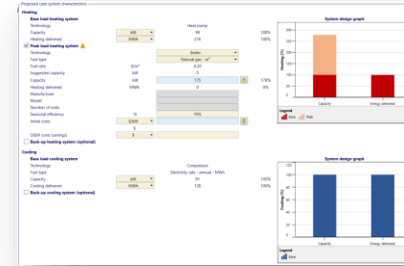
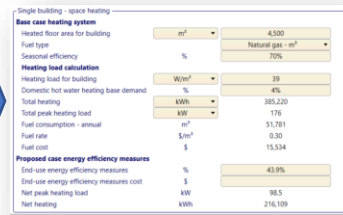
Basic Site Data

(an energy audit could be source)

RETScreen Export Heat/Cool/Power Model

Carbon & Financial Case

Historical Data  
Floor Area  
Heat/Cool Load (W/m<sup>2</sup>)  
Heat/Cool Efficiency

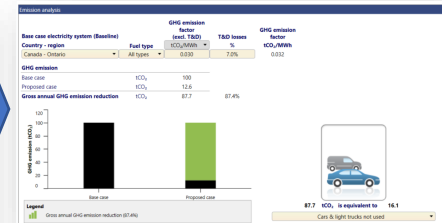
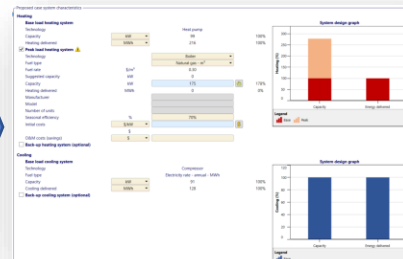
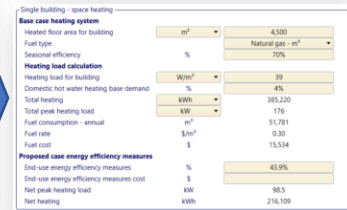


## 2. Partial Facility (or whole facility with no historical data)

RETScreen (Whole/Partial) Building Model

RETScreen Export Heat/Cool/Power Model

Carbon & Financial Case

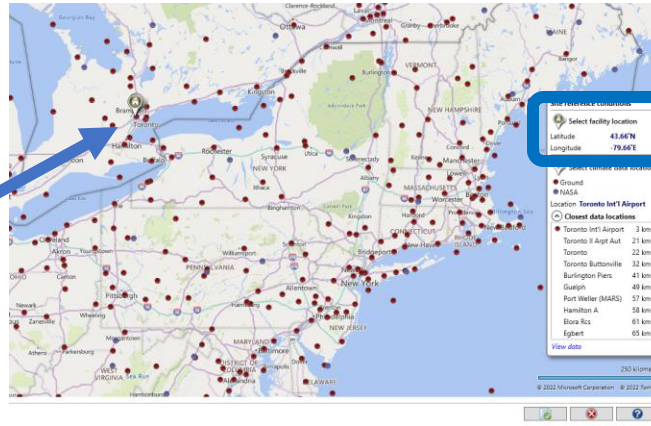
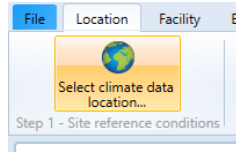


# Method 1: Whole Facility

From historical data possibly supported by an energy audit providing an end-use breakdown and efficiency measures.

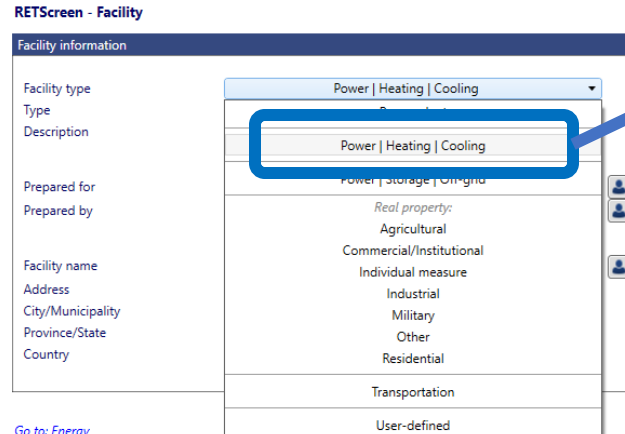
# Accessing RETScreen Power/Heating Cooling Model and Setting Location

