

**OCTOBER 30, 2024**

# Efficient electrification workshop #4 – Part 1: Modelling HVAC with RETScreen Expert

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# Agenda

- Welcome and introductions
- Quick overview of RETScreen Expert
- Overview of how to use RETScreen Expert to model HVAC systems
- Presentation of HVAC circumstances
- HVAC circumstances
- Modelled results and solutions
- Cautions to avoid poor results
- Wrap-up and Q and A



# Quick overview of RETScreen Expert

# RETScreen Expert

- Intelligent decision support tool to enable stakeholders to rapidly identify, assess, optimize and track the performance of clean energy investments over the entire project life cycle
- 38 languages covering two thirds of the world's population



# RETScreen development

- Natural Resources Canada (CanmetENERGY)
- Renewable Energy and Energy Efficiency Partnership
- Independent Electricity System Operator
- United Nations Environment Programme
- National Aeronautics and Space Administration
- Global Environment Facility



Natural Resources  
Canada

**REEEP**



**SAVE ON  
ENERGY**  
POWER WHAT'S NEXT

# The complete toolbox! Let's take a quick look

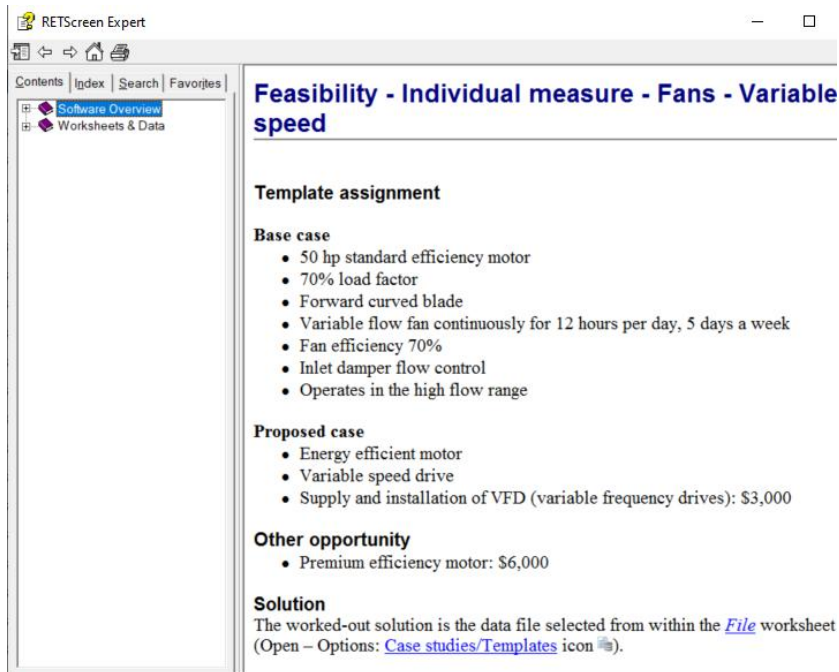
The screenshot displays the RETScreen Expert software interface. At the top, there is a menu bar with options: File, Location, Facility, Energy, Cost, Emission, Finance, Risk, Data, Analytics, Report, Custom. Below the menu bar is a header with the RETScreen Expert logo and the text "Clean Energy Management Software - Version 9.1".

The interface is divided into several sections:

- Getting started - Options:** Includes icons for Home, Open, Close, Settings, Help, Subscribe, Save, Save As, and Exit. Below these are options for Analysis type (Blank project, Benchmark, Feasibility, Performance, All) and Portfolio analysis (My portfolio, My portfolio - Example, Net zero plan - Example).
- Workflow - Per facility:** A central circular diagram showing a workflow. The cycle starts with "Start" and moves through "Performance" (Data, Analytics, Report), "Location" (Benchmark, Facility), "Energy" (Cost, Emission, Feasibility), and "Risk" (Finance, Risk). The central hub is labeled "Virtual Energy Analyzer". Other components shown are "Performance Tracker", "Financial Risk Assessor", and "Smart Project Identifier".
- Facility type - Examples:** Lists various facility types: Power plants, Power | Heating | Cooling, Power | Storage | Off-grid, Real property: Industrial | Agricultural, Commercial/Institutional, Residential, Military, Individual measure, Transportation, and User-defined.
- Integrated features:** Lists features such as User manual, eLearning, Databases, and Dashboards.
- About us:** Mentions CanmetENERGY in Varennes and lists partners: RETScreen Innovation Lab, RETScreen Data Onboarding, and RETScreen Capacity Building.
- In collaboration with:** Lists partners: ieso, REEEP, NASA, UNEP, and gef.

At the bottom of the interface, there is a footer with the text: "RETScreen Expert - Professional - 9.1.0.90", "© Minister of Natural Resources Canada 1997-2024.", and "NRCCan/CanmetENERGY/Varennes".

# Learning resource – case studies and templates



RETScreen Expert

Contents | Index | Search | Favorites

- Software Overview
- Worksheets & Data

## Feasibility - Individual measure - Fans - Variable speed

### Template assignment

#### Base case

- 50 hp standard efficiency motor
- 70% load factor
- Forward curved blade
- Variable flow fan continuously for 12 hours per day, 5 days a week
- Fan efficiency 70%
- Inlet damper flow control
- Operates in the high flow range

#### Proposed case

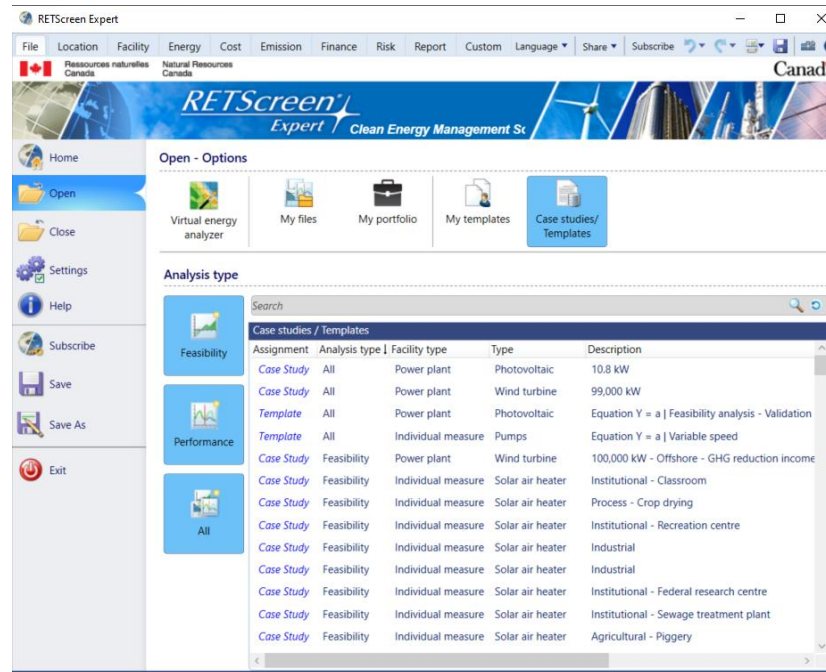
- Energy efficient motor
- Variable speed drive
- Supply and installation of VFD (variable frequency drives): \$3,000

