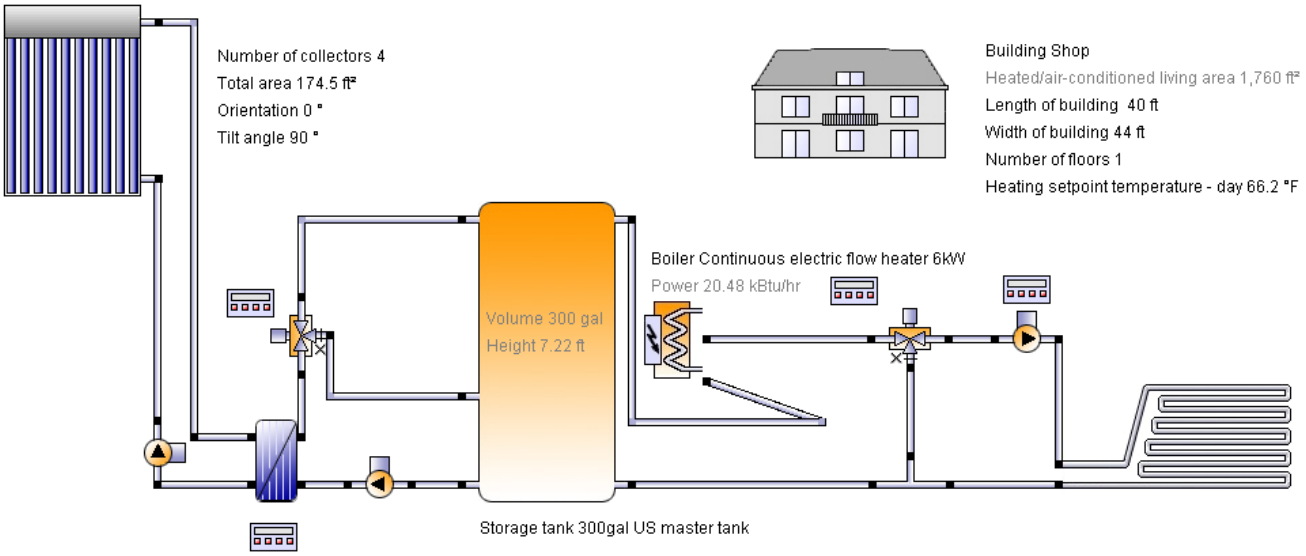
Financial Report

Project **13a: Space heating (solar thermal, modular heat generator)**



Location of the system

Canada

Toronto

Longitude: -79.42°

Latitude: 43.7°

Elevation: 538 ft

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Comments on the project

Designed using 4 WSE58 Super Tubes . Mounted Vertical . Special Price $800

Photograph of property

System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	2,101.7 kBtu
Total energy consumption [Quse]	1,889 kBtu
System performance (Quse / Etot)	0.9
Comfort demand	Energy demand covered

Overview solar thermal energy (annual values)

Collector area	175 ft²
Solar fraction total	92.9%
Total annual field yield	10,015 kBtu
Collector field yield relating to gross area	57 kBtu/ft²/Year
Collector field yield relating to aperture area	61 kBtu/ft²/Year
Max. energy savings	8,486.1 kBtu
Max. reduction in CO2 emissions	2,941.1 pound

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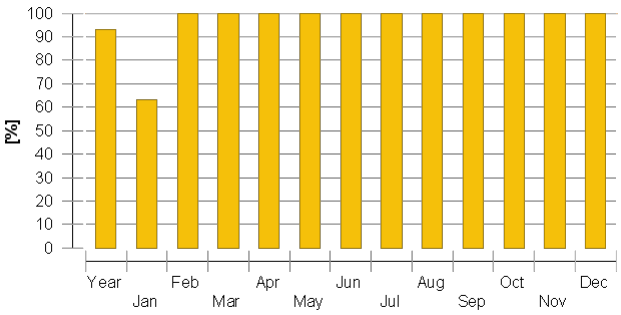
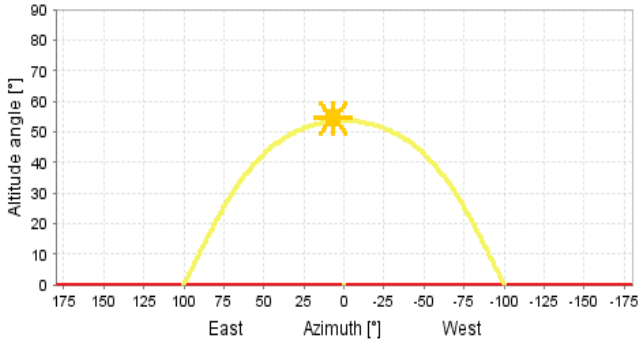
Solar fraction: fraction of solar energy to system [SFn]



