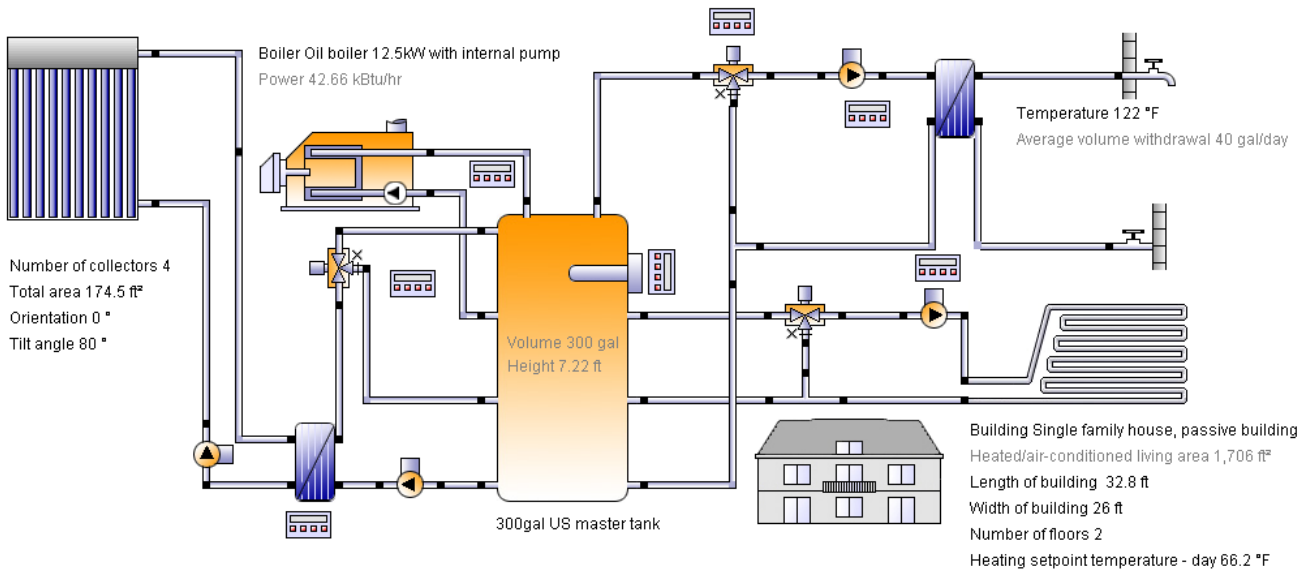


Project

9c: Space heating (solar thermal, fresh-water station)



Location of the system

Map section

"Current report item is not supported in this report format."

La Ronge

Longitude: -105.356°

Latitude: 55.102°

Elevation: 1,516 ft

This report has been created by:

Elliott William

303 47 Str.E

S7K 5H2 Saskatoon

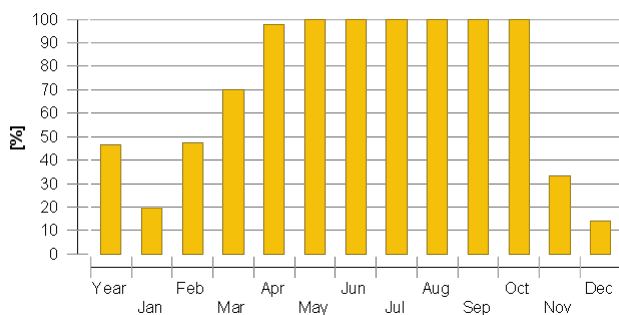
System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	33,450.3 kBtu
Total energy consumption [Quse]	38,837.4 kBtu
System performance (Quse / Etot)	1.16
Comfort demand	Energy demand covered

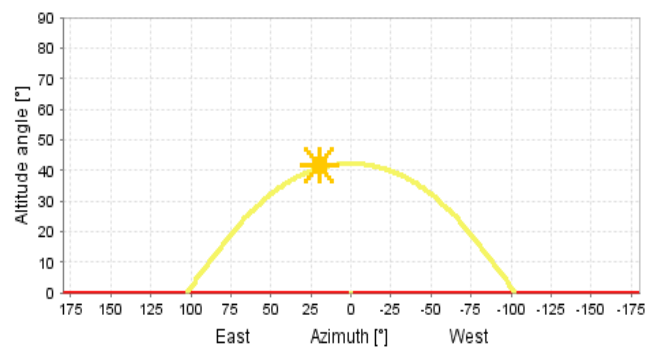
Overview solar thermal energy (annual values)