- Open Retscreen Expert and Navigate to the Location tab across the top bar
- Default location for template files are in Toronto, if a different location is required click 'select climate data location...' button and select building location



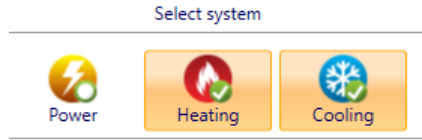
Next step

- Note: if location is energy rates and fuels select may need to be changed to match building location
- To setup Retscreen's power/heating/ cooling model, navigate to the Facility page and under 'facility type' select 'Power/ Heating/ Cooling' and proceed to Energy tab to begin analysis



# Calibrate Power Model

- Select Heating and Cooling for 'system selection' (not power) and set fuel rates
- Navigate to 'Load & network' section and proceed to populate building data



- Populate the base case system with correct floor area and equipment efficiency (green box)
- Calibrate the heating and cooling models to the heating and cooling values calculated from historical data – for example from an existing energy audit. (use help section for guidance based on design temperature on location tab)
- Determine % hot water usage for heating and non weather cooling load % based historical consumption and demand data. (see excel template)
- Populate 'end-use energy efficiency measures' based on projects in the building if necessary

Single building - space cooling

**Base case cooling system**

Cooled floor area for building  m<sup>2</sup>

Fuel type  Electricity rate - annual

**Adjust W/m<sup>2</sup> to calibrate**

kW/kW

W/m<sup>2</sup>

**Non-weather dependent cooling**

Total cooling  kWh

Total peak cooling load  kW

Fuel consumption - annual

Fuel rate \$/kWh 0.10

Fuel cost \$ 4,971

**Proposed case energy efficiency measures**

End-use energy efficiency measures %

End-use energy efficiency measures cost \$

Net peak cooling load kW 113

Net cooling kWh 159,060

Single building - space heating

**Base case heating system**

Heated floor area for building  m<sup>2</sup>

Fuel type  Natural gas - m<sup>3</sup>

Seasonal efficiency  70%

**Adjust W/m<sup>2</sup> to calibrate**

Heating load for space heating  kW/m<sup>2</sup>

Domestic hot water heating base demand %  3.4%

Total heating  MWh

Total peak heating load  kW

Fuel consumption - annual m<sup>3</sup> 7,196

Fuel rate \$/m<sup>3</sup> 0.30

Fuel cost \$ 2,159

**Proposed case energy efficiency measures**

End-use energy efficiency measures %  45%

End-use energy efficiency measures cost \$

Net peak heating load kW 13.9

Net heating MWh 29.5

Next step

# Calibration continued...

Proposed case load characteristics

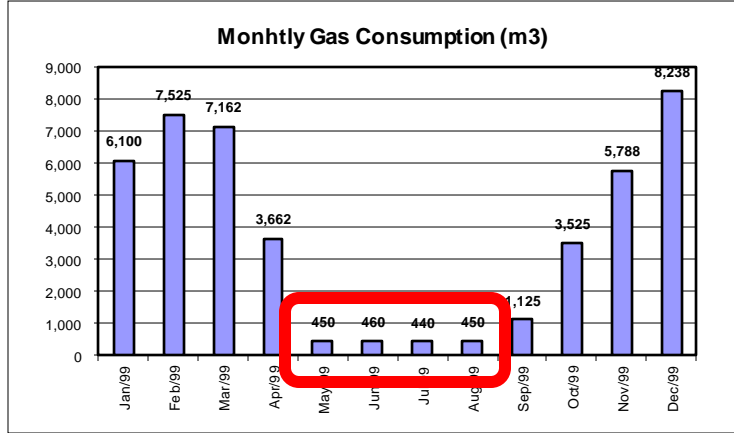
Month	Cooling system load kW	Heating net average load kW	Heat for cooling kW	Heating system load kW
January	0.07	8.6	0	8.6
February	0.07	7.2	0	7.2
March	0.07	5.2	0	5.2
April	0.07	3	0	3
May	1.5	1.3	0	1.3
June	3.7	0.09	0	0.09
July	4.9	0.09	0	0.09
August	4.5	0.09	0	0.09
September	2.7	0.54	0	0.54
October	0.07	2.3	0	2.3
November	0.07	3.9	0	3.9
December	0.07	6.2	0	6.2
Peak load - annual	8.1	13.9	0	13.9

