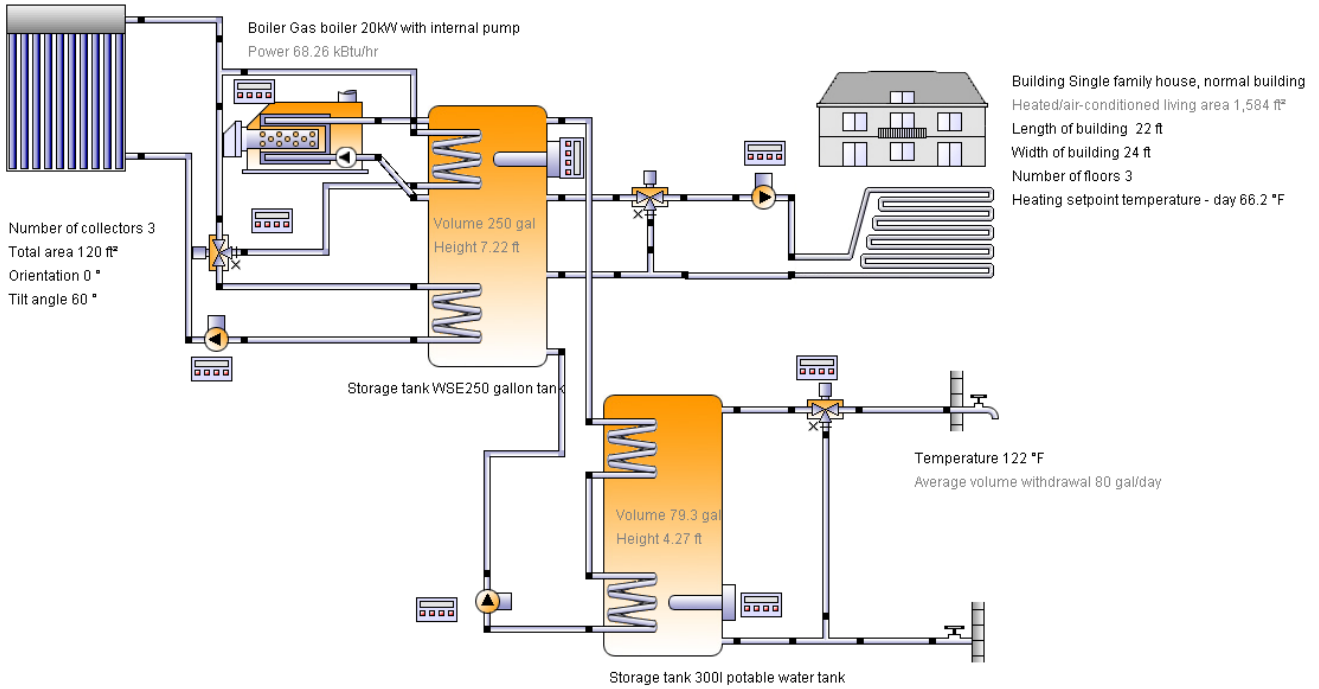


Project

9e: Space heating (solar thermal, 2 tanks)



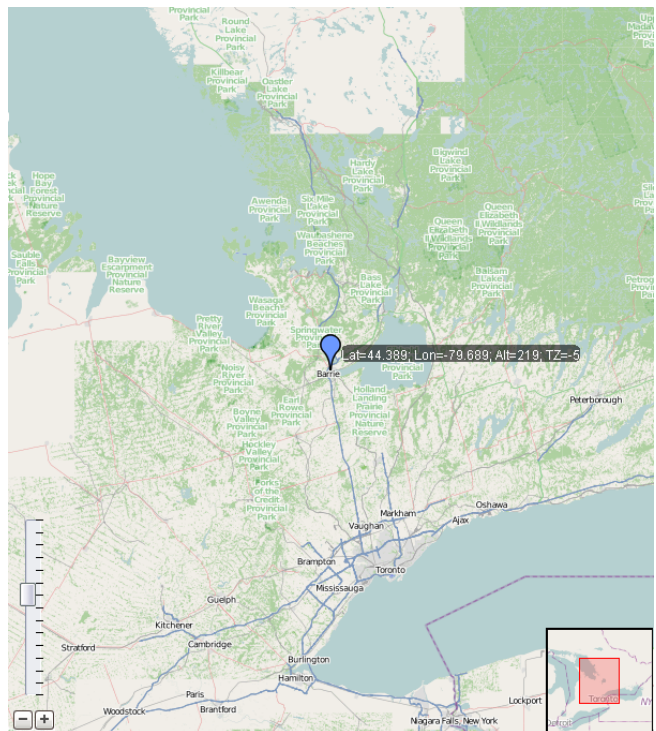
Location of the system

Barrie
Longitude: -79.689°
Latitude: 44.389°
Elevation: 719 ft

This report has been created by:

Elliott William
303 47 Str.E
S7K 5H2 Saskatoon

Map section



Comments on the project

Using 3 WSE58ST price 2,700 and allowing \$1,000 for other equipment . Please note this is a budgetary analysis.