Collector area	175 ft ²
Solar fraction total	46.2%
Solar fraction hot water [SFnHw]	76.8 %
Solar fraction building [SFnBd]	27.9 %
Total annual field yield	21,991 kBtu
Collector field yield relating to gross area	126 kBtu/ft ² /Year
Collector field yield relating to aperture area	135 kBtu/ft ² /Year
Max. fuel savings	200.3 gal: [Heating oil]
Max. energy savings	25,872.3 kBtu
Max. reduction in CO2 emissions	5,026.2 pound

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



Horizon line



Meteorological data-Overview

Outdoor temperature 24h	33.5 °F
Annual global irradiance	375.7 kBtu/ft ²
Annual diffuse irradiance	149.6 kBtu/ft ²

Financial analysis - Solar thermal

Purchase costs	4,400 CAD
Life span	50 years
Proportional incentives	0 %
Incentives per area	0 CAD
Fixed incentives	0 CAD
Inflation	2 %
Interest	4 %

Financial analysis - Solar thermal

Increase of energy prices	5 %
Electricity	0.2 CAD/kWh
Heating oil	3.785 CAD/gal; 0.029 CAD/kBtu
Effective purchase cost after grants	4,400 CAD
Annual fuel cost savings	758.246 CAD
Solar energy cost per kWh	0.02 CAD
Payback period	6 years
Present value of the system	82,902.203 CAD
Net present value	78,502.203 CAD

Component overview (annual values)

Boiler	Oil boiler 12.5kW with internal pump	
Power	kBtu/hr	42.66
Total efficiency	%	78.9
Energy from/to the system [Qaux]	kBtu	25,559.7
Fuel and electrical energy consumption [Eaux]	kBtu	32,386.6
Energy savings solar thermal	kBtu	25,872.3
CO savings solar thermal	pound	5,026.2
Fuel savings solar thermal	gal	200.3

Collector North America	WSE58ST	
Data Source		u138368
Number of collectors		4
Number of arrays		2
Total area	ft ²	174.5
Total aperture area	ft ²	163.396
Tilt angle	°	80
Orientation	°	0
Collector field yield [Qsol]	kBtu	21,991.5
Irradiance onto collector area [Esol]	kBtu	83,949.4
Collector efficiency [Qsol / Esol]	%	26.2
Direct irradiance after IAM	kBtu	57,561.3
Diffuse irradiance after IAM	kBtu	33,894.6

Building	Single family house, passive building	
Heated/air-conditioned living area	ft ²	1,706
Heating setpoint temperature	°F	66.2
Heating energy demand excluding DHW [Qdem]	kBtu	30,740.8
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft ²	18
Solar gain through windows	kBtu	53,402.6
Total energy losses	kBtu	107,920.1

Convactor Floor heating	Floor heating 1000W	
Number of heating/cooling modules	-	10
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	30,696.2

Hot water demand	Constant	
Withdraw volume	gal/d	40.2
Temperature setting	°F	122
Energy from/to the system [Quse]	kBtu	8,096.6

External heat exchanger Fresh water station heat exchanger	Plate heat exchanger, medium size	
Transfer capacity	W/K	10,000

External heat exchanger Solar loop heat exchanger	Plate heat exchanger, small	
Transfer capacity	W/K	5,000

Pump Space heating loop pump	Pump, medium	
Circuit pressure drop	psi	0.423
Flow rate	gpm	3.8
Fuel and electrical energy consumption [Epar]	kBtu	389.1

Pump Fresh water station pump	Pump, small	
Circuit pressure drop	psi	0.017
Flow rate	gpm	1.2
Fuel and electrical energy consumption [Epar]	kBtu	129.6

