

MAY 16, 2024

Efficient Electrification Workshop #2

Net Zero Planning with RETScreen Expert

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Agenda

- Welcome and Introductions
- Overview of RETScreen Expert
- RETScreen Archetypes and the Virtual Energy Analyzer
- Activity 1: Using the Archetypes
- Overview of the Portfolio and Net Zero Planning Framework
- Activity 2: Building a Net Zero Plan
- Wrap-up & Q&A



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 2/3rds 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



RETScreen Expert Overview



Virtual Energy Analyzer

Typical consumption of a building and corresponding archetype for a particular area (no audit required).



Benchmark Analysis

Modelled building as compared to other similar referenced buildings worldwide.



Feasibility Analysis

Modelling of clean energy projects including analysis of energy, cost, emission, financing, and sensitivity/risk.



Performance Analysis

Monitoring, analysis, and reporting key energy performance data. Used for MT&R and M&V of savings.



Portfolio Analysis

Manage energy across a large number of facilities, from energy efficiency measures in a single building to multiple buildings worldwide.

Project Types



Power plants

Photovoltaic, wind turbine, solar thermal power, gas turbine, etc.



Power | Heating | Cooling

Cogeneration projects



Industrial

Manufacturing, food, chemical, metal, non-metal, petroleum, paper, etc.



Commercial/Institutional

Education, food retail, health care, office, warehouse, etc.



Residential

Apartment building, attached dwellings, single family homes, etc.



Agricultural

Greenhouse, poultry



Individual measures









Power supply systems, heating supply, cooling systems, heating systems, end-use (Building envelope, lights, motors, fans, heat recovery, process, etc.)



Transportation

Transportation including on-road vehicles, off-road vehicles, aircrafts, marine fleets, trains.

Databases

-  **Product data** (Manufacturers and model numbers)
-  **Cost data** (initial installed costs and ongoing O&M)
-  **Climate data** (Ground-based monitoring stations)
-  **Weather data** (NASA's Satellite-derived Meteorological Data)
-  **Hydrology data** (Flow-duration curve dataset)
-  **Project data** (Archetypes, case studies, templates)
-  **Benchmark data** (Modelled or monitored data)
-  **Energy resource maps** (Wind maps)

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. On the right side of the menu bar, there are options for Language, Share, and Subscribe. The main header area features 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 buttons for Home, Open, Close, Settings, Help, Subscribe, Save, Save As, and Exit. Below these are sections 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 cycle. The cycle is divided into four quadrants: Performance (top-left), Location (top-right), Energy (bottom-right), and Finance (bottom-left). The cycle is labeled with "Start" at the top, "Report" at the top-right, "Benchmark" at the right, "Feasibility" at the bottom, "Emission" at the bottom-left, "Risk" at the left, and "Data" at the top-left. The central area contains "Performance Tracker", "Virtual Energy Analyzer", "Financial Risk Assessor", and "Smart Project Identifier".
- Facility type - Examples:** Lists various facility types: Power plants, Power | Heating | Cooling, Power | Storage | Off-grid, Industrial | Agricultural, Commercial/Institutional, Residential, Military, Individual measure, Transportation, and User-defined.
- Integrated features:** Lists features such as User manual, eLearning, Databases, and Dashboards. It also includes an "About us" section with logos for CanmetENERGY in Varennes, RETScreen Innovation Lab, RETScreen Data Onboarding, and RETScreen Capacity Building. A "In collaboration with:" section lists logos for 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 "NRC/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

