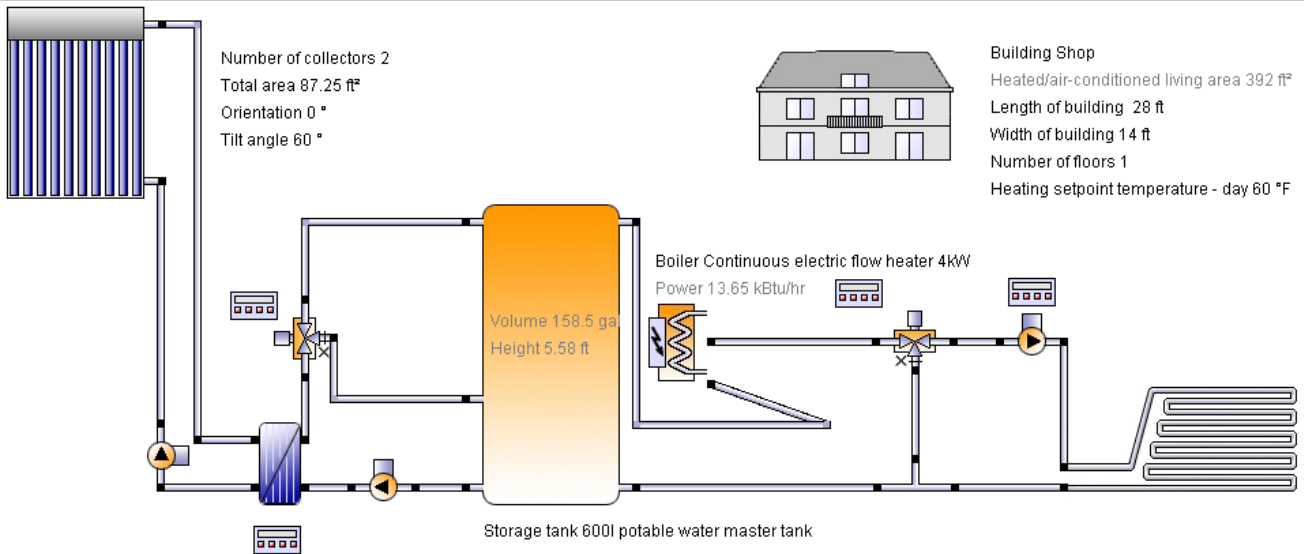


Project

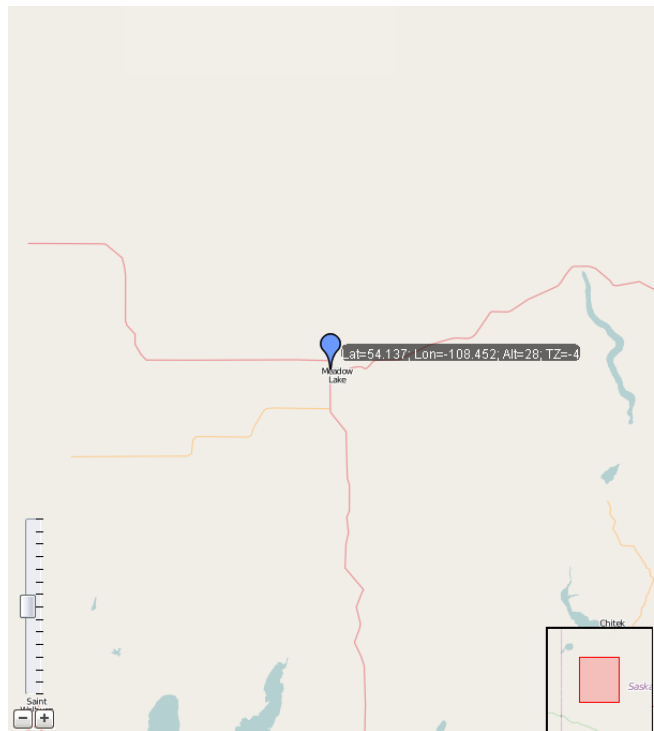
13a: Space heating (solar thermal, modular heat generator)



Location of the system

Meadow lake
Longitude: -108.452°
Latitude: 54.137°
Elevation: 92 ft

Map section



This report has been created by:

Elliott William
303 47 Str.E
S7K 5H2 Saskatoon

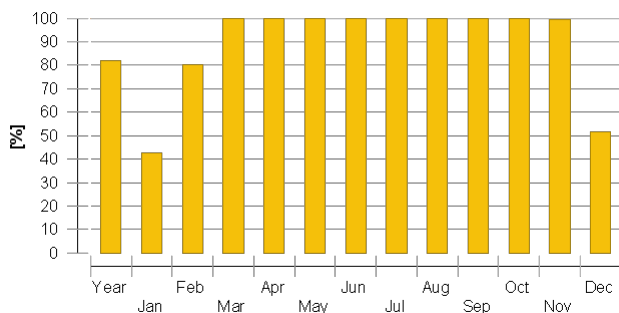
System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	4,601.8 kBtu
Total energy consumption [Quse]	5,348.9 kBtu
System performance (Quse / Etot)	1.16
Comfort demand	Energy demand covered

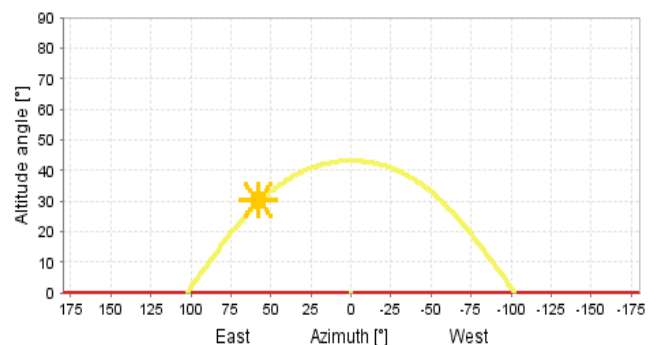
Overview solar thermal energy (annual values)

Collector area	87 ft ²
Solar fraction total	81.7%
Total annual field yield	11,472 kBtu
Collector field yield relating to gross area	131 kBtu/ft ² /Year
Collector field yield relating to aperture area	140 kBtu/ft ² /Year
Max. energy savings	12,075.5 kBtu
Max. reduction in CO2 emissions	4,185.1 pound

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



Horizon line



Meteorological data-Overview

Outdoor temperature 24h	37.3 °F
Annual global irradiance	392.7 kBtu/ft ²
Annual diffuse irradiance	156.8 kBtu/ft ²

Financial analysis - Solar thermal

Purchase costs	2,500 CAD
Life span	50 years
Proportional incentives	0 %

Financial analysis - Solar thermal

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	2,500 CAD
Annual fuel cost savings	707.8 CAD
Solar energy cost per kWh	0.03 CAD
Payback period	4 years
Present value of the system	77,571.406 CAD
Net present value	75,071.406 CAD

Component overview (annual values)

Boiler	Continuous electric flow heater 4kW	
Power	kBtu/hr	13.65
Total efficiency	%	91.1
Energy from/to the system [Qaux]	kBtu	2,569.2
Fuel and electrical energy consumption [Eaux]	kBtu	2,821
Energy savings solar thermal	kBtu	12,075.5
CO savings solar thermal	pound	4,185.1
Fuel savings solar thermal	kBtu	12,078.6

Collector North America		WSE58ST
Data Source		u138368
Number of collectors		2
Number of arrays		8
Total area	ft ²	87.25
Total aperture area	ft ²	81.698
Tilt angle	°	60
Orientation	°	0
Collector field yield [Qsol]	kBtu	11,471.7
Irradiance onto collector area [Esol]	kBtu	47,109.9
Collector efficiency [Qsol / Esol]	%	24.4
Direct irradiance after IAM	kBtu	34,211.2
Diffuse irradiance after IAM	kBtu	17,745.2

Building	Shop	
Heated/air-conditioned living area	ft ²	392
Heating setpoint temperature	°F	61.5
Heating energy demand excluding DHW [Qdem]	kBtu	4,692.1
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft ²	12
Solar gain through windows	kBtu	28,434.5
Total energy losses	kBtu	81,335.6

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	4,573.4

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	0.026
Flow rate	gpm	0.5
Fuel and electrical energy consumption [Epar]	kBtu	761.7

