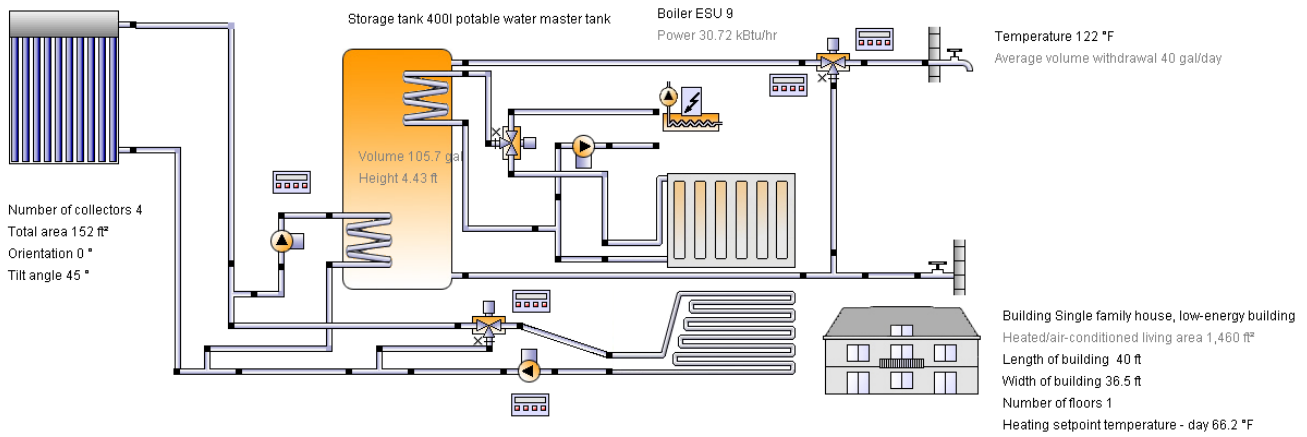


Project

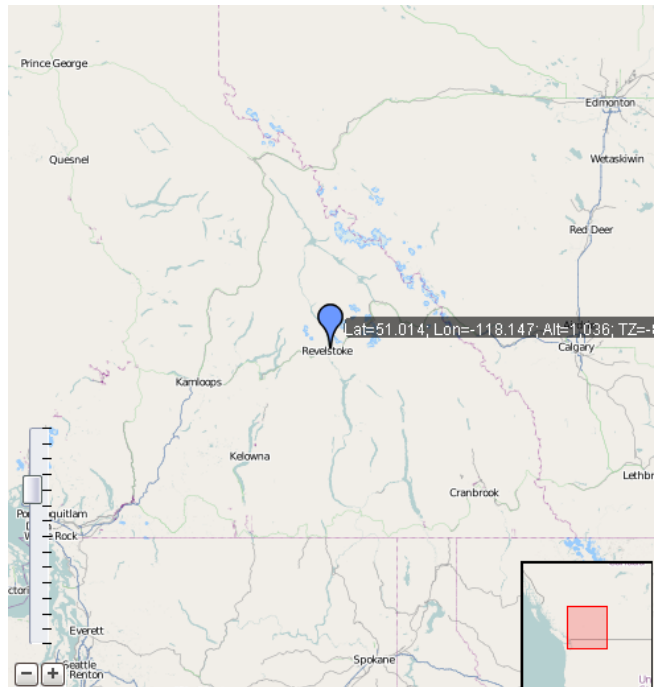
9k: Space heating (solar thermal, 2 heating loops)



Location of the system

Revelstoke
Longitude: -118.147°
Latitude: 51.014°
Elevation: 3,399 ft

Map section



This report has been created by:

William Elliott
303 47 Str.E
S7K 5H2 Saskatoon

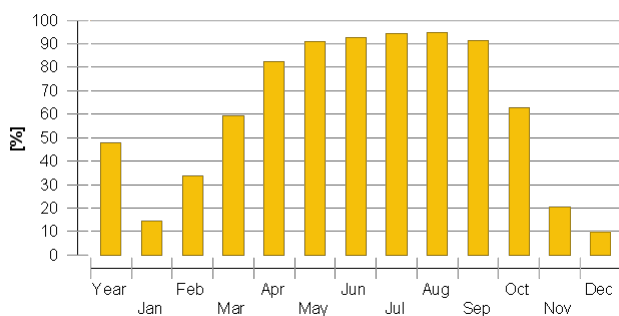
System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	34,532.5 kBtu
Total energy consumption [Quse]	61,354.6 kBtu
System performance (Quse / Etot)	1.78
Comfort demand	Energy demand covered

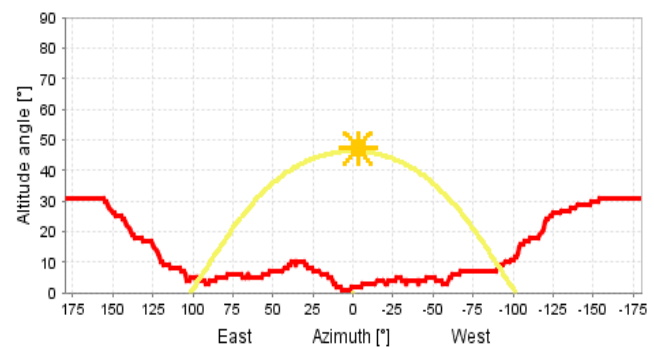
Overview solar thermal energy (annual values)

Collector area	152 ft ²
Solar fraction total	47.5%
Solar fraction hot water [SFnHw]	60.4 %
Solar fraction building [SFnBd]	42.8 %
Total annual field yield	31,546 kBtu
Collector field yield relating to gross area	208 kBtu/ft ² /Year
Collector field yield relating to aperture area	232 kBtu/ft ² /Year
Max. energy savings	31,545.6 kBtu
Max. reduction in CO2 emissions	10,932.9 pound

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



Horizon line



Meteorological data-Overview

Outdoor temperature 24h	40.5 °F
Annual global irradiance	406 kBtu/ft ²
Annual diffuse irradiance	163.2 kBtu/ft ²

Financial analysis - Solar thermal

Purchase costs	5,000 CAD
Life span	40 years
Proportional incentives	0 %
Incentives per area	0 CAD
Fixed incentives	0 CAD
Inflation	3 %
Interest	5 %
Increase of energy prices	6 %

Financial analysis - Solar thermal

Electricity	0.14 CAD/kWh
Effective purchase cost after grants	5,000 CAD
Annual fuel cost savings	1,294.321 CAD
Solar energy cost per kWh	0.02 CAD
Payback period	4 years
Present value of the system	119,628.656 CAD
Net present value	114,628.656 CAD

Component overview (annual values)

Boiler	ESU 9	
Power	kBtu/hr	30.72
Total efficiency	%	103.7
Energy from/to the system [Qaux]	kBtu	34,833.9
Fuel and electrical energy consumption [Eaux]	kBtu	33,587.5
Energy savings solar thermal	kBtu	31,545.6
CO savings solar thermal	pound	10,932.9
Fuel savings solar thermal	kBtu	31,553.7

Collector North America	WSE58Super Tube	
Data Source		u138368
Number of collectors		4
Number of arrays		2
Total area	ft ²	152
Total aperture area	ft ²	136
Tilt angle	°	45
Orientation	°	0
Collector field yield [Qsol]	kBtu	31,545.6
Irradiation onto collector area [Esol]	kBtu	79,069.3
Collector efficiency [Qsol / Esol]	%	39.9
Direct irradiation after IAM	kBtu	56,278
Diffuse irradiation after IAM	kBtu	31,370.8