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
Case Study	All	Power plant	Photovoltaic	10.8 kW
Case Study	All	Power plant	Wind turbine	99,000 kW
Template	All	Power plant	Photovoltaic	Equation Y = a Feasibility analysis - Validation
Template	All	Individual measure	Pumps	Equation Y = a Variable speed
Case Study	Feasibility	Power plant	Wind turbine	100,000 kW - Offshore - GHG reduction income
Case Study	Feasibility	Individual measure	Solar air heater	Institutional - Classroom
Case Study	Feasibility	Individual measure	Solar air heater	Process - Crop drying
Case Study	Feasibility	Individual measure	Solar air heater	Institutional - Recreation centre
Case Study	Feasibility	Individual measure	Solar air heater	Industrial
Case Study	Feasibility	Individual measure	Solar air heater	Industrial
Case Study	Feasibility	Individual measure	Solar air heater	Institutional - Federal research centre
Case Study	Feasibility	Individual measure	Solar air heater	Institutional - Sewage treatment plant
Case Study	Feasibility	Individual measure	Solar air heater	Agricultural - Piggyery

Learning resource – contextual text and video help

Subscriber: TdS Dixon Inc - Professional

Industrial - Beverage

Options

- eLearning
- RETScreen Connect

Motor

Type	
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](#)

YouTube - Pumps

youtube.com/watch...

Premium

Feasibility Analysis with RETScreen Expert
Pumps

CanmetENERGY

RETScreen eLearning

5.26K subscribers

Subscribed

9 9 9 9 9

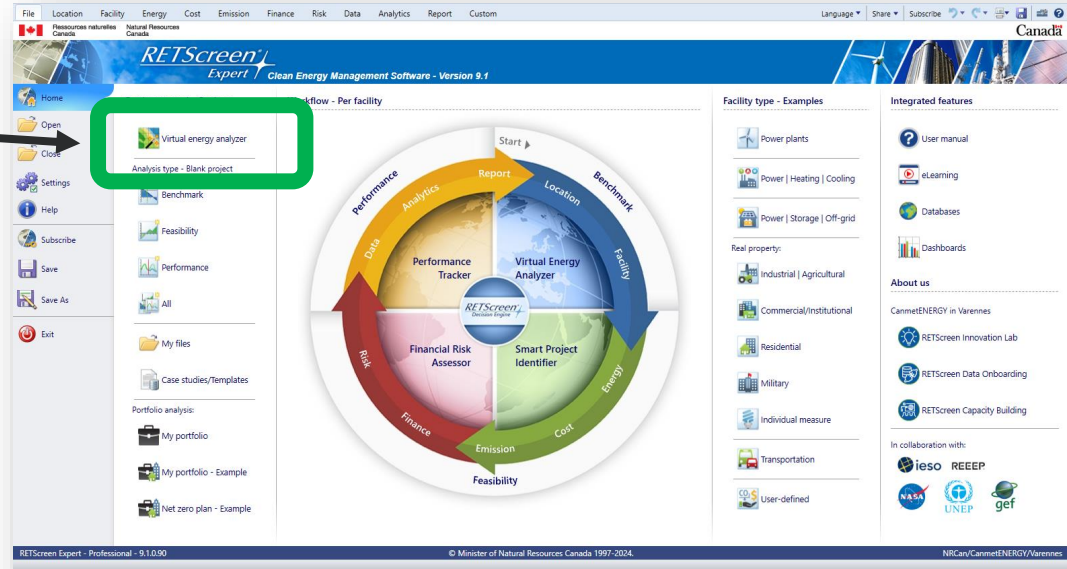
1.2K views 4 years ago Step-by-Step Energy Audits & Individual Energy Efficiency | ...more

All From RETScreen eLearning Computer program For you

Overview of RETScreen Expert Platform (20 min)

RETScreen Archetypes

Accessed via the
Virtual Energy
Analyzer



Getting started: the Virtual Energy Analyzer

By facility type

RETScreen - Facility Subscriber: T&S Dixon Inc - Professional

Facility information

Facility type: Commercial/Institutional
 Type: Public building
 Description: Community centre - Feasibility [Emission] Target - 80-90%

Prepared for: Prepared for
 Prepared by: Prepared by

Facility name: Archetype
 Address: Address
 City/Municipality: Wrennes
 Province/State: QC
 Country: Canada