Horizon line



Meteorological data-Overview

Outdoor temperature 24h	48 °F
Annual global irradiance	428.9 kBtu/ft²
Annual diffuse irradiance	195.7 kBtu/ft²

Financial analysis - Solar thermal

Purchase costs	4,200 CAD
Life span	50 years
Proportional incentives	0 %
Incentives per area	0 CAD
Fixed incentives	0 CAD
Inflation	2 %
Interest	4 %
Increase of energy prices	5 %
Electricity	0.2 CAD/kWh
Effective purchase cost after grants	4,200 CAD
Annual fuel cost savings	497.408 CAD
Solar energy cost per kWh	0.06 CAD
Payback period	8 years
Present value of the system	54,232.75 CAD
Net present value	50,032.75 CAD

Component overview (annual values)

Boiler	Continuous electric flow heater 6kW	
Power	kBtu/hr	20.48
Total efficiency	%	83.1
Energy from/to the system [Qaux]	kBtu	766.9
Fuel and electrical energy consumption [Eaux]	kBtu	923.3
Energy savings solar thermal	kBtu	8,486.1
CO_2 savings solar thermal	pound	2,941.1
Fuel savings solar thermal	kBtu	8,488.3

Collector North America	WSE58ST	
Data Source		u138368
Number of collectors		4
Number of arrays		8
Total area	ft²	174.5
Total aperture area	ft²	163.396
Tilt angle	°	90
Orientation	°	0
Collector field yield [Qsol]	kBtu	10,015.1
Irradiance onto collector area [Esol]	kBtu	59,548.2
Collector efficiency [Qsol / Esol]	%	16.8
Direct irradiance after IAM	kBtu	26,055.2
Diffuse irradiance after IAM	kBtu	25,659.1

Building	Shop	
Heated/air-conditioned living area	ft²	1,760
Heating setpoint temperature	°F	66.2
Heating energy demand excluding DHW [Qdem]	kBtu	1,889
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft²	1.1
Solar gain through windows	kBtu	42,534.2
Total energy losses	kBtu	260,952.7

Convector Floor heating	Floor heating 1000W	
Number of heating/cooling modules	-	35
Power per heating module under standard conditions	kBtu/hr	3
Nominal inlet temperature	°F	104
Nominal return temperature	°F	95
Net energy from/to heating/cooling modules	kBtu	1,421

External heat exchanger Solar loop heat exchanger	Plate heat exchanger, huge	
Transfer capacity	W/K	30,000

Pump Solar loop pump 1	Pump, medium	
Circuit pressure drop	psi	0.054
Flow rate	gpm	1
Fuel and electrical energy consumption [Epar]	kBtu	560.6

Pump Space heating loop pump	Pump, large	
Circuit pressure drop	psi	10.703
Flow rate	gpm	13.5
Fuel and electrical energy consumption [Epar]	kBtu	57.3