Pump Solar loop pump 2	Pump, small	
Circuit pressure drop	psi	0.041
Flow rate	gpm	1
Fuel and electrical energy consumption [Epar]	kBtu	272.5

Pump Solar loop pump 1	Pump, small	
Circuit pressure drop	psi	0.244
Flow rate	gpm	1
Fuel and electrical energy consumption [Epar]	kBtu	272.5

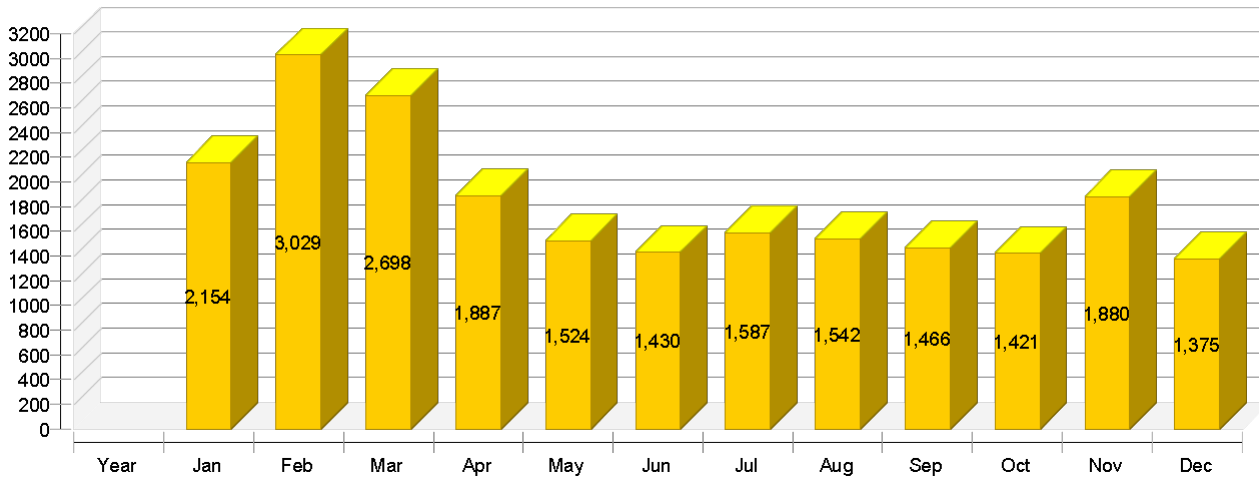
Storage tank Buffer tank	300gal US master tank	
Volume	gal	300
Height	ft	7.22
Material		Enameled steel
Insulation		Flexible polyurethane foam
Thickness of insulation	in	4
Heat loss	kBtu	3,062.4
Connection losses	kBtu	2,198.8

Loop

Solar loop		
Fluid mixture		Ethylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	5.5
Pressure on top of the circuit	psi	58.016

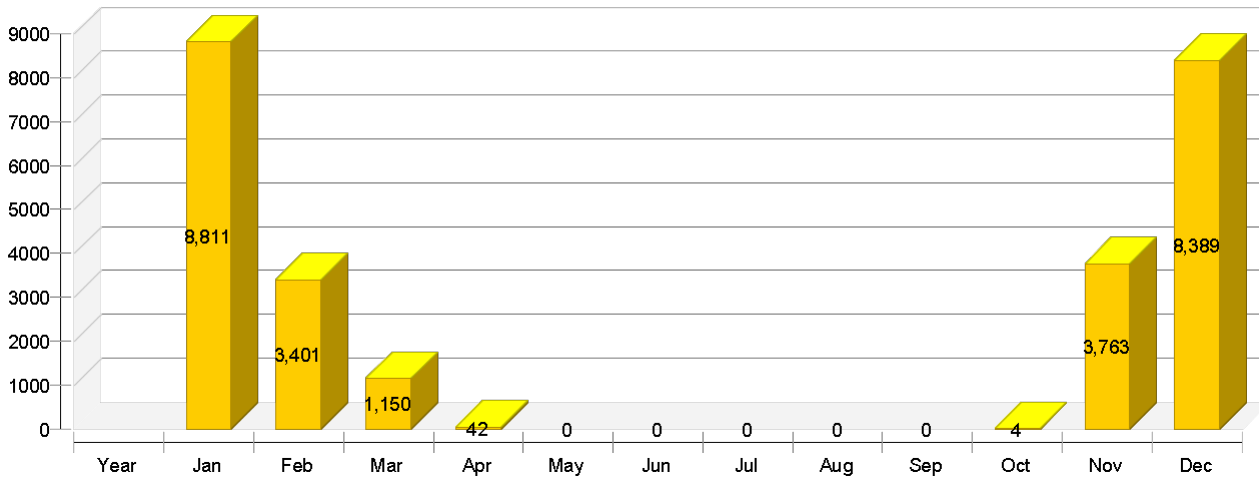
Solar thermal energy to the system [Qsol]