#### Other opportunity

- Premium efficiency motor: \$6,000

#### Solution

The worked-out solution is the data file selected from within the [File](#) worksheet (Open – Options: [Case studies/Templates](#) icon).



RETScreen Expert

File Location Facility Energy Cost Emission Finance Risk Report Custom Language Share Subscribe

Resources naturelles Canada Natural Resources Canada

## RETScreen Expert

Clean Energy Management System

Home

Open

Close

Settings

Help

Subscribe

Save

Save As

Exit

### Open - Options

Virtual energy analyzer | My files | My portfolio | My templates | **Case studies/Templates**

### Analysis type

Search

| Case studies / Templates | Assignment  | Analysis type      | Facility type    | Type   | Description |
|--------------------------|-------------|--------------------|------------------|--|-------------|
| <b>Case Study</b>        | All         | Power plant        | Photovoltaic     | 10.8 kW  |             |
| <b>Case Study</b>        | All         | Power plant        | Wind turbine     | 99,000 kW  |             |
| <b>Template</b>          | All         | Power plant        | Photovoltaic     | Equation Y = a   Feasibility analysis - Validation |             |
| <b>Case Study</b>        | Feasibility | Power plant        | Wind turbine     | 100,000 kW - Offshore - GHG reduction income       |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Pumps            | Equation Y = a   Variable speed                    |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Solar air heater | Institutional - Classroom                          |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Solar air heater | Process - Crop drying                              |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Solar air heater | Institutional - Recreation centre                  |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Solar air heater | Industrial   |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Solar air heater | Industrial   |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Solar air heater | Institutional - Federal research centre            |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Solar air heater | Institutional - Sewage treatment plant             |             |
| <b>Case Study</b>        | Feasibility | Individual measure | Solar air heater | Agricultural - Piggyery                            |             |

# Learning resource – contextual text and video help

Subscriber: TdS Dixon Inc - Professional

**RETScreen - Energy Model**

Industrial - Beverage

**Fuels & schedules**

- Electricity and fuels
- Schedules

**Equipment**

**End-use**

- Pumps

**Optimize supply**

**Summary**

- Include measure?
- Comparison

**Pumps**

Description: Pumps

Note:

Method: Pumps, Water pumping

**Options**

- eLearning
- RETScreen Connect

**Motor**

|                                   |    |
|-----------------------------------|----|
| Capacity                          | %  |
| Efficiency - full load            | %  |
| Manufacturer                      |    |
| Model                             |    |
| Load factor                       | %  |
| Efficiency - operating conditions | %  |
| Motor shaft power load            | kW |

**Pump**

|                           |     |
|---------------------------|-----|
| Efficiency                | %   |
| Fluid load - full flow    | kW  |
| Flow type                 |     |
| Flow range                |     |
| Flow control type         |     |
| Operating hours           | h/d |
| Incremental initial costs | \$  |
| Incremental O&M savings   | \$  |
| Number of pumps           |     |
| Electricity               | kWh |

**Capacity**

The user enters the capacity of the motor. This value, also called "motor horsepower," "motor rated power" or "motor size," represents the motor rating or the motor rated shaft power load and can typically be found on the motor nameplate. The user can consult the RETScreen Product Database for more information.

Show figure:

[Pump-Motor System Schematic](#)

Pumps - YouTube

youtube.com/watch...

Premium

Feasibility Analysis with RETScreen Expert

Pumps

CanmetENERGY

RETScreen eLearning

5.26K subscribers

1.2K views 4 years ago Step-by-Step Energy Audits & Individual Energy Efficiency | ...more

Overview of RETScreen Expert Platform (20 min)





# Modelling a basic HVAC system

# The RETScreen HVAC models

- Heating systems
- Cooling systems
- Ventilation models
  - Level 1: Detail
  - Level 2: Simple

Heating system

Description Heating system

Note

Method: Single fuel, Multiple fuels

Options: eLearning, RETScreen Connect

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Heating system

|            | Base case                    | Proposed case                |
|------------|------------------------------|------------------------------|
| Technology | Heating system               | Heating system               |
| Fuel type  | Natural gas - m <sup>3</sup> | Natural gas - m <sup>3</sup> |
| Fuel rate  | 0.30                         | 0.30                         |

Heating equipment

Cooling system

Description Cooling system

Note

Options: eLearning, RETScreen Connect

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Cooling system

|            | Base case                    | Proposed case                |
|------------|------------------------------|------------------------------|
| Technology | Cooling system               | Cooling system               |
| Fuel type  | Natural gas - m <sup>3</sup> | Natural gas - m <sup>3</sup> |
| Fuel rate  | 0.30                         | 0.30                         |

Cooling equipment  
 Coefficient of performance - seasonal: kW/kW  
 Incremental initial costs: \$  
 Incremental O&M savings: \$  
 Refrigerant - Optional