Benchmark - Commercial/Institutional - Public building

Facility size - Actual: 2,250 m²
 Facility size - Archetype: 2,250 m²

Fuel consumption

Energy use intensity: kWh
 Energy unit: kWh/m²
 Reference unit: m²

Benchmark: 272 kWh/m²
 Minimum (Typical): 182 kWh/m²
 Maximum (Typical): 370 kWh/m²

Base case: 533 kWh/m²

Set target: Target
 Year: Year
 Target: -78%

Plan

Energy use intensity (kWh/m²)

Base case
 Benchmark
 Target

By measure

RETScreen - Energy Model Subscriber: T&S Dixon Inc - Professional

Individual measure - Heat recovery - Ventilation

Fuels & schedules

Electricity and fuels: Fuel saved kWh

Equipment

Heating: 989,998
 Boiler: 100,000 27,946 0 3.6 ✓

End-use

Ventilation: 3,489,742
 Heat recovery - Ventilation: 120,000 98,508 0 1.2 ✓

Heat recovery

Heat recovery - Furnace: 3,500,000
 Heat recovery - Furnace: 340,000 98,798 0 3.4 ✓

Total
 7,979,740
 560,000 225,251 0 2.5

Summary

Include measure?
 Comparison

Image

Times New Roman 16

Archetype

Base case

- Several large makeup air units use glycol as heat transfer fluid
- Building fan and ventilation systems are on constantly
- Air flow rate is 350,000 m³/h with 100% fresh air
- Intake air damper is leaky
- Space heating temperature is constant at 20 °C
- Heating/cooling changeover temperature is 20 °C
- Natural gas fired steam boiler seasonal efficiency is 75%

Proposed case

- Minimize usage: reduce flow by 10% and install heat exchanger on ventilation system, heat exchanger efficiency is 15%, cost is \$120,000
- Maximize efficiency: install economizer on boiler stack to preheat feed water, increasing boiler efficiency to 80%, cost is \$100,000
- Optimize supply: recover heat from other system (economizer on a furnace), heat recovered 2,800 MWh, cost is \$340,000

Demonstration of a few Archetypes

Community Centre – 30- 40% Energy

RETScreen Expert

File Location Facility Energy Cost Emission Finance Risk Report Custom

Step 1 - Fuels & schedules Step 2 - Equipment Step 3 - End-use Step 4 - Optimize supply Step 5 - Summary

Subscriber: Tds Dixon Inc - Professional

Commercial/Institutional - Community centre - Feasibility | Energy | Target - 30-40% - Public building

Fuels & schedules

Electricity and fuels Schedules

Equipment

Heating

	Heating	Cooling	Electricity	Incremental initial costs	Fuel cost savings	Incremental O&M savings	Simple payback	Include measure?
	kWh	kWh	kWh	\$	\$	\$	yr	
Space heating	0			0	0	0		<input checked="" type="checkbox"/>
Domestic hot water	0			0	0	0		<input checked="" type="checkbox"/>

Cooling

Air conditioning	0			0	0	0		<input checked="" type="checkbox"/>
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Building envelope

Building envelope	90,026	3,161		3,100	2,857	0	1.1	<input checked="" type="checkbox"/>
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Ventilation

Zone - East	177,310	4,509		17,908	5,456	0	3.3	<input checked="" type="checkbox"/>
Zone - West	216,712	5,510		19,452	6,668	0	2.9	<input checked="" type="checkbox"/>
Gymnasium	108,356	2,755		13,908	3,334	0	4.2	<input checked="" type="checkbox"/>