**Proposed case load and energy**

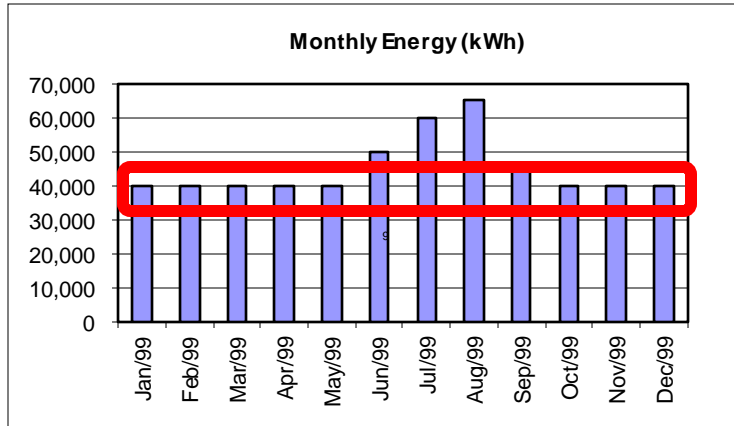
System peak load	kW	<b>Heating</b> 13.9	<b>Cooling</b> 8.1
System energy	MWh	29.5	14

- Once Base case system have been defined and efficiency measures accounted for, jump to 'Load characteristics'
- On this page you will see the 'Proposed Case load characteristics' that are used to determine the proposed case systems
- Record these numbers for further inputs

# Calibration continued...determining Heating and Cooling Energy



- For Gas, we want to know the percentage of total consumption that is for Domestic hot water, to do this:
  - take the total m3 in the non-cooling season as a percentage of total gas consumption



- For Electricity the process is similar to determine you cooling energy to calibrate, to do this:
  - Take the total kWh in the non-cooling season and subtract that from the total kWh for the year, this will be the energy required for cooling

# Use Proposed Heat/Cool Loads to Model 100% Heat Pump System

- 'Size' the proposed case system appropriately based on previously calculated capacities for both heating and cooling
- Use the RETScreen Database to find a system, but be careful heating and cooling system are not linked
- In Demo models, capacity in proposed case matches calculated values simply for demo purposes, exact sizing will be based on systems available to meet the building needs
- Costing for new systems will need to be calculated by user

Base load cooling system

Technology	Compressor	
Fuel type	Natural gas - m <sup>3</sup>	
Fuel rate	0.00	
Capacity	kW	8.1
Manufacturer		
Model		
Number of units		
Coefficient of performance - seasonal	kW/kWh	3.2
Cooling delivered	kWh	13,966
Initial costs	\$/kW	
OBM costs (savings)	\$	