Ventilation

Description Dealed Ventilation

Note

Method: Method 1, Method 2

Options: eLearning, RETScreen Connect

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Ventilation - Method 1

|                             | Base case      | Proposed case  | Energy saved |
|-----------------------------|----------------|----------------|--------------|
| Schedule                    | 24/7           | 24/7           |              |
| Flow                        | L/s            |                |              |
| Fresh air                   | %              |                |              |
| System reheat               | Yes            | Yes            |              |
| System selection            | Heating        | Heating        |              |
| Fan control                 | Constant       | Constant       |              |
| Ventilation control         | Constant       | Constant       |              |
| Intake air damper leakage   | Leaky          | Leaky          |              |
| Heat recovery efficiency    | %              |                |              |
| Costing method              |                | Level 1        |              |
| Incremental initial costs   | \$             |                |              |
| Incremental O&M savings     | \$             |                |              |
| Number of ventilation units | 1              | 1              |              |
| Heating system              | Heating system | Heating system |              |
| Heating                     | kWh            |                |              |

Ventilation

Description Simple Ventilation

Note

Method: Method 1, Method 2

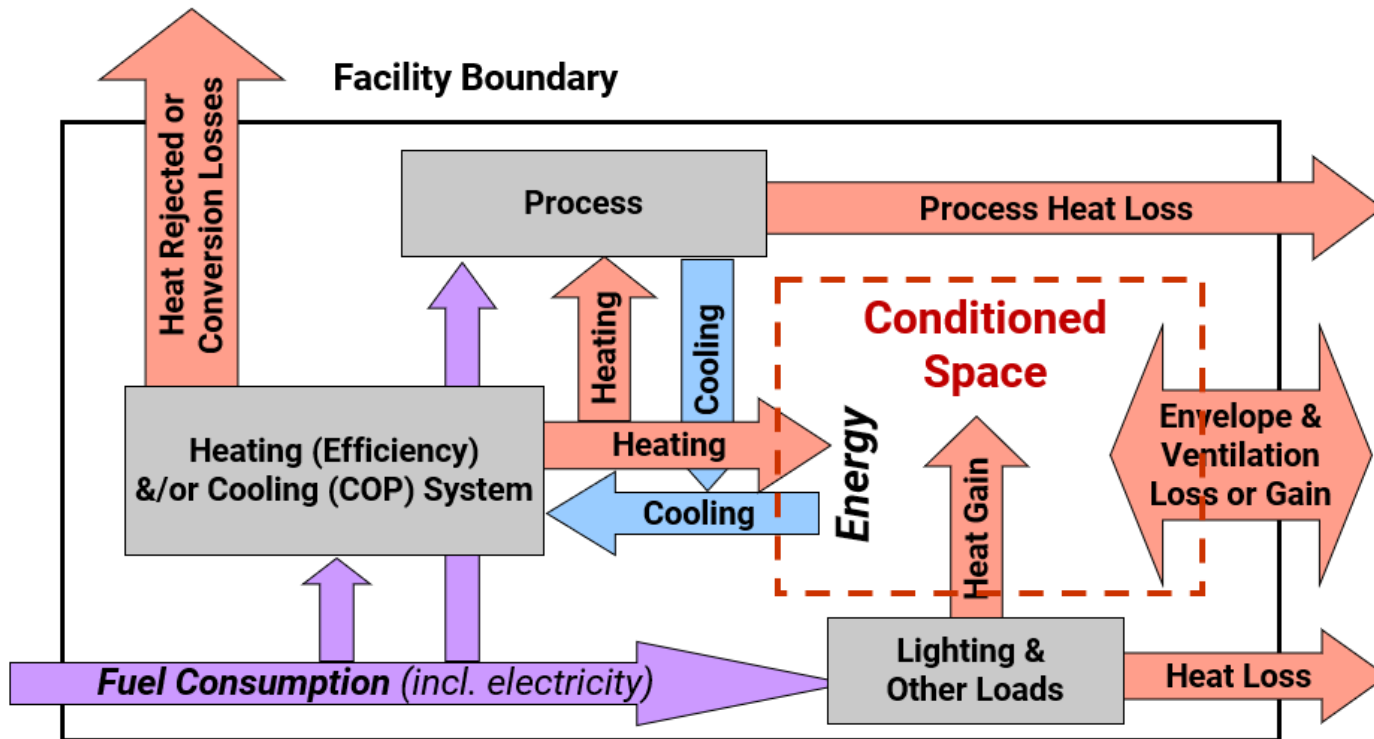
Options: eLearning, RETScreen Connect

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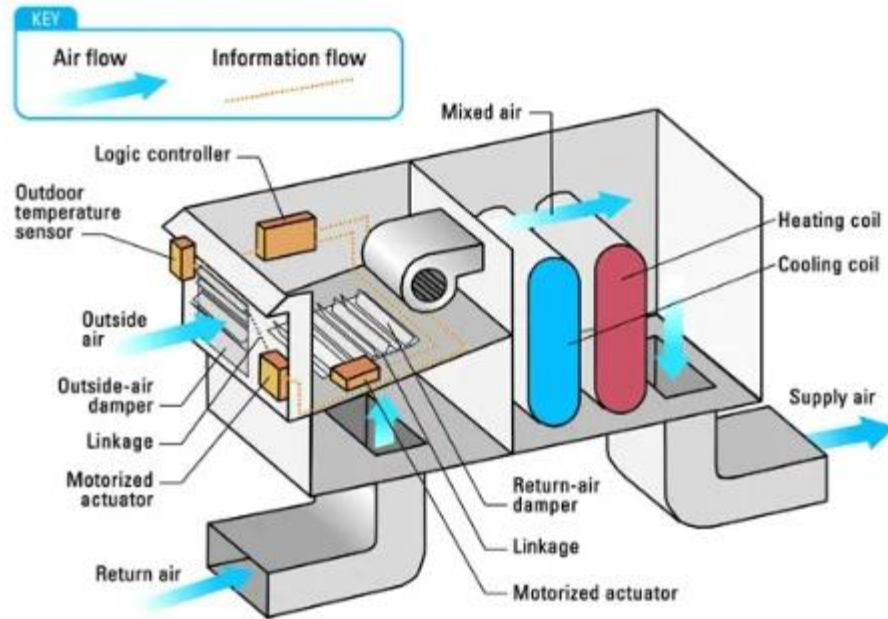
Ventilation - Method 2

| Description                       | Base case        |          |          |                          | Proposed case    |          |          |                          | Unit cost | Total cost |
|-----------------------------------|------------------|----------|----------|--------------------------|------------------|----------|----------|--------------------------|-----------|------------|
|                                   | System selection | Quantity | Schedule | Heat recovery efficiency | System selection | Quantity | Schedule | Heat recovery efficiency |           |            |
| Heating                           | Heating          |          | 24/7     | %                        | Heating          |          | 24/7     | %                        | \$(/L/s)  | \$         |
| <b>Total</b>                      |                  |          |          |                          |                  |          |          |                          |           | 0          |
| Incremental initial costs - other | \$               |          |          |                          |                  |          |          |                          |           |            |
| Incremental initial costs - total | \$               |          |          |                          |                  |          |          |                          |           | 0          |
| Incremental O&M savings           | \$               |          |          |                          |                  |          |          |                          |           |            |
| Heating system                    |                  |          |          |                          |                  |          |          |                          |           |            |
| Heating                           | kWh              |          |          |                          |                  |          |          |                          |           |            |