Lights

Office			2,837	1,280	284	0	4.5	<input checked="" type="checkbox"/>
Meeting room			3,989	4,050	399	0	10.2	<input checked="" type="checkbox"/>
Library			2,978	1,200	298	62	3.3	<input checked="" type="checkbox"/>
Lobby			1,915	600	191	31	2.7	<input checked="" type="checkbox"/>
Cafeteria			1,092	320	109	17	2.5	<input checked="" type="checkbox"/>
Kitchen			766	240	76.6	12	2.7	<input checked="" type="checkbox"/>
Washroom			766	540	76.6	12	6.1	<input checked="" type="checkbox"/>
Dressing room			1,744	1,080	174	24	5.4	<input checked="" type="checkbox"/>
Gymnasium			5,248	2,960	525	0	5.6	<input checked="" type="checkbox"/>
Fitness center			1,276	400	128	21	2.7	<input checked="" type="checkbox"/>
Corridor Stairway			596	240	59.6	12	3.4	<input checked="" type="checkbox"/>
Sign - Exit			2,102	688	210	96	2.2	<input checked="" type="checkbox"/>
Exterior - Facade			1,051	980	105	73	5.5	<input checked="" type="checkbox"/>
Exterior - Parking			6,877	3,031	688	30	4.2	<input checked="" type="checkbox"/>
Exterior - Sign			263	344	26.3	82	3.2	<input checked="" type="checkbox"/>

Electrical equipment

Office			2,698	0	270	0	Immediate	<input checked="" type="checkbox"/>
Cafeteria			6,504	600	650	75	0.8	<input checked="" type="checkbox"/>

Arena – Curling - 80-90% Carbon Reduction

Commercial/Institutional - Arena - curling - Feasibility | Emission | Target - 80-90% - Public building

Fuels & schedules

Electricity and fuels Schedules

Equipment

Heating

	Heating	Cooling	Electricity	Incremental initial costs	Fuel cost savings	Incremental O&M savings	Simple payback	Include measure?
	kWh	kWh	kWh	\$	\$	\$	yr	
Space heating	34,814			575,990	-978	-4,992	None	<input checked="" type="checkbox"/>
Domestic hot water	387			46,775	-211	0	None	<input checked="" type="checkbox"/>

Cooling

Refrigeration system		104,956		300,000	10,496	0	28.6	<input checked="" type="checkbox"/>
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Building envelope

Curling rink	-1,449			88,000	72.2	0	1,218.6	<input checked="" type="checkbox"/>
Lobby	-1,439			3,800	19.6	0	193.6	<input checked="" type="checkbox"/>
Maintenance	-1,424			1,500	66.6	0	22.5	<input checked="" type="checkbox"/>

Ventilation

Curling rink	743			24,480	13.4	0	1,820.3	<input checked="" type="checkbox"/>
Lobby	-4,107			0	129	0	Immediate	<input checked="" type="checkbox"/>
Maintenance	-402			0	32.6	0	Immediate	<input checked="" type="checkbox"/>

Lights

Curling rink								<input checked="" type="checkbox"/>
Lobby Washroom								<input checked="" type="checkbox"/>
Maintenance								<input checked="" type="checkbox"/>
Kitchen								<input checked="" type="checkbox"/>
Sign - Exit								<input checked="" type="checkbox"/>
Exterior - Parking								<input checked="" type="checkbox"/>
Exterior - Sign								<input checked="" type="checkbox"/>

Optimize supply

Photovoltaic - 198 kW (38%) Offsite renewables

Summary

Include measure? Comparison

Emission analysis

Subscriber: Tds Dixon Inc - Professional

Base case electricity system (Baseline)

Country - region: Canada - Ontario Fuel type: All types GHG emission factor (excl. T&D): 0.025 T&D losses: 7.0% GHG emission factor: 0.027

GHG emissions

Category	Base case (tCO ₂ e)	Proposed case (tCO ₂ e)
Electrical equipment	28.7	2.9
Hot water	25.8	2.9
Gross annual GHG emission reduction	25.8	2.9