Photograph of property



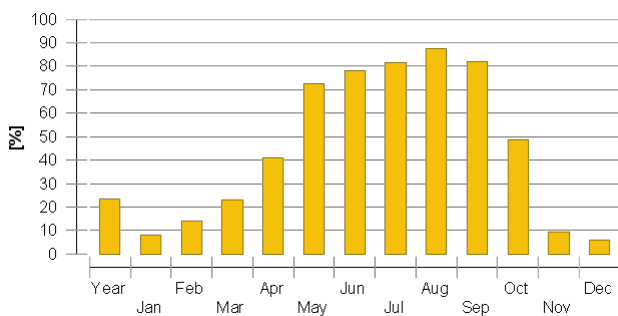
System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	79,153.4 kBtu
Total energy consumption [Quse]	76,010.5 kBtu
System performance (Quse / Etot)	0.96
Comfort demand	Energy demand covered

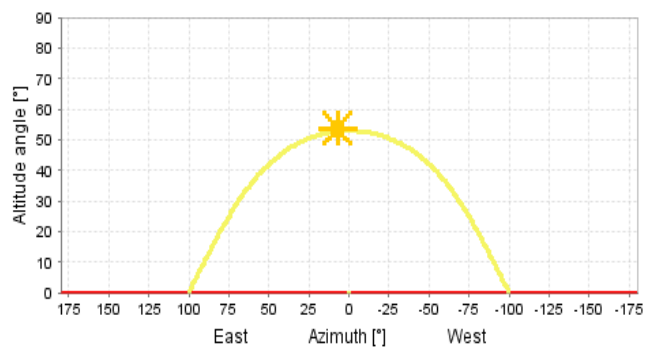
Overview solar thermal energy (annual values)

Collector area	120 ft ²
Solar fraction total	23.4%
Solar fraction hot water [SFnHw]	49.6 %
Solar fraction building [SFnBd]	10.9 %
Total annual field yield	20,483 kBtu
Collector field yield relating to gross area	171 kBtu/ft ² /Year
Collector field yield relating to aperture area	180 kBtu/ft ² /Year
Max. fuel savings	21,427 ft ³ : [Natural gas H]
Max. energy savings	22,704.8 kBtu
Max. reduction in CO2 emissions	3,587.8 pound

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



Horizon line



Meteorological data-Overview

Outdoor temperature 24h	43.7 °F
Annual global irradiance	436 kBtu/ft ²
Annual diffuse irradiance	196.6 kBtu/ft ²

Financial analysis - Solar thermal

Purchase costs	3,700 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
Natural gas H	0.031 CAD/ft ³ ; 0.031 CAD/kBtu
Effective purchase cost after grants	3,700 CAD
Annual fuel cost savings	725.6 CAD
Solar energy cost per kWh	0.02 CAD
Payback period	5 years
Present value of the system	79,391.617 CAD
Net present value	75,691.617 CAD

Component overview (annual values)

Boiler 2	Gas boiler 20kW with internal pump	
Power	kBtu/hr	68.26
Total efficiency	%	85.6
Energy from/to the system [Qaux]	kBtu	66,993.7
Fuel and electrical energy consumption [Eaux]	kBtu	78,246.7
Energy savings solar thermal	kBtu	21,738
CO savings solar thermal	pound	3,252.7
Fuel savings solar thermal	ft ³	21,427

Collector North America	WSE58ST	
Data Source		u138368
Number of collectors		3
Number of arrays		3
Total area	ft ²	120
Total aperture area	ft ²	114
Tilt angle	°	60
Orientation	°	0
Collector field yield [Qsol]	kBtu	20,482.6
Irradiance onto collector area [Esol]	kBtu	58,928.4
Collector efficiency [Qsol / Esol]	%	34.8
Direct irradiance after IAM	kBtu	37,732.6
Diffuse irradiance after IAM	kBtu	27,048.5