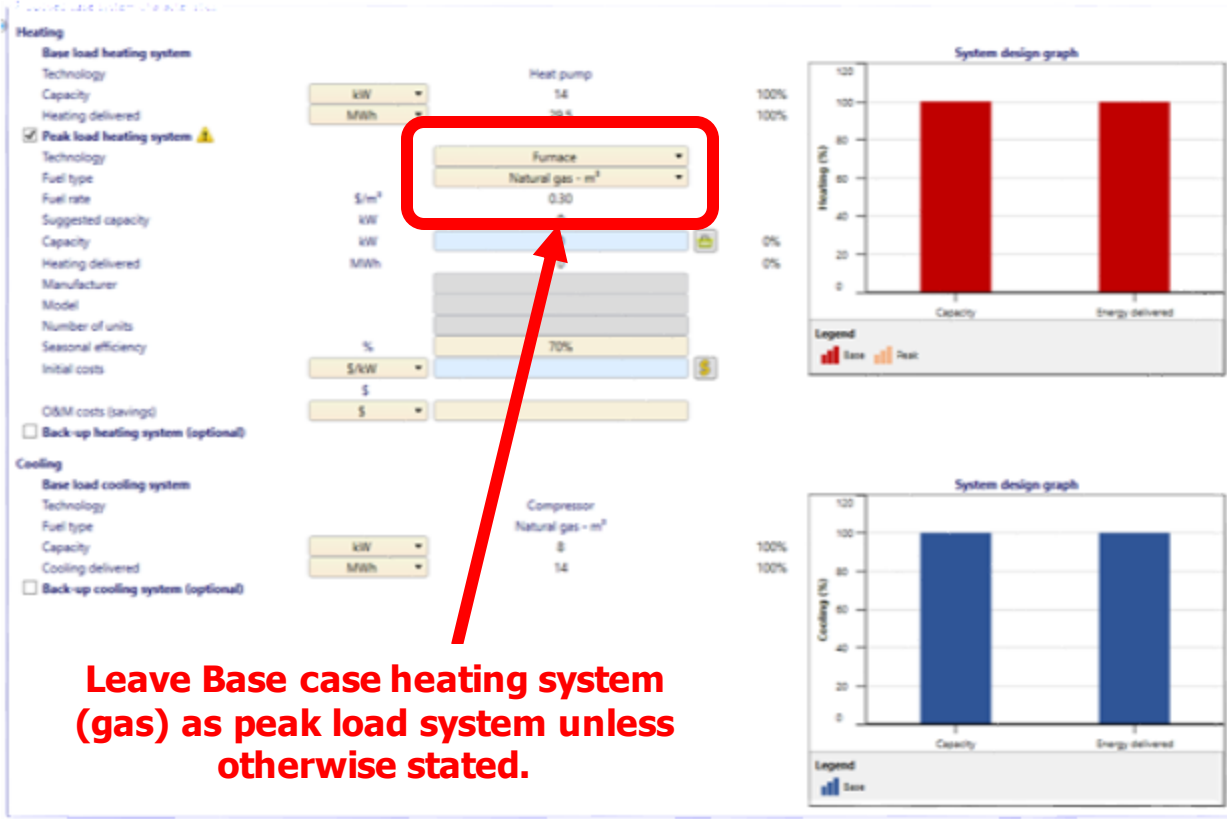
Peak load cooling system

Fuel selection

Fuel type	Electricity rate - annual	
Fuel rate	\$/MWh	100
Heat pump		
Capacity	kW	13.9
Manufacturer		
Model		
Number of units		
Seasonal efficiency	%	200%
Heating delivered	GWh	2,782.7
Fuel required	GWh	0.03
Initial costs	\$	
OBM costs (savings)	\$/kW-year	

**Proposed case electric load (demand)  
for heat pump system at proposed COP!**

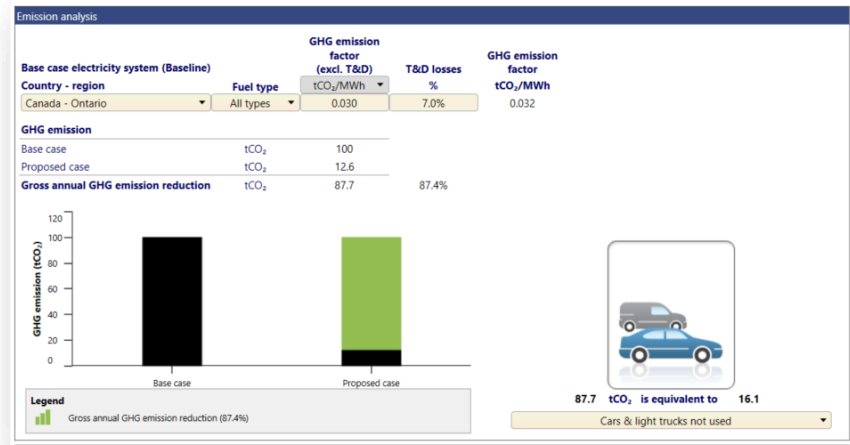
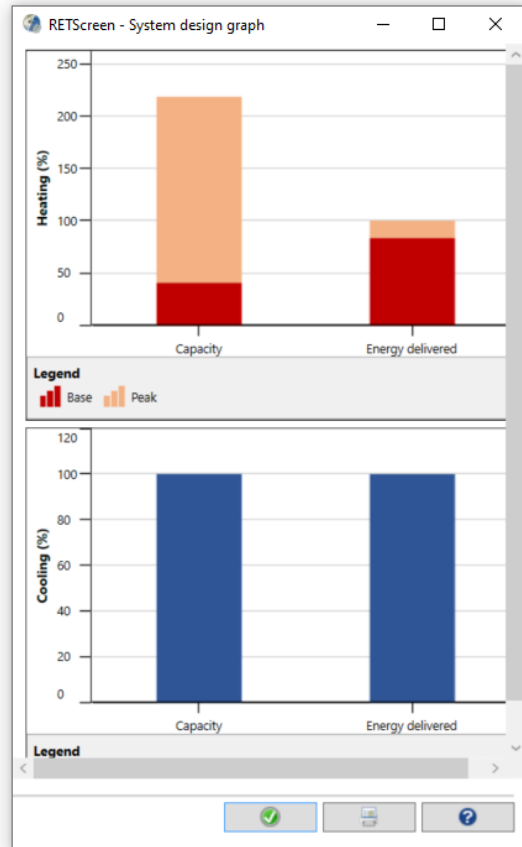
# Peak Load System & Fraction (%) of Heat Delivered