# RETScreen and HVAC energy balances



# Heating, ventilation and cooling with a rooftop unit (RTU)



# Models required

- Electricity and fuels
- Schedules
- Heating system
- Cooling system
- Ventilation
- Motor/fan

RETScreen - Energy Model Subscriber: Tds Dixon Inc - Professional

Commercial/Institutional - Office space with a warehouse - Services

Show: Energy   Heating   Cooling   Electricity   Simple payback   Include measure?  
Fuel consumption - base case   kWh   kWh   kWh   yr  

|                             | Heating       | Cooling      | Electricity   | Simple payback yr | Include measure?                    |
|-----------------------------|---------------|--------------|---------------|-------------------|-------------------------------------|
| <b>Heating</b>              |               |              |               |                   |                                     |
| RTU Furnace                 |               |              |               |                   | <input checked="" type="checkbox"/> |
| <b>Cooling</b>              |               |              |               |                   |                                     |
| RTU A/C                     |               |              |               |                   | <input checked="" type="checkbox"/> |
| <b>Ventilation</b>          |               |              |               |                   |                                     |
| RTU Ventilation (HVAC)      | 53,666        | 2,395        |               | Immediate         | <input checked="" type="checkbox"/> |
| <b>Electrical equipment</b> |               |              |               |                   |                                     |
| RTU Fan Motor               |               |              | 30,660        | 1.1               | <input checked="" type="checkbox"/> |
| <b>Total</b>                | <b>53,666</b> | <b>2,395</b> | <b>30,660</b> | <b>0.8</b>        |                                     |

# Demonstration – build the system

There is one rooftop unit providing space heating and cooling to the building:

- The heating equipment is a furnace with a seasonal efficiency of 80%
- The cooling equipment is a compressor unit with a seasonal COP of 3.0

## Base Case – Office and Warehouse Ventilation (Method 1)

- Building is cooled to 21°C, on the same schedule as heating
- 5,000 cfm capacity rooftop unit provides ventilation, with heating and cooling as required
- Ventilation (fresh air) is 20% of system airflow
- The fan is driven by a 5hp motor (measured at 3.5 kW) (set heating and cooling impact to 0%)
- The ventilation system operates 24 hours 7 days a week (constant)
- Dampers have medium leakage
- The system does not have heat recovery

# Now let's improve the system

## Proposed Case

- The building is only occupied 10 hours per day, 6 days per week
- Modify the fan and ventilation control to operate according to the occupancy schedule
  - You will need to add a schedule in the model
- Implement a night time setback and set up of 4°C during unoccupied periods
- Cost of controls to implement fan, ventilation, and temperature control is \$3,000

Hint: You need to define a new Schedule, Heating equipment, Cooling equipment, two Ventilation equipment sheets and a Fan motor sheet (under Electrical equipment)

# Results of model

**RETScreen - Energy Model** Subscriber: TdS Dixon Inc - Professional

Commercial/Institutional - Office space with a warehouse - Services

|                             | Show: Energy  | Heating      | Cooling      | Electricity   | Simple payback | Include measure?                    |
|-----------------------------|---------------|--------------|--------------|---------------|----------------|-------------------------------------|
|                             | Fuel saved    | kWh          | kWh          | kWh           | yr             | <input checked="" type="checkbox"/> |
| <b>Heating</b>              |               |              |              |               |                |                                     |
| RTU Furnace                 | 0             |              |              |               |                | <input checked="" type="checkbox"/> |
| <b>Cooling</b>              |               |              |              |               |                |                                     |
| RTU A/C                     |               | 0            |              |               |                | <input checked="" type="checkbox"/> |
| <b>Ventilation</b>          |               |              |              |               |                |                                     |
| RTU Ventilation (HVAC)      | 34,499        | 1,540        |              |               | Immediate      | <input checked="" type="checkbox"/> |
| <b>Electrical equipment</b> |               |              |              |               |                |                                     |
| RTU Fan Motor               |               |              |              | 19,710        | 1.1            | <input checked="" type="checkbox"/> |
| <b>Total</b>                | <b>34,499</b> | <b>1,540</b> | <b>1,540</b> | <b>19,710</b> | <b>0.8</b>     |                                     |



# What have we modelled?

## Key elements

1. RETScreen always models single zone systems.
2. Most RETScreen models consider the system to be able to provide both heating and cooling (i.e. switchover systems).
3. Economizer free cooling operation is not considered in RETScreen.