kBtu



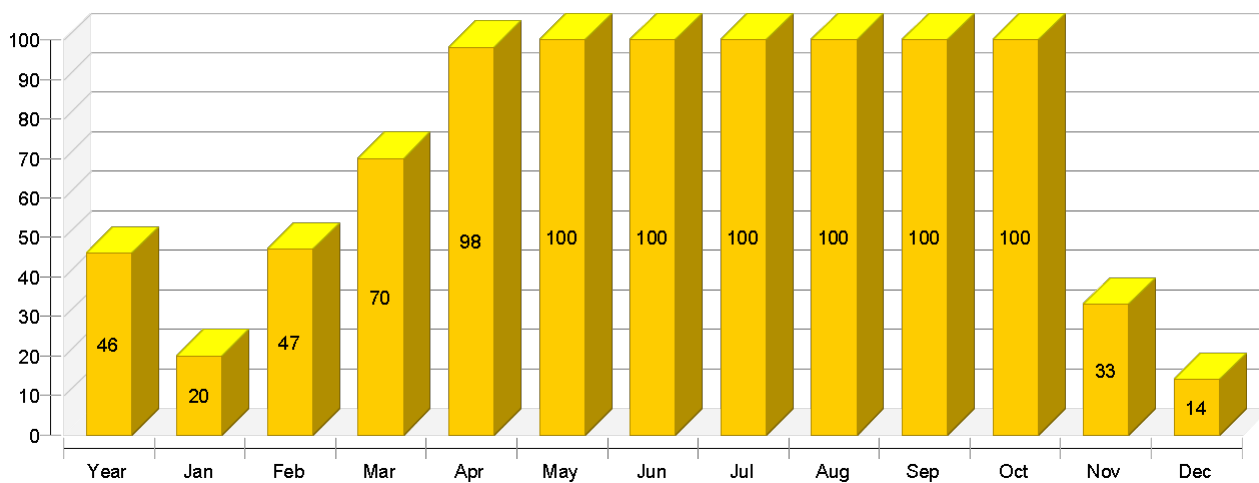
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu



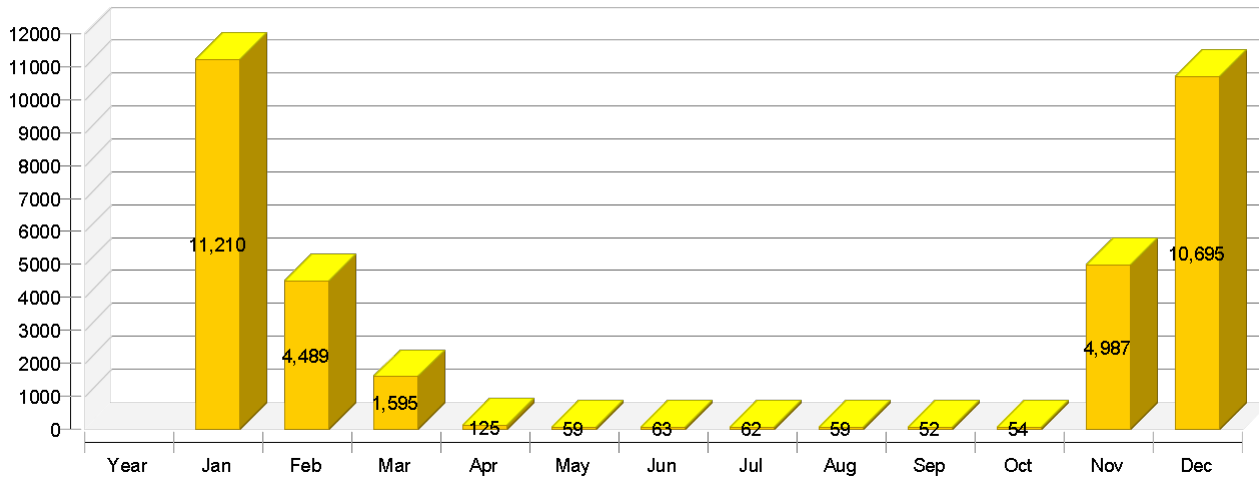
Solar fraction: fraction of solar energy to system [SFn]