Reduction: 89.9%

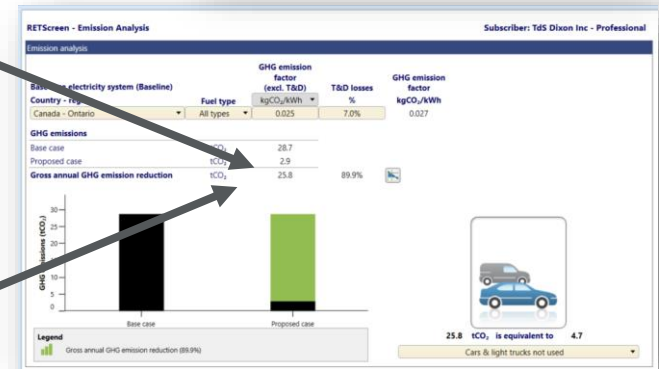
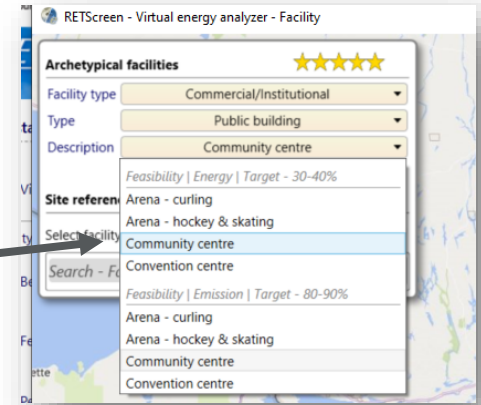
25.8 tCO₂e is equivalent to 4.7 Cars & light trucks not used



Activity 1: Using the Archetypes

Navigating and Changing an Archetype

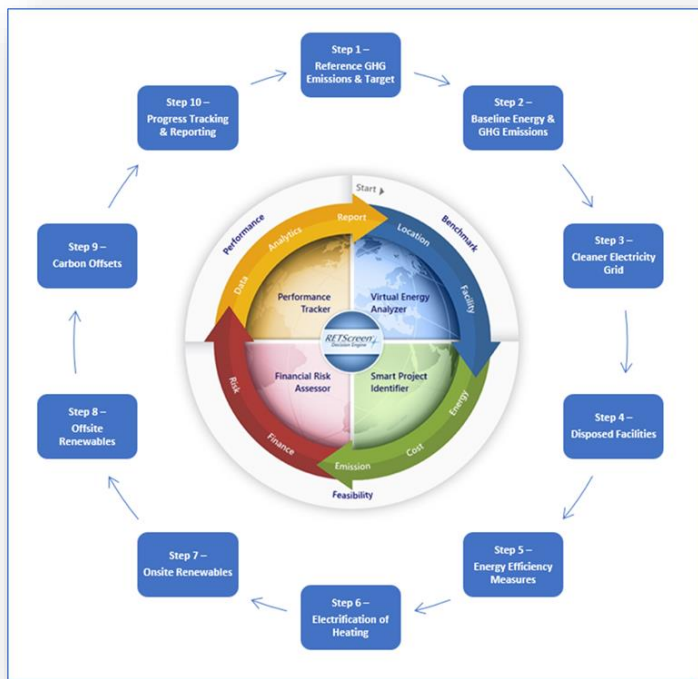
- Pick an archetype of your choice and a location that interests you.
- Choose a 30 – 40% energy reduction example
- Record the change in carbon emissions.
- Change the Heating Equipment from a Natural Gas Boiler to an Electric Heat Pump with a seasonal efficiency of 200%.
- Determine the reduction in carbon emissions due to Heat Pump.