# System type

**Know your systems before modelling them in RETScreen**

# HVAC system services

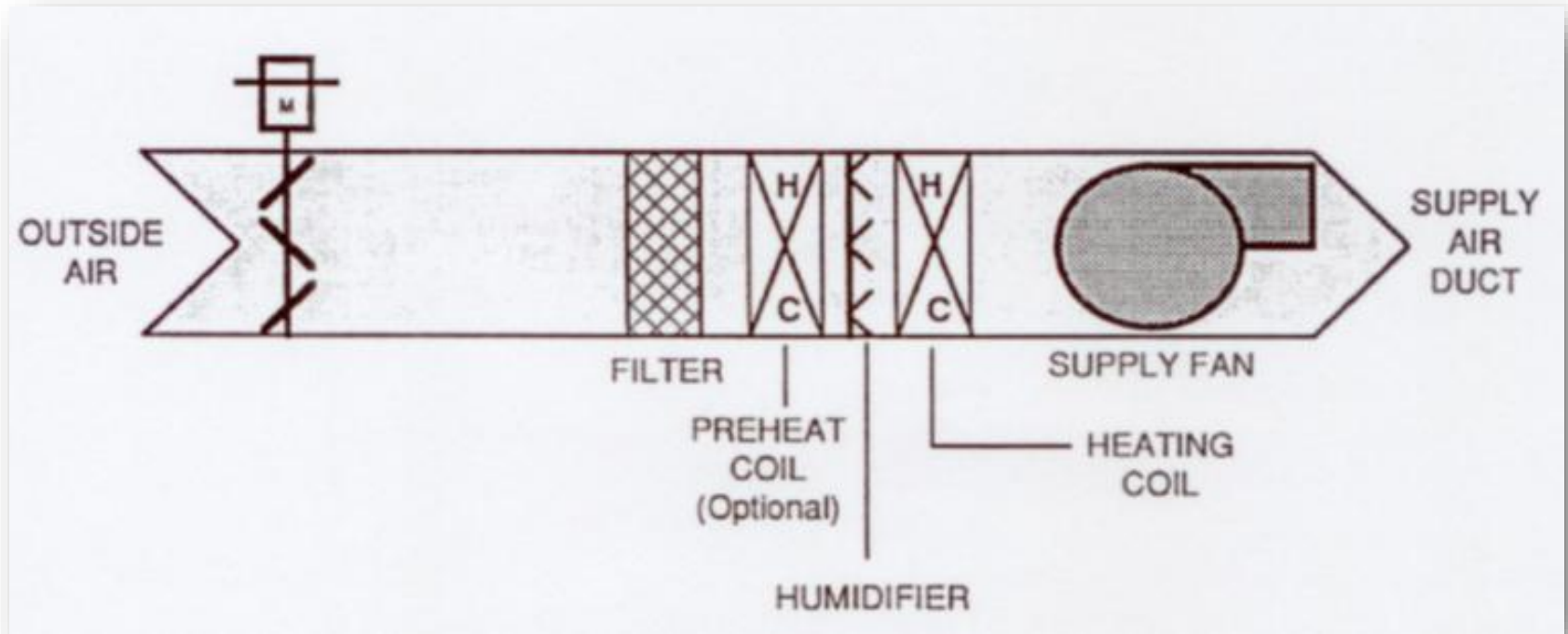
- Always identify what services your HVAC system provides to spaces
- Typically, a system can provide the following, but most systems do NOT provide all these services:
  1. Space heating (in contrast to outdoor air heating)
  2. Space humidification
  3. Space cooling
  4. Space air filtration
  5. Ventilation (i.e. bringing in outdoor air)



# Circumstance/scenario 1

# Case study situation

- Make-up air (MUA) system



# Services provided

- Ventilation only!
- MUA will pre-condition the outdoor air but does not provide space heating, cooling, humidification and filtration
  - The presence of filters, heating and cooling coils and a humidifier does not mean it is used for space air conditioning
  - It is a **cold-deck** system

**Cold-deck system:** A cold-deck system refers to a design whereby air is distributed to various zones or areas within a building at a temperature at or below a space temperature set point. Cold deck systems are often contrasted with hot-deck systems whereby air is heated and then distributed.

# Case study situation results

Ventilation

Description

Note

Method

Method 1  Method 2

Options

eLearning  RETScreen Connect

Ventilation - Method 2

| Description | Base case         |          |          |             |                                  | Proposed case     |          |          |             |                                  |
|-------------|-------------------|----------|----------|-------------|----------------------------------|-------------------|----------|----------|-------------|----------------------------------|
|             | System selection  | Quantity | Schedule | Flow<br>cfm | Heat recovery<br>efficiency<br>% | System selection  | Quantity | Schedule | Flow<br>cfm | Heat recovery<br>efficiency<br>% |
| -           | Heating & cooling | 1        | 24/7     | 10,000      | 0%                               | Heating & cooling | 1        | 24/7     | 10,000      | 70%                              |

**Total**

|                                   | Base case | Proposed case | Energy saved |
|-----------------------------------|-----------|---------------|--------------|
| Incremental initial costs - other | \$        |               | \$           |
| Incremental initial costs - total | \$        | 0             |              |
| Incremental O&M savings           | \$        |               |              |
| Heating system                    | Furnace   | Furnace       |              |
| Heating                           | kWh       | 446,299       | 133,890      |
|                                   |           |               | 312,409      |
|                                   |           |               | 70%          |
| Cooling system                    | AC        | AC            |              |
| Cooling                           | kWh       | 79,150        | 23,745       |
|                                   |           |               | 55,405       |
|                                   |           |               | 70%          |

# Cautions

- Only model the make-up or exhaust (relief) flows – not both
  - The exhaust fan is modelled but not its flow
- As it is a cold-deck system, be mindful of the associated schedule
- MUA Schedule should be set higher than space temperature, such as 2 °C higher

Schedules

| Description                                   |      | 24/7  | MUA   |
|---|------|-------|-------|
| <b>Occupied</b>                               |      |       |       |
| Temperature - space heating                   | °C   | 22    | 24    |
| Temperature - space cooling                   | °C   | 22    | 24    |
| <b>Unoccupied</b>                             |      |       |       |
| Temperature - space heating                   | °C   |       | 18    |
| Temperature - space cooling                   | °C   |       | 24    |
| <b>Occupancy rate - daily</b>                 |      |       |       |
| Monday  | h/d  | 24    | 24    |
| Tuesday                                       | h/d  | 24    | 24    |
| Wednesday                                     | h/d  | 24    | 24    |
| Thursday                                      | h/d  | 24    | 24    |
| Friday  | h/d  | 24    | 24    |
| Saturday                                      | h/d  | 24    | 24    |
| Sunday  | h/d  | 24    | 24    |
| Occupancy rate - annual                       | h/yr | 8,760 | 8,760 |
|   | %    | 100%  | 100%  |
| <b>Heating/cooling changeover temperature</b> |      |       |       |
| Heating/cooling changeover temperature        | °C   | 16    |       |
| Length of heating season                      | d    | 240   |       |
| Length of cooling season                      | d    | 125   |       |