Pump Space heating loop pump	Pump, large	
Circuit pressure drop	psi	31.593
Flow rate	gpm	22.6
Fuel and electrical energy consumption [Epar]	kBtu	257.3

Pump Solar loop pump 2	Pump, medium	
Circuit pressure drop	psi	0.01
Flow rate	gpm	0.5
Fuel and electrical energy consumption [Epar]	kBtu	761.7

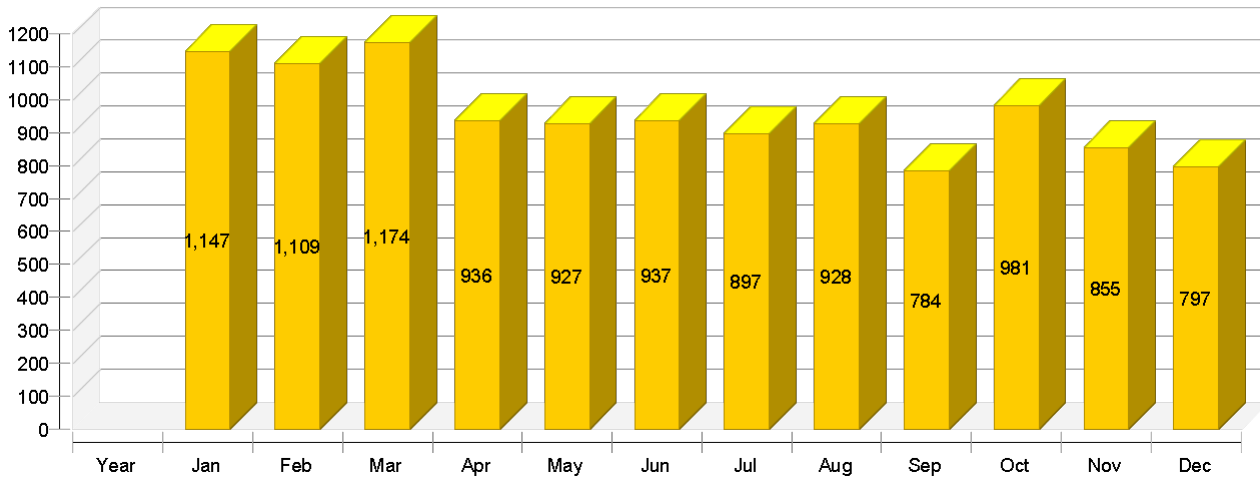
Storage tank Solar buffer tank	600l potable water master tank	
Volume	gal	158.5
Height	ft	5.58
Material		Stainless steel
Insulation		Rigid PU foam
Thickness of insulation	in	3.1
Heat loss	kBtu	2,622.5
Connection losses	kBtu	1,581.6

Loop

Solar loop		
Fluid mixture		Ethylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	7.6
Pressure on top of the circuit	psi	58.016

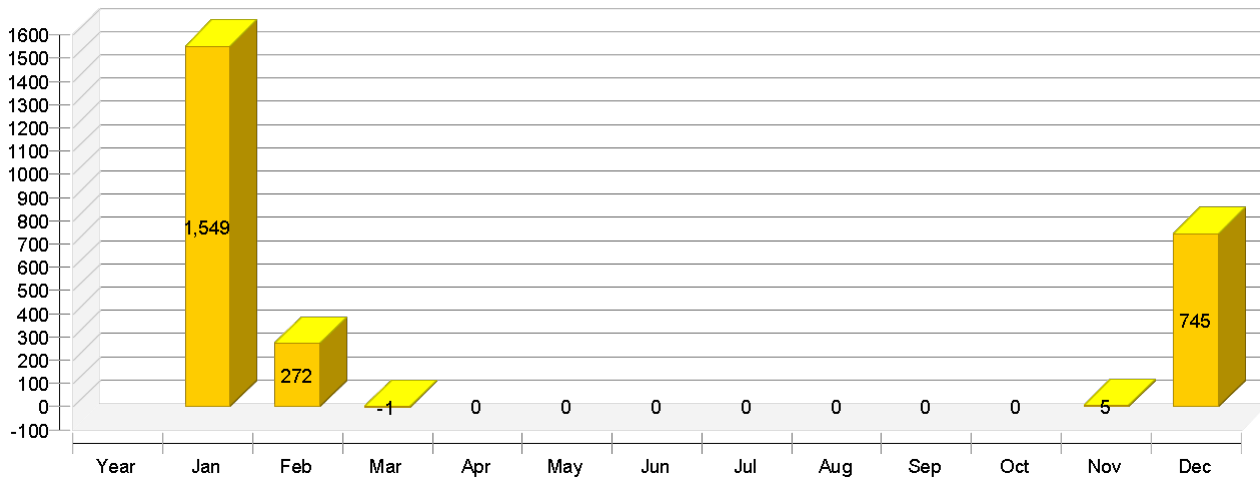
Solar thermal energy to the system [Qsol]