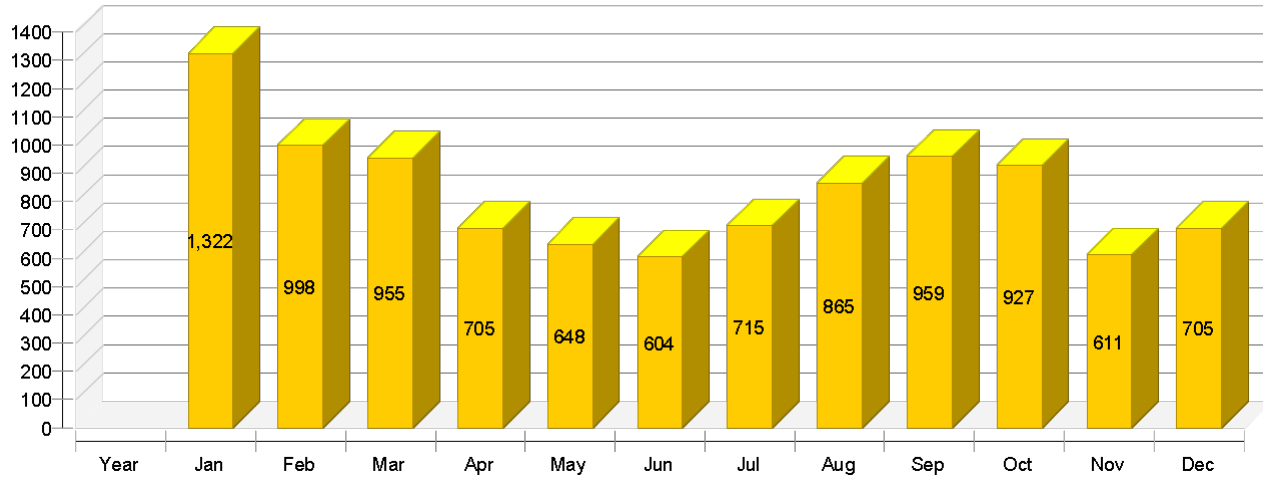
Pump Solar loop pump 2	Pump, medium	
Circuit pressure drop	psi	0.033
Flow rate	gpm	1
Fuel and electrical energy consumption [Epar]	kBtu	560.6

Storage tank Solar buffer tank	300gal US master tank	
Volume	gal	300
Height	ft	7.22
Material		Enameled steel
Insulation		Flexible polyurethane foam
Thickness of insulation	in	4
Heat loss	kBtu	3,376.1
Connection losses	kBtu	1,696.2

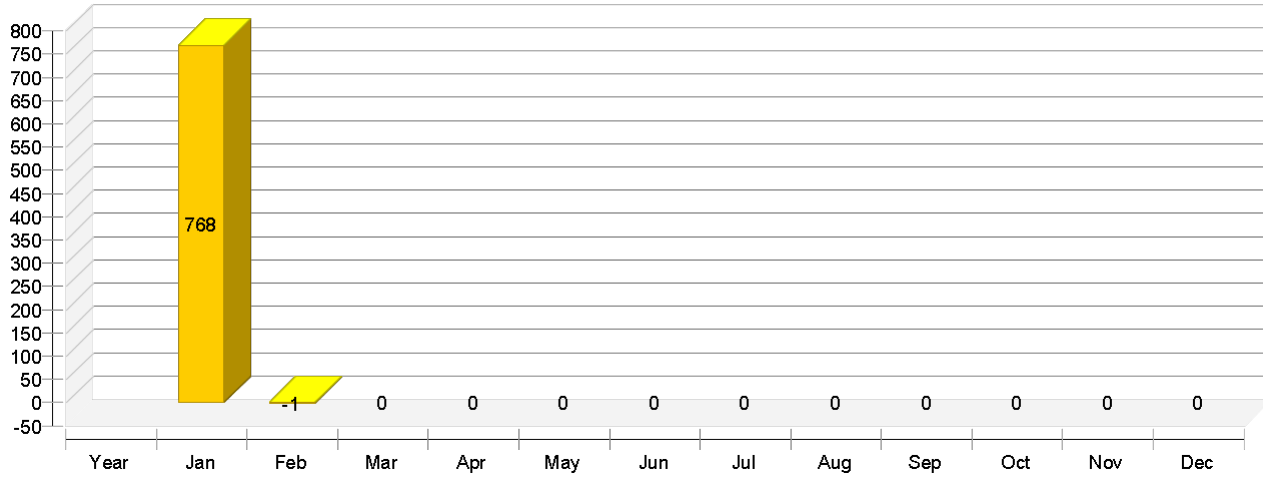
Loop

Solar loop		
Fluid mixture		Ethylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	8
Pressure on top of the circuit	psi	58.016