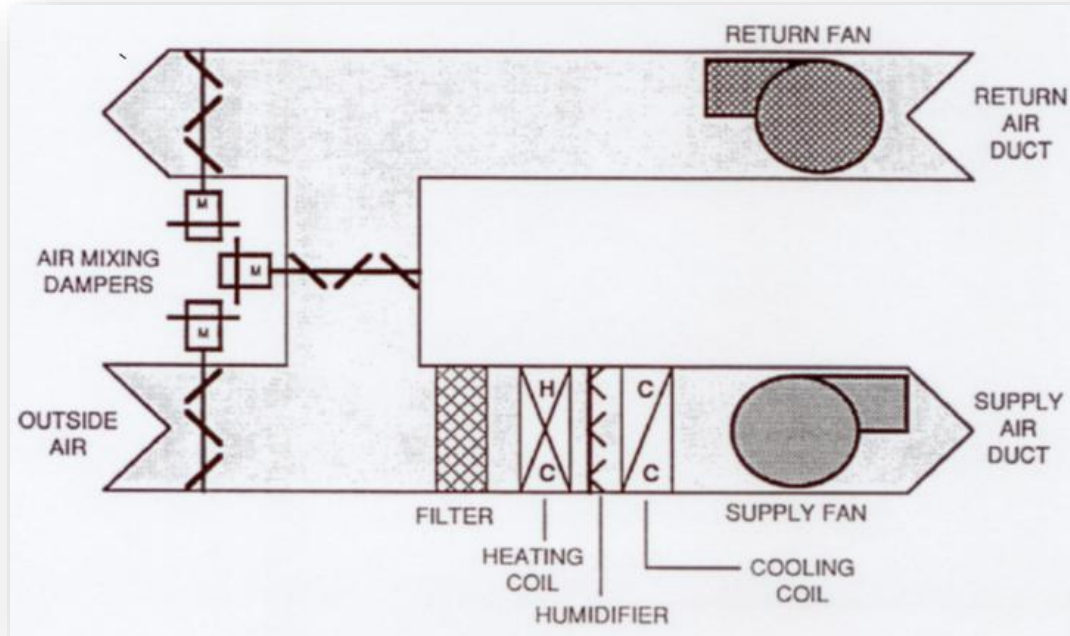




# Circumstance/scenario 2

# Case study situation

- Constant volume system – single zone



# Services provided

- This system can provide all 5 services
- It is typically controlled by a space thermostat
  - It is a **switch-over** being cold-deck when there is a cooling call and hot-deck when there is a heating call
- This system is the basis for the ventilation element in RETScreen

# Case study situation results

**RETScreen - Energy Model** Subscriber: TdS Dixon Inc - Professional

Commercial/Institutional - Office space with a warehouse - Services

**Fuels & schedules**

- Electricity and fuels
- Schedules

**Equipment**

- Heating
  - RTU Furnace
- Cooling
  - RTU A/C

**End-use**

- Ventilation
  - RTU Ventilation (HVAC)
  - Washroom Exhaust
- Electrical equipment
  - Halogen To LED
  - Computers
  - RTU Fan Motor

**Optimize supply**

**Summary**

- Include measure?
- Comparison

Ventilation

Description: RTU Ventilation (HVAC)

Note:

Method 1

Method 2

eLearning

RETScreen Connect

Ventilation - Method 1

|                             | Base case         | Proposed case     | Energy saved |
|-----------------------------|-------------------|-------------------|--------------|
| Schedule                    | 24/7              | Setback           |              |
| Flow                        | cfm 5,000         | 5,000             |              |
| Fresh air                   | % 20%             | 20%               |              |
| System reheat               | No                | No                |              |
| System selection            | Heating & cooling | Heating & cooling |              |
| Fan control                 | Constant          | Schedule          |              |
| Ventilation control         | Constant          | Schedule          |              |
| Intake air damper leakage   | Medium            | Medium            |              |
| Heat recovery efficiency    | % 0%              | 0%                |              |
| Costing method              |                   | Level 1           |              |
| Incremental initial costs   | \$                |                   | \$           |
| Incremental O&M savings     | \$                |                   |              |
| Number of ventilation units | 1                 | 1                 |              |
| Heating system              | RTU Furnace       | RTU Furnace       |              |
| Heating                     | kWh 42,933        | 15,333            | 27,600       |
|                             |                   |                   | 64.3%        |
| Cooling system              | RTU A/C           | RTU A/C           |              |
| Cooling                     | kWh 7,185         | 2,566             | 4,619        |
|                             |                   |                   | 64.3%        |

# Cautions

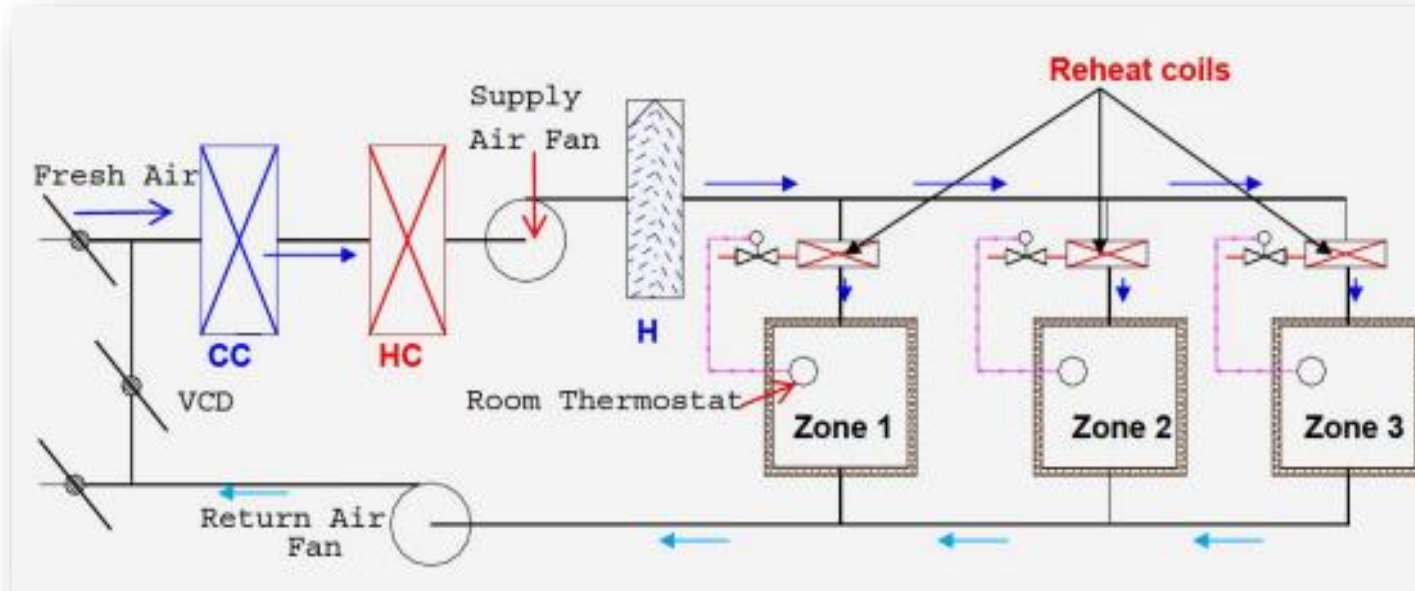
- The system does not respond to a call from space heating and cooling
  - Heating and cooling are only for heating and/or cooling mixed air to the schedule set point
- Free cooling is not considered
- Associated exhaust flows are only defined if they are superior to the % defined in the ventilation element
  - Exhaust fan motors are still defined