- 'Size' the proposed case system appropriately based on previously calculated capacities for both heating and cooling
- Use the RETScreen Database to find a system, but be careful heating and cooling system are not linked
- In Demo models, capacity in proposed case matches calculated values simply for demo purposes, exact sizing will be based on systems available to meet the building needs



# Fraction (%) of Heat Delivered Versus Carbon Reduction



- In some cases the energy delivered may not meet the needs of the building, therefore a gas backup system may be required for peak load heating, rather than installing a larger system...
- We can see carbon reduction is still likely to be very high vs the cost of putting the larger peaking system, which could be costly

# Method 2: Partial Facility or No Historical Data/ End-Use Breakdown

Using RETScreen Expert Building Model Data

# Use Energy Model: Heating, Cooling & Electricity & Interactions

Commercial/Institutional - Office - Small - Office building

Fuels & schedules

Electricity and fuels

Schedules

Equipment

Heating

Space heating

Domestic hot water

Cooling

Air conditioning

End-use

Building envelope

Office

Roof - Office - Steel

Walls - Office - Brick

Ventilation

Office

Washroom

Lights

Optimize supply

Heating

Solar water heater

Power

Photovoltaic - 24 kW

Summary

Include measure?

Comparison

	Heating kWh	Cooling kWh	Electricity kWh	Incremental initial costs \$	Fuel cost savings \$	Incremental O&M savings \$	Simple payback yr	Include measure? <input type="checkbox"/>
<b>Space heating</b>								
Space heating				0	0	0		<input checked="" type="checkbox"/>
Domestic hot water				0	0	0		<input checked="" type="checkbox"/>
<b>Cooling</b>								
Air conditioning				0	0	0	7.9	<input checked="" type="checkbox"/>
<b>Building envelope</b>								
Office	23,187	18,172		3,850	486	0	7.9	<input checked="" type="checkbox"/>
<b>Ventilation</b>								
Office	26,796	9,133		14,400	904	0	15.9	<input checked="" type="checkbox"/>
Washroom	1,117	381		600	1.9	0	313.7	<input checked="" type="checkbox"/>
<b>Lights</b>								
Office			11,615	7,575	584	90.7	11.2	<input checked="" type="checkbox"/>
Cafeteria			619	429	34.9	6.4	10.4	<input checked="" type="checkbox"/>
Sign - Exit			193	46	14	28	1.1	<input checked="" type="checkbox"/>
Exterior - Parking			1,402	850	102	-5	8.8	<input checked="" type="checkbox"/>
Exterior - Facade			2,575	1,910	135	85	8.7	<input checked="" type="checkbox"/>
Exterior - Doors			1,104	820	57.8	35	8.8	<input checked="" type="checkbox"/>
<b>Electrical equipment</b>								
Office			12,148	1,520	545	25	2.7	<input checked="" type="checkbox"/>
Server room			2,628	0	0	0		<input checked="" type="checkbox"/>
<b>Hot water</b>								
Hot water	2,782			1,890	21	60	23.3	<input checked="" type="checkbox"/>
<b>Fans</b>								
Office			10,367	200	203	0	1.0	<input checked="" type="checkbox"/>
Washroom			516	0	0	0		<input checked="" type="checkbox"/>
<b>Heating</b>								
Solar water heater	0			0	0	0		<input type="checkbox"/>
<b>Power</b>								
Photovoltaic - 24 kW				0	0	0		<input type="checkbox"/>
<b>Total</b>	<b>53,882</b>	<b>27,686</b>	<b>43,167</b>	<b>34,090</b>	<b>3,088</b>	<b>325</b>	<b>10.0</b>	