Overview of the Portfolio and Net Zero Planning Tool

Portfolio decarbonization framework

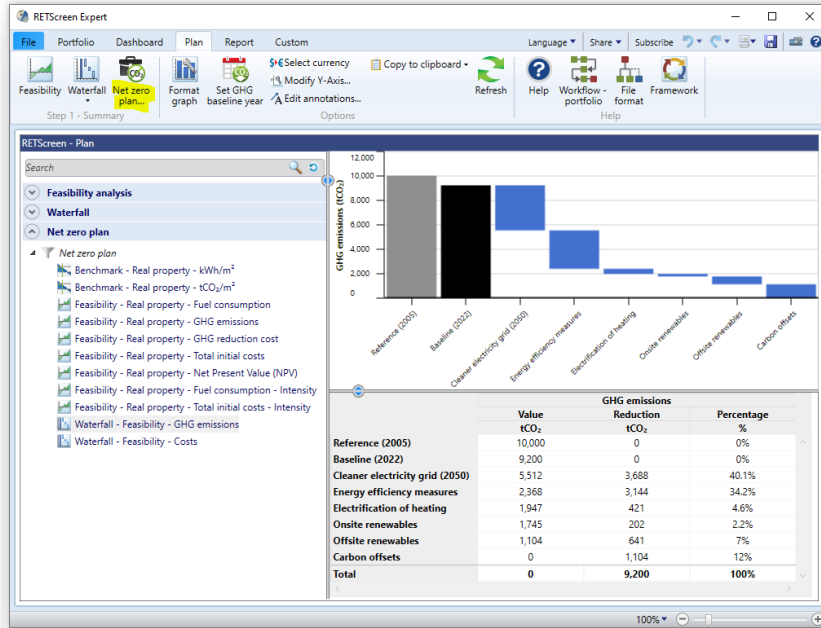


- Step 1 - Reference GHG Emissions & Target
- Step 2 - Baseline Energy & GHG Emissions
- Step 3 - Cleaner Electricity Grid
- Step 4 - Disposed Facilities
- Step 5 - Energy Efficiency Measures
- Step 6 - Electrification of Heating
- Step 7 - Onsite Renewables
- Step 8 - Offsite Renewables
- Step 9 - Carbon Offsets
- Step 10 - Progress Tracking & Reporting

Portfolio-wide Net Zero Planning Tool

Input

Output



RETScreen - Net zero plan - Real property

Step 1 - Reference GHG emissions and target

Reference: 10,000 tCO₂e
 Reference year: 2005
 GHG emission reduction - Target: 80%
 Year: 2050

Step 2 - Baseline energy and GHG emissions

GHG emission factor - Electricity: Database | Projected
 Baseline year: 2022
 Base case heating system: Archetypical facilities

Step 3 - Cleaner electricity grid

GHG emission factor - Electricity: Database | Projected
 Year: 2050

Step 4 - Disposed facilities

Include:
 Disposed facilities - Group - Name: Disposed facilities

Step 5 - Energy efficiency measures

Archetypical facilities: Feasibility | Emission | Target - 80-90%

Step 6 - Electrification of heating

Include:
 Boiler | Furnace:
 Air-source heat pump:
 Ground-source heat pump:
 Peak load heating system: Natural gas
 Percentage of energy supplied: 30%

Step 7 - Onsite renewables

Include: Photovoltaic:
 Photovoltaic - Solar collector area:

Rooftop	35%	0%	% of roof
Ground mount	50%	25%	% of roof

 Boiler | Furnace:

Rooftop	35%	0%	% of roof
Ground mount	50%	25%	% of roof

 Air-source heat pump:

Rooftop	35%	0%	% of roof
Ground mount	50%	25%	% of roof

 Ground-source heat pump:

Rooftop	35%	0%	% of roof
Ground mount	50%	25%	% of roof

Step 8 - Offsite renewables

Include:
 Electricity rate - annual: 0.16 \$/kWh

Step 9 - Carbon offsets

Include:
 Net annual GHG emission reduction: 100%
 Carbon offsets rate: 12 \$/tCO₂e

Step 10 - Progress tracking and reporting

See - Performance analysis module

Financial parameters | Emission

Financial parameters: TBS - LCCA
 Method: 2%
 Fuel cost escalation rate: 2%
 Inflation rate: 2%
 Discount rate: 3%
 Project life: 40
 Debt ratio: 0%
 Emission: Carbon shadow price | GHG reduction credit rate: 300
 Carbon shadow price duration | GHG reduction credit duration: 40

Display

Benchmark Analysis:
 Feasibility analysis:
 Waterfall:
 Custom:

Demonstration: Building the Net Zero Plan

https://www.youtube.com/watch?v=9at_7oywNj0

RETScreen - Net zero plan - Real property

Destination folder
 File location C:\Users\sdixo\Documents\RETScreen Expert\My Files\ Browse...
 Group - Name Net zero plan