# Circumstance/scenario 3

# Case study situation

- Constant volume system with reheat



[https://www.ijirset.com/upload/2016/april/242\\_68\\_Basic.pdf](https://www.ijirset.com/upload/2016/april/242_68_Basic.pdf)

# Services provided

- This system provides 4 of the 5 services
  - It is not typically used for space heating
- It is typically controlled by a supply duct temperature sensor
  - It is a cold-deck system
- Reheat coils are typically not used as the primary source of space heating (excluding fan-powered boxes)



# Case study situation results

- RETScreen screenshot of modelled scenario/circumstance

Commercial/Institutional - Office building

**Fuels & schedules**

- Electricity and fuels
- Schedules

**Equipment**

- Heating
  - Boiler
- Cooling
  - Compressor

**End-use**

- Ventilation
  - Constant Volume Reheat
- Process heat
  - Reheat

**Optimize supply**

**Summary**

- Include measure?
- Comparison

Ventilation

Description: Constant Volume Reheat

Note:

Method: Method 1, Method 2

Options: eLearning, RETScreen Connect

Ventilation - Method 1

|                             | Base case         | Proposed case     | Energy saved |
|-----------------------------|-------------------|-------------------|--------------|
| Schedule                    | 24/7              | 24/7              |              |
| Flow                        | 4,000 L/s         | 4,000             |              |
| Fresh air                   | 15%               | 15%               |              |
| System reheat               | No                | No                |              |
| System selection            | Heating & cooling | Heating & cooling |              |
| Fan control                 | Schedule          | Schedule          |              |
| Ventilation control         | Schedule          | Schedule          |              |
| Intake air damper leakage   | Tight             | Tight             |              |
| Heat recovery efficiency    |                   |                   |              |
| Costing method              |                   | Level 1           |              |
| Incremental initial costs   |                   |                   |              |
| Incremental O&M savings     |                   |                   |              |
| Number of ventilation units | 1                 | 1                 |              |
| Heating system              | Boiler            | Boiler            |              |
| Heating                     | 6,354 kWh         | 6,354             | 0<br>0%      |
| Cooling system              | Compressor        | Compressor        |              |
| Cooling                     | 7,856 kWh         | 7,856             | 0<br>0%      |

# Cautions

- It is defined in an almost identical manner to the single zone system but:
  - Its schedule must account for its cold-deck nature
- System reheat should NOT be selected
  - Use a separate Process Load to capture reheat
- It is not assigned to specific zones or spaces; the system is independent of the building envelope defined in the model.



# System Schedule and Reheat

- The schedule must be defined to a value of typically 5°C or 1 °C above average yearly ambient, whichever is greater.
- Reheat should be defined as a process load using:

Load = System Flow (CFM) \* 1.08 \* (Room Temp. - Supply Temp.) (oF) \* % with Reheat

- Note: Results are in BTU/hr.

# Cold Deck Schedule and Reheat

Options  
 eLearning  
 RETScreen Connect

Schedules

Description 24/7 VAV

**Occupied**

Temperature - space heating °C 22 8.2

Temperature - space cooling °C 22 24

**Unoccupied**

Temperature - space heating °C 5

Temperature - space cooling °C 24

**Occupancy rate - daily**

| Day       | h/d | 24 | 24 |
|-----------|-----|----|----|
| Monday    | h/d | 24 | 24 |
| Tuesday   | h/d | 24 | 24 |
| Wednesday | h/d | 24 | 24 |
| Thursday  | h/d | 24 | 24 |
| Friday    | h/d | 24 | 24 |
| Saturday  | h/d | 24 | 24 |
| Sunday    | h/d | 24 | 24 |


Occupancy rate - annual h/yr 8,760 8,760

% 100% 100%

Heating/cooling changeover temperature °C 16

Length of heating season d 240

Length of cooling season d 125

Options  
 RETScreen Connect

Process heat

Description Reheat

Note

Process heat

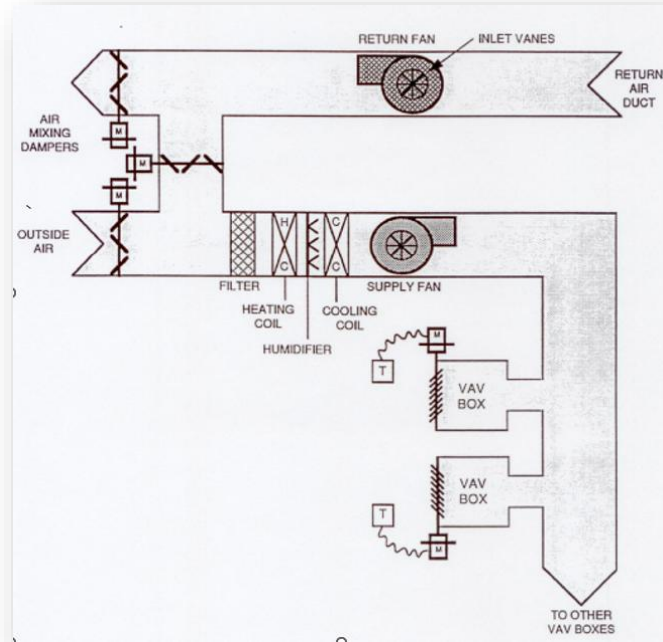
|                           | Base case  | Proposed case | Energy saved |
|---------------------------|------------|---------------|--------------|
| Level                     | Level 2    |               |              |
| Heating load              | kW 0.23    | 0.23          |              |
| Duty cycle                | % 100%     | 100%          |              |
| Operating hours           | h/yr 1,500 | 1,500         |              |
| Incremental initial costs | \$         |               |              |
| Incremental O&M savings   | \$         |               |              |
| Heating system            | Boiler     | Boiler        |              |
| Number of units           | 1          | 1             |              |
| Heating                   | kWh 345    | 345           | 0            |
|                           |            |               | 0%           |