Building	Single family house, normal building	
Heated/air-conditioned living area	ft ²	1,584
Heating setpoint temperature	°F	66.2
Heating energy demand excluding DHW [Qdem]	kBtu	59,890.8
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft ²	37.8
Solar gain through windows	kBtu	88,465.2
Total energy losses	kBtu	178,489.2

Convactor Floor heating	Floor heating 1000W	
Number of heating/cooling modules	-	13
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	59,699.6

Hot water demand	Constant	
Withdraw volume	gal/d	80.3
Temperature setting	°F	122
Energy from/to the system [Quse]	kBtu	16,119.7

Pump Space heating loop pump	Pump, medium	
Circuit pressure drop	psi	0.734
Flow rate	gpm	5
Fuel and electrical energy consumption [Epar]	kBtu	308.1

Pump Solar loop pump	Pump, small	
Circuit pressure drop	psi	0.06
Flow rate	gpm	0.7
Fuel and electrical energy consumption [Epar]	kBtu	354.2

Pump Potable water tank loading pump	Pump, small	
Circuit pressure drop	psi	0.128
Flow rate	gpm	2.6
Fuel and electrical energy consumption [Epar]	kBtu	69.5

Storage tank Buffer tank	WSE250 gallon tank	
Volume	gal	250
Height	ft	7.22
Material		Enameled steel
Insulation		Flexible polyurethane foam
Thickness of insulation	in	4
Heat loss	kBtu	2,148
Connection losses	kBtu	3,015.2

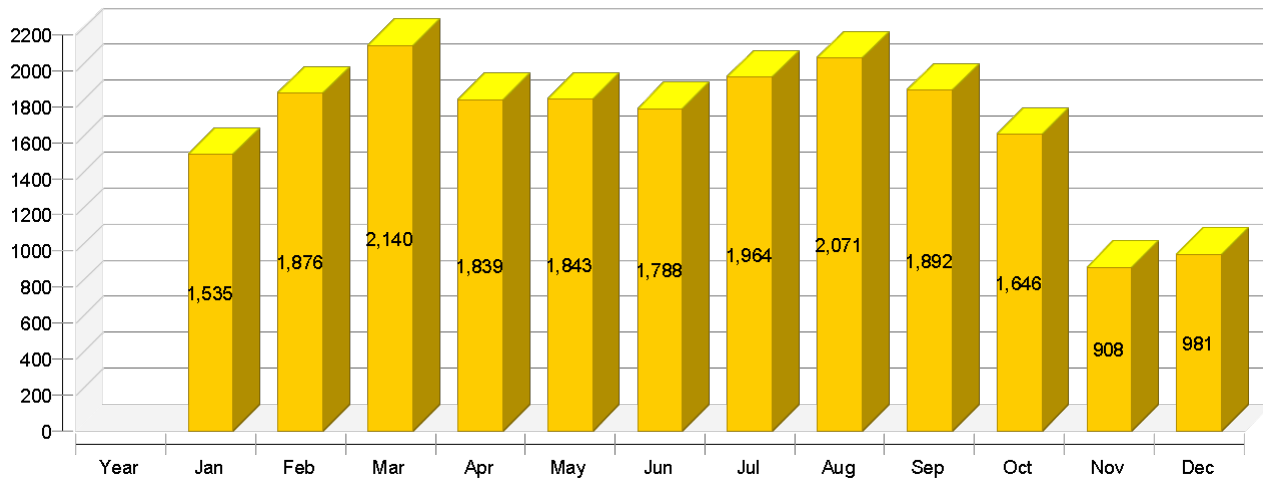
Storage tank Potable water tank	300l potable water tank	
Volume	gal	79.3
Height	ft	4.27
Material		Stainless steel
Insulation		Rigid PU foam
Thickness of insulation	in	3.1
Heat loss	kBtu	1,254.8
Connection losses	kBtu	1,259.3

Loop

Solar loop		
Fluid mixture		Ethylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	23.3
Pressure on top of the circuit	psi	58.016