- Start with RETScreen ArcheType Building (virtual Energy Analyzer) similar to your building supplied with tool
- OR Build an Energy Model of your building based on current building characteristics
- Use data From include measure screen to determine Heating and cooling consumption
- Ensure you are viewing 'Energy – base case'

# Use Energy Model: Determine Efficiency Improvement (%)

- In "Comparison" section determine Fuel saved %

Summary - Electricity and fuels

Fuel type	Fuel type		Base case		Proposed case		Savings	
	Fuel rate	Fuel consumption - unit	Fuel consumption	Fuel cost	Fuel consumption	Fuel cost	Fuel saved	Savings
Natural gas	\$ 0.30	m <sup>3</sup>	7,196	\$ 2,159	3,918	\$ 1,175	3,278	\$ 983
Electricity	\$ 0.10	kWh	51,819	\$ 5,182	30,770	\$ 3,077	21,049	\$ 2,105
<b>Total</b>				<b>\$ 7,341</b>		<b>\$ 4,252</b>		<b>\$ 3,088</b>

Project verification

Fuel type	Fuel consumption - unit	Fuel consumption - historical	Fuel consumption - Base case	Fuel consumption - variance
Natural gas	m <sup>3</sup>		7,196	
Electricity	kWh		51,819	

Savings

Fuel consumption	Heating kWh	Cooling kWh	Electricity kWh	Total kWh	Plan kWh	Variance %
Base case	76,477	8,652	43,167	128,296	142,017	-9.7%
Proposed case	41,639	4,357	26,413	72,409	80,407	-9.9%
Fuel saved	34,838	4,295	16,754	55,887	61,610	-9.3%
Fuel saved - %	45.6%	49.6%	38.8%	43.6%	43.4%	

# Calibrate Energy Model to Power Model (ignore non-weather usage)

- Open New RETScreen Model, Select Power, Heating and Cooling on Facility Page
- Select Heating and Cooling for system selection (not power) and set fuel rates
- Populate the base case system with correct floor area and equipment efficiency (green box)
- Calibrate the heating and cooling models to the heating and cooling values in efficiency model, adjust w/m2 as needed within reasonable values
- Determine % hot water usage for heating and non weather cooling load % based on the 'include measure' screen data in the building model
- Populate 'end-use energy efficiency measures' input based on values from comparison

**Energy Model Data:**

Heating	Cooling
kWh	kWh
23,107	18,172
26,796	9,133
1,117	381
2,782	
0	
53,882	27,686

**Power Model - Base case cooling system**

Cooled floor area for building	m <sup>2</sup>	4,500
Fuel type	Electricity rate - annual	3.2
W/m <sup>2</sup>	25	
Total cooling	kWh	159,060
Total peak cooling load	kW	113
Fuel consumption - annual		
Fuel rate	\$/kWh	0.10
Fuel cost	\$	4,971

**Proposed case energy efficiency measures**

End-use energy efficiency measures	%	
End-use energy efficiency measures cost	\$	
Net peak cooling load	kW	113
Net cooling	kWh	159,060

**Power Model - Base case heating system**

Heated floor area for building	m <sup>2</sup>	600
Seasonal efficiency	Natural gas - m <sup>3</sup>	70%
Heating load for domestic hot water	W/m <sup>2</sup>	42
Domestic hot water heating base demand	%	3.4%
Total heating	MWh	53.5
Total peak heating load	kW	25.2
Fuel consumption - annual	m <sup>3</sup>	7,198
Fuel rate	\$/m <sup>3</sup>	0.30
Fuel cost	\$	2,159

**Proposed case energy efficiency measures**

End-use energy efficiency measures	%	45%
End-use energy efficiency measures cost	\$	
Net peak heating load	kW	13.9
Net heating	MWh	29.5