Default
 Climate data location Canada - Alberta - Edmonton Municipal
 Facility location Canada - AB - Edmonton

Archetypal facilities ★★★★★
 Facility type Commercial/Institutional
 Type Education
 Description Elementary school/Primary school

Archetypes
 Climate data location Canada - Alberta - Edmonton Municipal
 Facility location Canada - AB - Edmonton

Facility name Apartment - High-rise
 Count 1
 Disposed facilities - Count
 Archetypal facilities ★★★★★
 Facility type Residential
 Type Apartment building/Multi-unit housing
 Description Apartment - High-rise

Climate data location Canada - Alberta - Edmonton Municipal
 Facility location Canada - AB - Edmonton

Facility name Clinic
 Count 1
 Disposed facilities - Count
 Archetypal facilities ★★★★★
 Facility type Commercial/Institutional
 Type Health care
 Description Clinic/Outpatient

Climate data location Canada - Alberta - Edmonton Municipal
 Facility location Canada - AB - Edmonton

RETScreen - Net zero plan - Real property

Step 1 - Reference GHG emissions and target
 Reference
 Reference year 10,000 tCO₂
 Reference year 2005
 GHG emission reduction - Target 80%
 Year 2050

Step 2 - Baseline energy and GHG emissions
 GHG emission factor - Electricity Database | Projected
 Baseline year 2022
 Base case heating system Archetypal facilities

Step 3 - Cleaner electricity grid
 GHG emission factor - Electricity Database | Projected
 Year 2050

Step 4 - Disposed facilities
 Include
 Disposed facilities - Group - Name Disposed facilities

Step 5 - Energy efficiency measures
 Archetypal facilities: Feasibility | Emission | Target - 80-90%

Step 6 - Electrification of heating
 Include
 Boiler | Furnace
 Air-source heat pump
 Ground-source heat pump
 Peak load heating system Natural gas
 Percentage of energy supplied 30%
 Advanced

Step 7 - Onsite renewables
 Include - Photovoltaic
 Photovoltaic - Solar collector area
 Rooftop Ground mount % of roof
 Boiler | Furnace 35% 0%
 Air-source heat pump 50% 25%
 Ground-source heat pump 50% 100%