%



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	21991	2154	3029	2698	1887	1524	1430	1587	1542	1466	1421	1880	1375
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Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu	25560	8811	3401	1150	42	0	0	0	0	0	4	3763	8389
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Heat generator fuel and electrical energy consumption [Eaux]

kBtu	32387	11035	4358	1503	68	0	0	0	0	0	5	4874	10544
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Solar fraction: fraction of solar energy to system [SFn]

%	46.2	19.6	47.1	70.1	97.8	100	100	100	100	100	99.7	33.3	14.1
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Total fuel and/or electrical energy consumption of the system [Etot]

kBtu	33450	11210	4489	1595	125	59	63	62	59	52	54	4987	10695
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Irradiance onto collector area [Esol]

kBtu	83949	6349	8376	10457	8916	7248	6180	6816	7113	6525	6475	5310	4184
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Electrical energy consumption of pumps [Epar]

kBtu	1064	175	131	93	57	59	63	62	59	52	49	113	151
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Heat loss to indoor room (including heat generator losses) [Qint]

kBtu	15690	2832	1588	1162	851	851	773	766	861	802	818	1678	2708
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Heat loss to surroundings (without collector losses) [Qext]

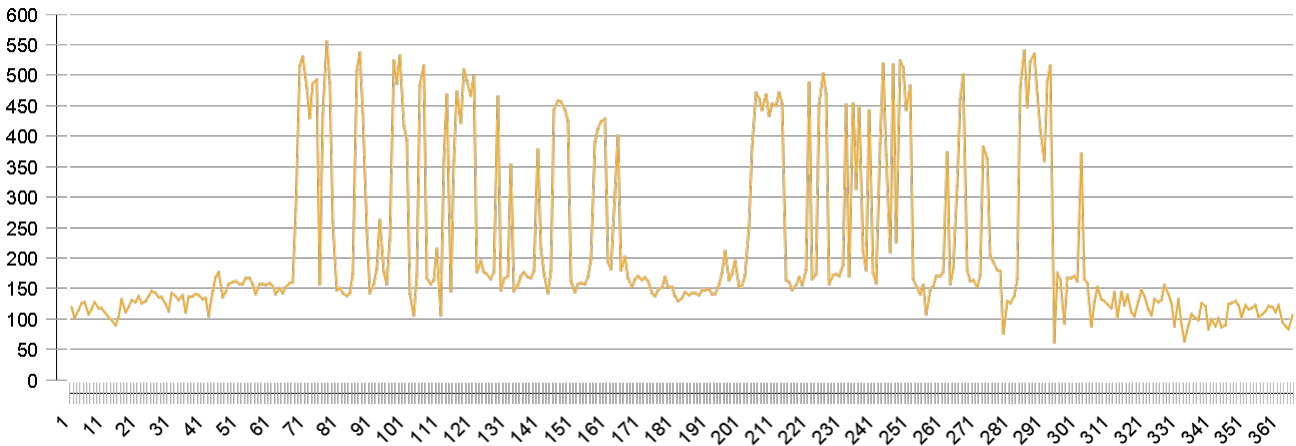
kBtu	954	83	100	107	87	89	79	72	78	74	73	60	53
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Total energy consumption [Quse]

kBtu	38837	10428	5771	3032	992	721	685	694	674	637	719	5183	9302
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Collector North America

Daily maximum temperature [°F]



Energy flow diagram