**Next step**

# Calibration continued...

Proposed case load characteristics

Month	Cooling system load kW	Heating net average load kW	Heat for cooling kW	Heating system load kW
January	0.07	8.6	0	8.6
February	0.07	7.2	0	7.2
March	0.07	5.2	0	5.2
April	0.07	3	0	3
May	1.5	1.3	0	1.3
June	3.7	0.09	0	0.09
July	4.9	0.09	0	0.09
August	4.5	0.09	0	0.09
September	2.7	0.54	0	0.54
October	0.07	2.3	0	2.3
November	0.07	3.9	0	3.9
December	0.07	6.2	0	6.2
Peak load - annual	8.1	13.9	0	13.9

**Proposed case load and energy**

System peak load	kW	<b>Heating</b> 13.9	<b>Cooling</b> 8.1
System energy	MWh	29.5	14

- Once Base case system have been defined and efficiency measures accounted for, jump to 'Load characteristics'
- On this page you will see the 'Proposed Case load characteristics' that are used to determine the proposed case systems
- Record these numbers for further inputs

# Use Proposed Heat/Cool Loads to Model 100% Heat Pump System

- 'Size' the proposed case system appropriately based on previously calculated capacities for both heating and cooling
- Use the RETScreen Database to find a system, but be careful heating and cooling system are not linked
- In Demo models, capacity in proposed case matches calculated values simply for demo purposes, exact sizing will be based on systems available to meet the building needs

Base load cooling system

Technology	Compressor	
Fuel type	Natural gas - m <sup>3</sup>	
Fuel rate	0.00	
Capacity	kW	8.1
Manufacturer		
Model		
Number of units		
Coefficient of performance - seasonal	kW/kW	3.2
Cooling delivered	kWh	13,966
Initial costs	\$/kW	
OBM costs (savings)	\$	

Fuel selection

Fuel type		
Fuel rate	\$/MWh	100
Heat pump		
Capacity	kW	13.9
Manufacturer		
Model		
Number of units		
Seasonal efficiency	%	200%
Heating delivered	kWh	2,302,211
Fuel required	GWh	0.03
Initial costs	\$	
OBM costs (savings)	\$/kW-year	1

**Proposed case electric load (demand)  
for heat pump system at proposed COP!**

# Peak Load System & Fraction (%) of Heat Delivered

Heating

Base load heating system

Technology: Heat pump

Capacity: 14 kW

Heating delivered: 14 MWh

Peak load heating system

Technology: Furnace

Fuel type: Natural gas - m<sup>3</sup>

Fuel rate: 0.30 \$/m<sup>3</sup>

Suggested capacity: kW

Capacity: kW

Heating delivered: MWh

Manufacturer:

Model:

Number of units:

Seasonal efficiency: 70%

Initial costs: \$/kW

O&M costs (savings): \$

Back-up heating system (optional)

Cooling

Base load cooling system

Technology: Compressor

Fuel type: Natural gas - m<sup>3</sup>

Capacity: 8 kW

Cooling delivered: 14 MWh

Back-up cooling system (optional)