kBtu



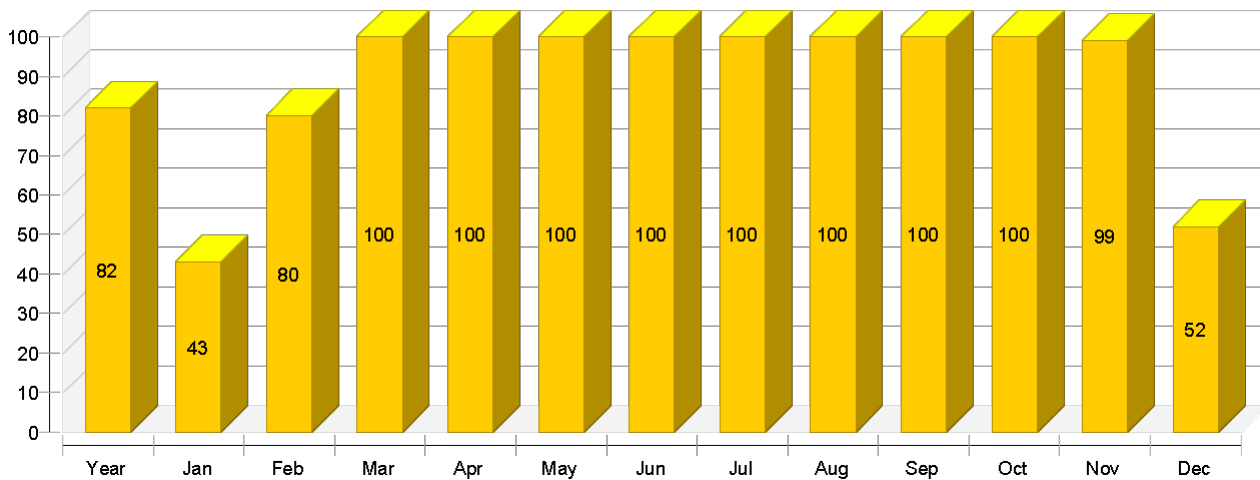
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu



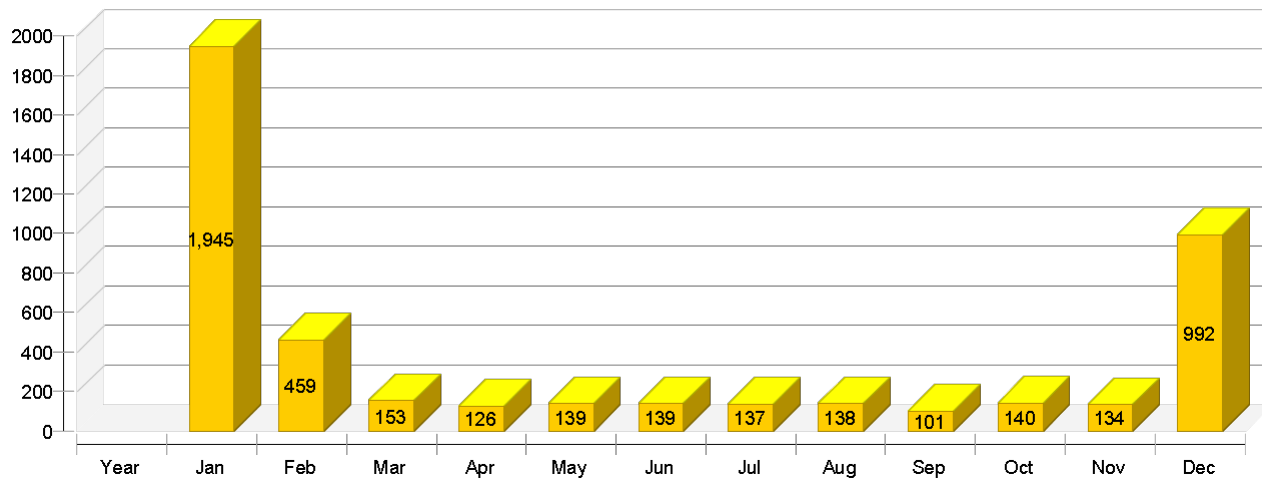
Solar fraction: fraction of solar energy to system [SFn]