# Circumstance/scenario 4

# Case study situation

- Variable air volume (VAV) systems



# Services provided

- This system provides 4 of the 5 services
  - It is not typically used for space heating
- It is typically controlled by a supply duct temperature sensor
  - It is a cold-deck system
- Reheat coils can be used but are not the primary source of space heating (excluding fan-powered boxes)

# Case study situation results

- RETScreen screenshot of modelled scenario/circumstance

Commercial/Institutional - Office building

**Fuels & schedules**

- Electricity and fuels
- Schedules

**Equipment**

- Heating
  - Boiler
- Cooling
  - Compressor

**End-use**

- Ventilation
  - Ventilation
- Process heat
  - Process heat

**Optimize supply**

**Summary**

- Include measure?
- Comparison

Ventilation - Method 1

|                             | Base case         | Proposed case     | Energy saved |
|-----------------------------|-------------------|-------------------|--------------|
| Schedule                    | VAV               | VAV               |              |
| Flow                        | 4,000 L/s         | 4,000             |              |
| Fresh air                   | 15%               | 15%               |              |
| System reheat               | No                | No                |              |
| System selection            | Heating & cooling | Heating & cooling |              |
| Fan control                 | Schedule          | Schedule          |              |
| Ventilation control         | Schedule          | Schedule          |              |
| Intake air damper leakage   | Tight             | Tight             |              |
| Heat recovery efficiency    |                   |                   |              |
| Costing method              |                   | Level 1           |              |
| Incremental initial costs   |                   |                   | \$           |
| Incremental O&M savings     |                   |                   | \$           |
| Number of ventilation units | 1                 | 1                 |              |
| Heating system              | Boiler            | Boiler            |              |
| Heating                     | 6,354 kWh         | 6,354             | 0<br>0%      |
| Cooling system              | Compressor        | Compressor        |              |
| Cooling                     | 5,298 kWh         | 5,298             | 0<br>0%      |



# Cautions

- The flow modulation is not modelled and the flow entered must be the typical average yearly flow
- Its schedule must account for its cold-deck nature, as shown for the constant volume system – identical approach.
- Do NOT select reheat but use the previous Process Load method:
  - Only difference is using the average flow.
  - It is not assigned to specific zones or spaces; the system is independent of the building envelope defined in the model



# Circumstance/scenario 5

# Case study situation

- Washroom, kitchen, process or general exhaust



# Case study situation results

Ventilation

Description


Note

Method


Method 1

Method 2

Options

  
eLearning

➔

  
RETScreen  
Connect

➔

Ventilation - Method 2

| Base case   |                   |          |          |                          |    | Proposed case     |          |                |                          |    |
|-------------|-------------------|----------|----------|--------------------------|----|-------------------|----------|----------------|--------------------------|----|
| Description | System selection  | Quantity | Schedule | Heat recovery efficiency |    | System selection  | Quantity | Schedule       | Heat recovery efficiency |    |
|             |                   |          |          | Flow<br>cfm              | %  |                   |          |                | Flow<br>cfm              | %  |
| -           | Heating & cooling | 1        | 24/7     | 10,000                   | 0% | Heating & cooling | 1        | 6 hours per da | 10,000                   | 0% |
| -           | Heating & cooling | 1        | 24/7     | 0                        | 0% | Heating & cooling | 1        | 12 hours per d | 2,500                    | 0% |
| -           | Heating & cooling | 1        | 24/7     | 0                        | 0% | Heating & cooling | 1        | 6 hours per da | 0                        | 0% |

**+ Total**

|                                   | Base case | Proposed case | Energy saved |
|-----------------------------------|-----------|---------------|--------------|
| Incremental initial costs - other | \$        | 8,000         | \$           |
| Incremental initial costs - total | \$        | 8,000         |              |
| Incremental O&M savings           | \$        |               |              |
| Heating system                    | Furnace   | Furnace       |              |
| Heating                           | kWh       | 446,299       | 167,362      |
|                                   |           |               | 278,937      |
|                                   |           |               | 62.5%        |
| Cooling system                    | AC        | AC            |              |
| Cooling                           | kWh       | 79,150        | 29,681       |
|                                   |           |               | 49,469       |
|                                   |           |               | 62.5%        |

# Cautions

- Only model the exhaust or make-up flows – not both
- Be attentive to the schedule (temperature) defined as the associated flow from exhaust, even when no MUA is present, system is considered cold-deck.



# Q and A period

# Workshop 2 – hands on with RETScreen Expert HVAC



Tuesday, Nov 12  
1:00 – 3:00 PM



# Efficient Electrification Toolkit and Helpdesk

The webinar materials will be shared with you by email.

The webinar recording can be accessed at [SaveonEnergy.ca/Training-and-Support](https://SaveonEnergy.ca/Training-and-Support). Select your sector and then “Efficient Electrification”.

For questions and technical support regarding the Efficient Electrification Toolkit, including RETScreen, contact [trainingandsupport@ieso.ca](mailto:trainingandsupport@ieso.ca).

Please use “EE toolkit helpdesk” as your email subject line. Requests will be triaged and addressed in the order they are received.



# Post-webinar support

One-on-one coaching – tailored support for managing energy resources effectively

## Post-webinar support intake form

Coaching sessions conducted virtually by phone, video calls, and email  
Designed for organizations, new or old, seeking guidance

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# Thank you

[SaveOnEnergy.ca](https://www.saveonenergy.ca)

[trainingandsupport@ieso.ca](mailto:trainingandsupport@ieso.ca)



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