System design graph

Category	Value (%)
Capacity	100%
Energy delivered	100%

System design graph

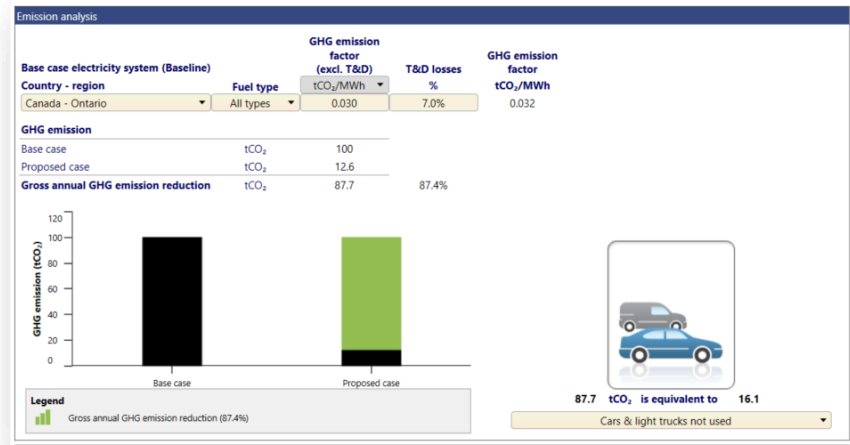
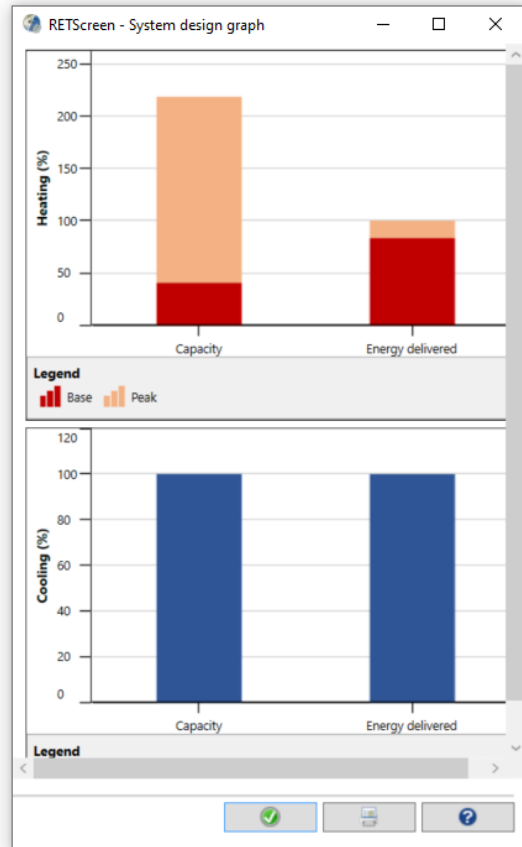
Category	Value (%)
Capacity	100%
Energy delivered	100%

**Leave Base case heating system (gas) as peak load system unless otherwise stated.**

- 'Size' the proposed case system appropriately based on previously calculated capacities for both heating and cooling
- Use the RETScreen Database to find a system, but be careful heating and cooling system are not linked
- In Demo models, capacity in proposed case matches calculated values simply for demo purposes, exact sizing will be based on systems available to meet the building needs



# Fraction (%) of Heat Delivered versus Carbon Reduction



- In some cases the energy delivered may not meet the needs of the building, therefore a gas backup system may be required for peak load heating, rather than installing a larger system...
- We can see carbon reduction is still likely to be very high vs the cost of putting the larger peaking system, which could be costly

# Reference for the Heating Cooling Load Model

- Click HELP and select Engineering e-Textbook
- Select Combined Heat & Power...  
...chapter
- Model is detailed in Section 2.1 (heating) & 2.2 (cooling)

The image displays three screenshots of the RETScreen Expert software interface, illustrating the steps to access the Engineering e-Textbook.

**Top Screenshot:** Shows the main menu with the 'Help' button highlighted in a red box. Below the menu, the 'Help & contact us' section has the 'Engineering e-Textbook' link highlighted in a red box.

**Middle Screenshot:** Shows the 'Engineering e-textbook' search results page. The search results list 'Combined Heat & Power (Cogeneration or Power | Heating | Cooling) - e-Textbook chapter' with a red box around the link.

**Bottom Screenshot:** Shows the 'RETScreen - Combined Heat & Power (Cogeneration or Power | Heating | Cooling) - e-Textbook chapter' page. The table of contents lists '2.1 Heating Project Load and Energy Calculation' with a red box around the link.

# Thank You!

Adam Trela, City of London (formerly)

Alex Bogun, Region of Peel

Amanda Martin, City of Markham

Dave Cano Tinoco, Town of Oakville

Jodi Janwin, City of Burlington

Jose Rocha, Region of Waterloo

Sokol Aliko, City of Windsor

Dave Gerrish, Queens University

Frank Misicek, Mohawk College

Mary Quintana, Brock University

Robert McCallum, Laurier College

## Webinar Follow Up

The webinar recording and materials will be shared with you by email.

For questions regarding the Efficient Electrification RETScreen Expert<sup>®</sup> tools contact [adam@knowenergy.com](mailto:adam@knowenergy.com).

Please help us by taking two minutes to complete a survey about this session! See the link to the survey in the Chat now.

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# Thank you

**[SaveOnEnergy.ca](http://SaveOnEnergy.ca)**

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