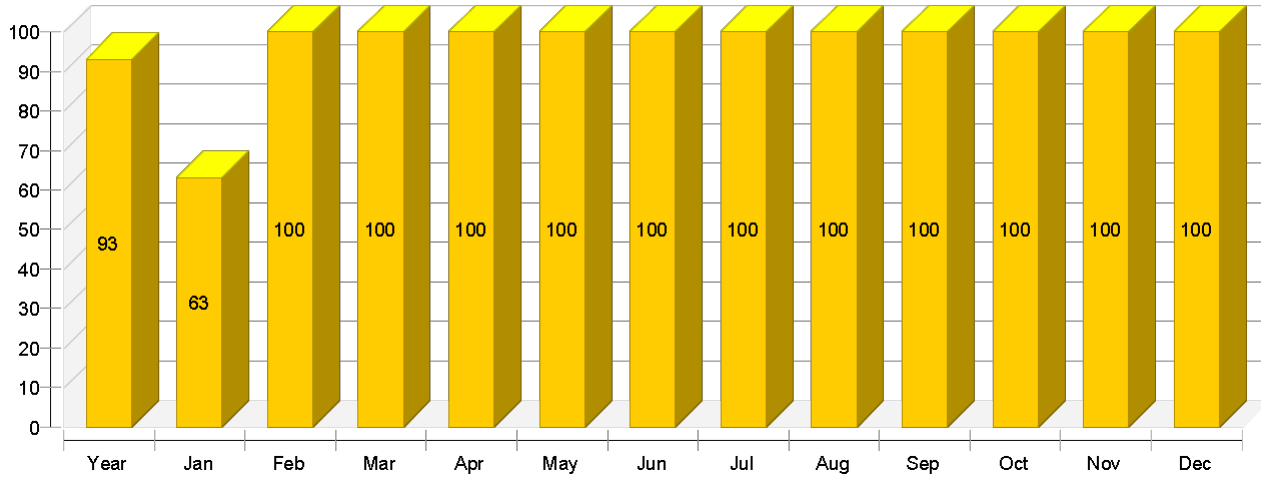
Solar thermal energy to the system [Qsol] kBtu



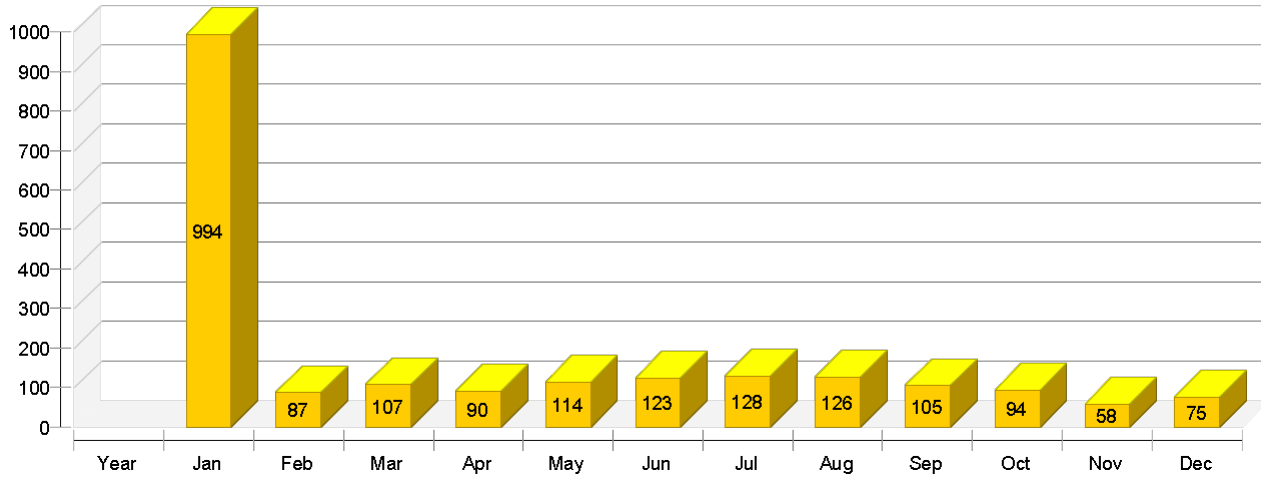
Heat generator energy to the system (solar thermal energy not included) [Qaux] kBtu