Step 8 - Offsite renewables
 Include
 Electricity rate - annual 0.16 \$/kWh

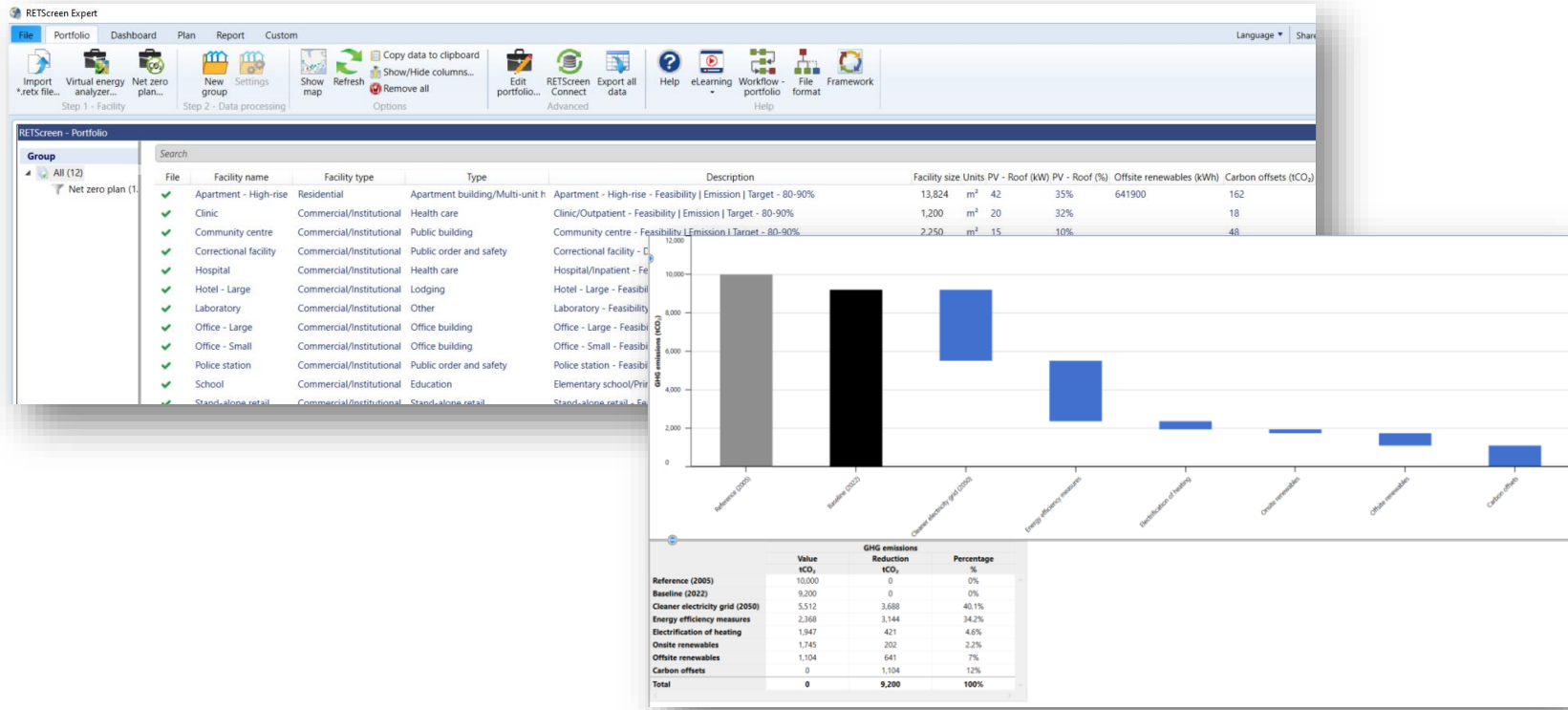
Step 9 - Carbon offsets
 Include
 Net annual GHG emission reduction 100%
 Carbon offsets rate 12 \$/tCO₂

Step 10 - Progress tracking and reporting
 See - Performance analysis module
 Performance

Financial parameters | Emission
 Financial parameters
 Method TBS - LCCA
 Fuel cost escalation rate 2%
 Inflation rate 2%
 Discount rate 3%
 Project life 40
 Debt ratio 0%
 Emission
 Carbon shadow price | GHG reduction credit rate 300
 Carbon shadow price duration | GHG reduction credit duration 40

Display
 Benchmark Analysis
 Feasibility analysis
 Waterfall
 Custom

Demonstration: Viewing the Net Zero Plan





Activity 2: Building a Net Zero Plan

Activity Description

- You are a municipality
- You have a variety of buildings.
- Tasked with creating a preliminary Net Zero Plan.
- Using RETScreen, generate a draft plan.
- Let's walk together, hands-on RETScreen, through the Net Zero Planner.



Phone Credit: <https://nras.org.uk/resource/using-the-computer/>

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. Select your Sector and then “Efficient Electrification”.

For questions and technical support regarding the Efficient Electrification Toolkit, including RETScreen, contact 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.



Efficient electrification toolkit

The Efficient Electrification Toolkit is designed to help organizations make informed decisions about electrifying building heating based on their specific building configuration, energy needs and objectives.

This information, learning resources and technical tools to help organizations across Ontario address the carbon-reduction goals for their buildings in an energy efficient and cost-effective manner.

Steps in the toolkit includes:

1. [Identify building needs and set objectives](#)
2. [Reduce heating demand](#)
3. [Optimize HVAC systems](#)
4. [Electrify heating systems](#)
5. [Balance heating and cooling sources](#)

[Training calendar](#)

Post-Webinar Support

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

[Post-webinar support intake form](#)

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

Thank You

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

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