%



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	11472	1147	1109	1174	936	927	937	897	928	784	981	855	797
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Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu	2569	1549	272	-1	0	0	0	0	0	0	0	5	745
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Heat generator fuel and electrical energy consumption [Eaux]

kBtu	2821	1639	296	9	10	10	10	10	10	10	10	15	794
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Solar fraction: fraction of solar energy to system [SFn]

%	81.7	42.6	80.3	100	100	100	100	100	100	100	100	99.4	51.7
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Total fuel and/or electrical energy consumption of the system [Etot]

kBtu	4602	1945	459	153	126	139	139	137	138	101	140	134	992
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Irradiance onto collector area [Esol]

kBtu	47110	3246	3915	4951	4555	4463	4078	4434	4475	4062	3880	2789	2261
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Electrical energy consumption of pumps [Epar]

kBtu	1781	306	163	144	117	129	129	127	128	92	130	119	198
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Heat loss to indoor room (including heat generator losses) [Qint]

kBtu	8181	514	576	805	758	793	764	785	787	707	752	612	330
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Heat loss to surroundings (without collector losses) [Qext]

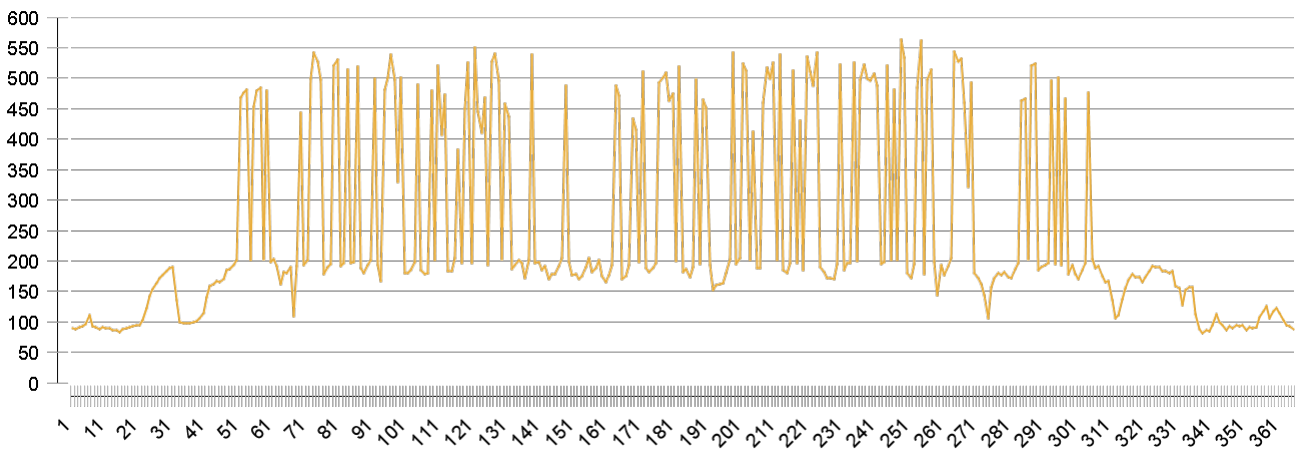
kBtu	3317	246	289	386	308	300	273	263	272	241	311	268	159
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Total energy consumption [Quse]

kBtu	5349	2229	761	211	71	64	58	67	79	81	61	220	1447
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Collector North America

Daily maximum temperature [°F]



Energy flow diagram