Solar fraction: fraction of solar energy to system [SFn] %



Total fuel and/or electrical energy consumption of the system [Etot] kBtu



	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solar thermal energy to the system [Qsol]													
kBtu	10015	1322	998	955	705	648	604	715	865	959	927	611	705
Heat generator energy to the system (solar thermal energy not included) [Qaux]													
kBtu	767	768	-1	0	0	0	0	0	0	0	0	0	0
Heat generator fuel and electrical energy consumption [Eaux]													
kBtu	923	819	8	10	9	10	9	10	10	9	10	9	10
Solar fraction: fraction of solar energy to system [SFn]													
%	92.9	63.3	100	100	100	100	100	100	100	100	100	100	100
Total fuel and/or electrical energy consumption of the system [Etot]													
kBtu	2102	994	87	107	90	114	123	128	126	105	94	58	75

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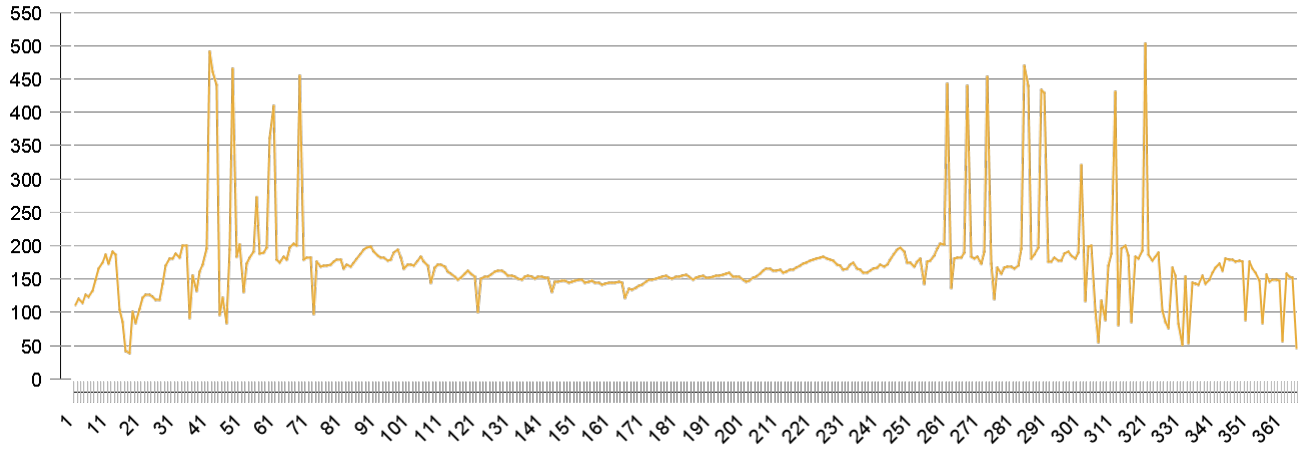
	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irradiance onto collector area [Esol]													
kBtu	59548	5238	6007	6308	5095	4578	4157	4692	5175	5683	5644	3501	3470
Electrical energy consumption of pumps [Epar]													
kBtu	1178	175	79	98	81	104	114	118	116	96	84	48	65
Heat loss to indoor room (including heat generator losses) [Qint]													
kBtu	8142	594	720	796	680	593	554	645	745	791	779	646	598
Heat loss to surroundings (without collector losses) [Qext]													
kBtu	2475	226	240	281	218	181	156	179	213	225	230	146	180
Total energy consumption [Quse]													
kBtu	1889	1362	116	22	25	44	50	56	53	60	52	22	27

Collector North America

Daily maximum temperature [°F]



Energy flow diagram