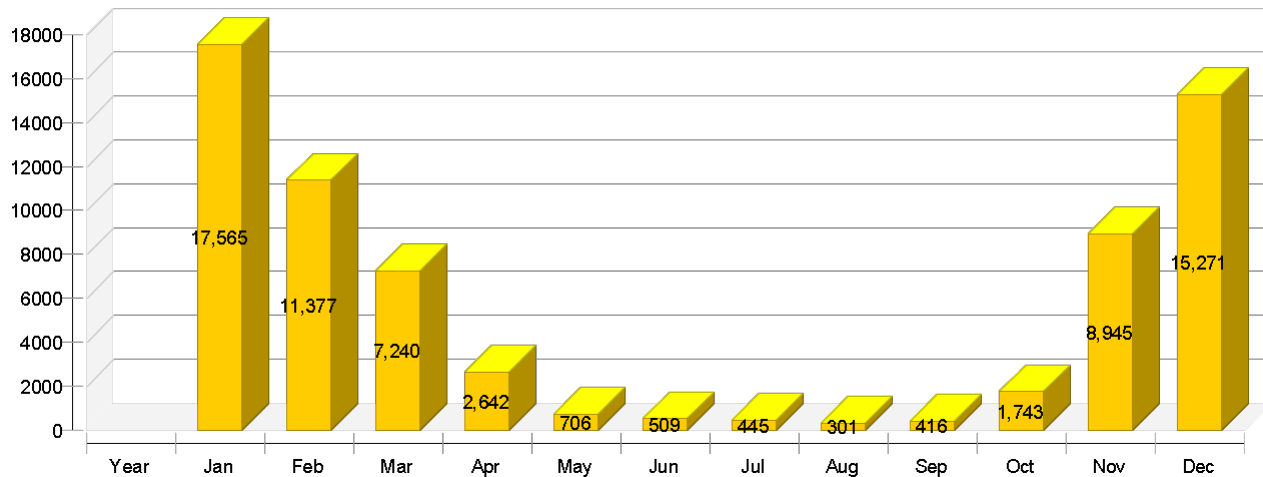
Solar thermal energy to the system [Qsol]

kBtu



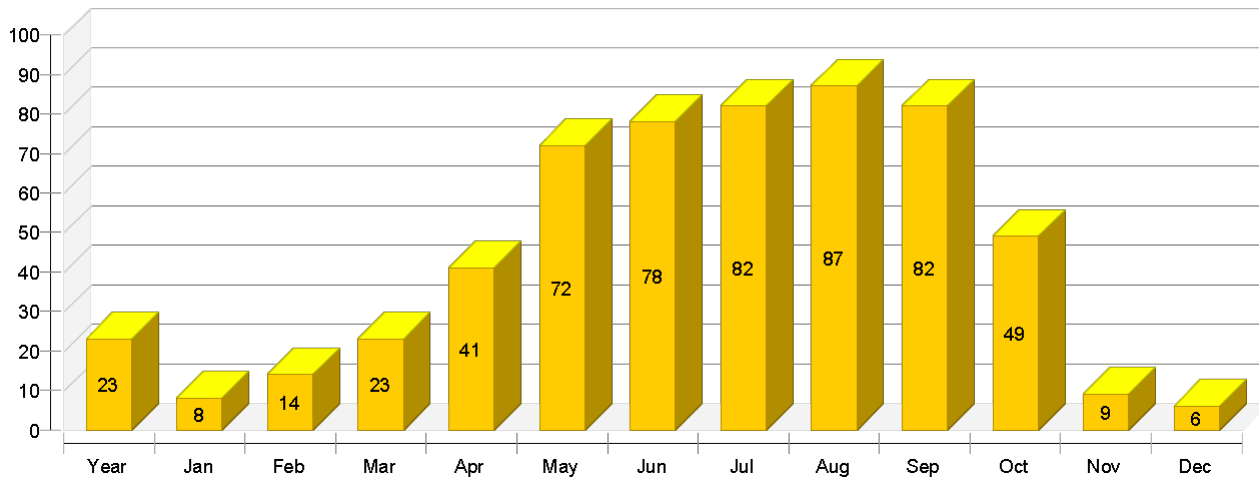
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu



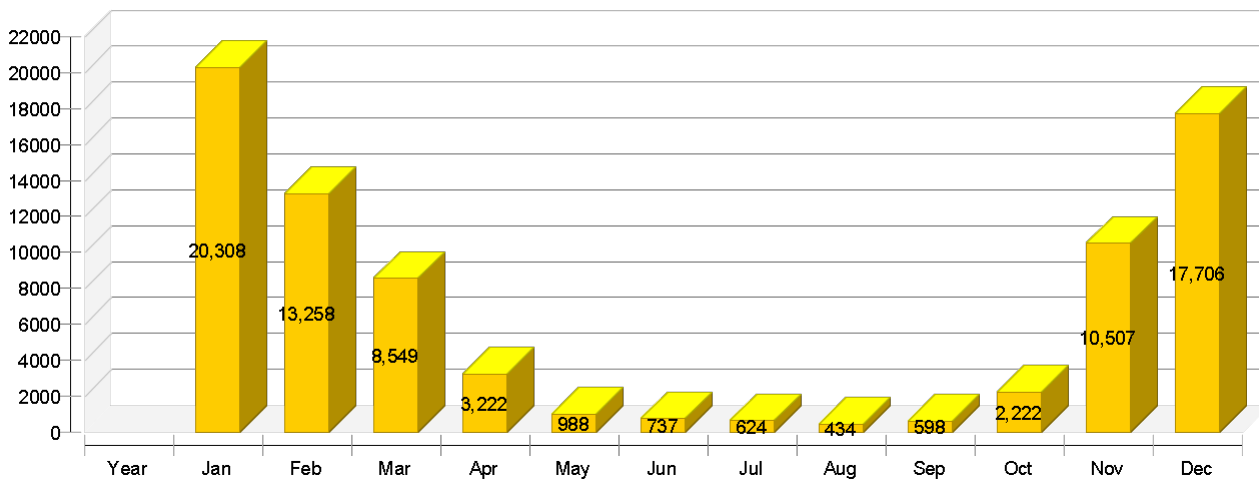
Solar fraction: fraction of solar energy to system [SFn]

%



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
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Solar thermal energy to the system [Qsol]

kBtu	20483	1535	1876	2140	1839	1843	1788	1964	2071	1892	1646	908	981
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Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu	67160	17565	11377	7240	2642	706	509	445	301	416	1743	8945	15271
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Heat generator fuel and electrical energy consumption [Eaux]

kBtu	78422	20183	13165	8477	3174	947	695	582	392	560	2183	10450	17613
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Solar fraction: fraction of solar energy to system [SFn]

%	23.4	8	14.2	22.8	41	72.3	77.8	81.5	87.3	82	48.6	9.2	6
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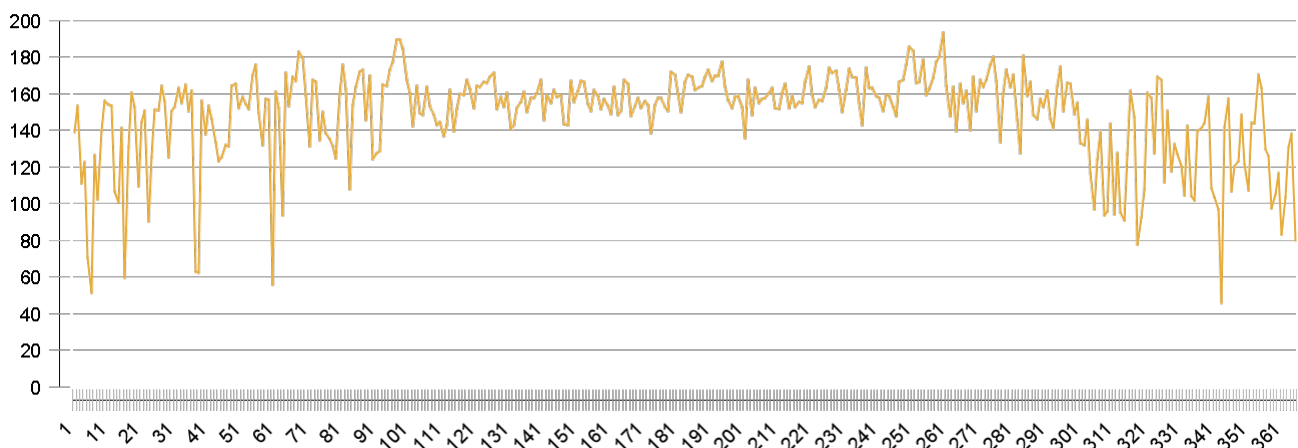
Total fuel and/or electrical energy consumption of the system [Etot]

kBtu	79153	20308	13258	8549	3222	988	737	624	434	598	2222	10507	17706
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Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Irradiance onto collector area [Esol]													
kBtu	58928	4399	5152	6054	5532	5541	5312	5646	5725	5262	4641	2670	2994
Electrical energy consumption of pumps [Epar]													
kBtu	732	125	94	72	48	41	42	41	42	38	38	57	94
Heat loss to indoor room (including heat generator losses) [Qint]													
kBtu	22604	3607	2701	2244	1487	1175	1094	1106	1059	1117	1386	2357	3270
Heat loss to surroundings (without collector losses) [Qext]													
kBtu	1221	98	110	122	125	115	105	103	106	108	102	58	70
Total energy consumption [Quse]													
kBtu	76010	18151	12349	8337	3431	1537	1366	1392	1370	1308	2433	9015	15320

Collector North America

Daily maximum temperature [°F]



Energy flow diagram