Building	Single family house, low-energy building	
Heated/air-conditioned living area	ft ²	1,460
Heating setpoint temperature	°F	66.2
Heating energy demand excluding DHW	kBtu	51,049.4
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft ²	35
Solar gain through windows	kBtu	45,409
Total energy losses	kBtu	111,615.6

Convector Floor heating	Floor heating 1000W	
Number of heating/cooling modules	-	3
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	22,200.9

Convector Radiator	Radiator 1000W	
Number of heating/cooling modules	-	4
Power per heating module under standard conditions	kBtu/hr	3
Nominal inlet temperature	°F	149
Nominal return temperature	°F	131
Net energy from/to heating/cooling modules	kBtu	28,724.6

Hot water demand	Constant	
Withdraw volume	gal/d	40.1
Temperature setting	°F	122
Energy from/to the system [Quse]	kBtu	10,236.1

Pump Space heating loop pump	Pump, small	
Circuit pressure drop	psi	0.109
Flow rate	gpm	1.8
Fuel and electrical energy consumption [Epar]	kBtu	402.2

Pump Heat generator pump	Pump, medium	
Circuit pressure drop	psi	0.776
Flow rate	gpm	4.4
Fuel and electrical energy consumption [Epar]	kBtu	447.8

Pump Solar loop pump	Pump, small	
Circuit pressure drop	psi	0.194
Flow rate	gpm	2.2
Fuel and electrical energy consumption [Epar]	kBtu	94.9

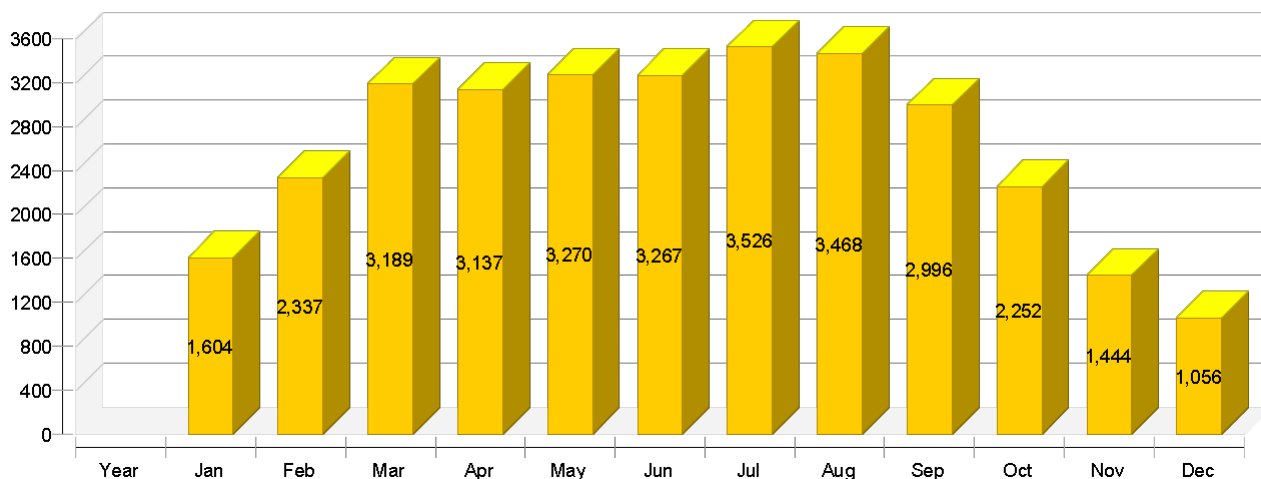
Storage tank Potable water tank	400l potable water master tank	
Volume	gal	105.7
Height	ft	4.43
Material		Stainless steel
Insulation		Rigid PU foam
Thickness of insulation	in	3.1
Heat loss	kBtu	816.1
Connection losses	kBtu	813.8

Loop

Solar loop		
Fluid mixture		Ethylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	211.4
Pressure on top of the circuit	psi	58.016

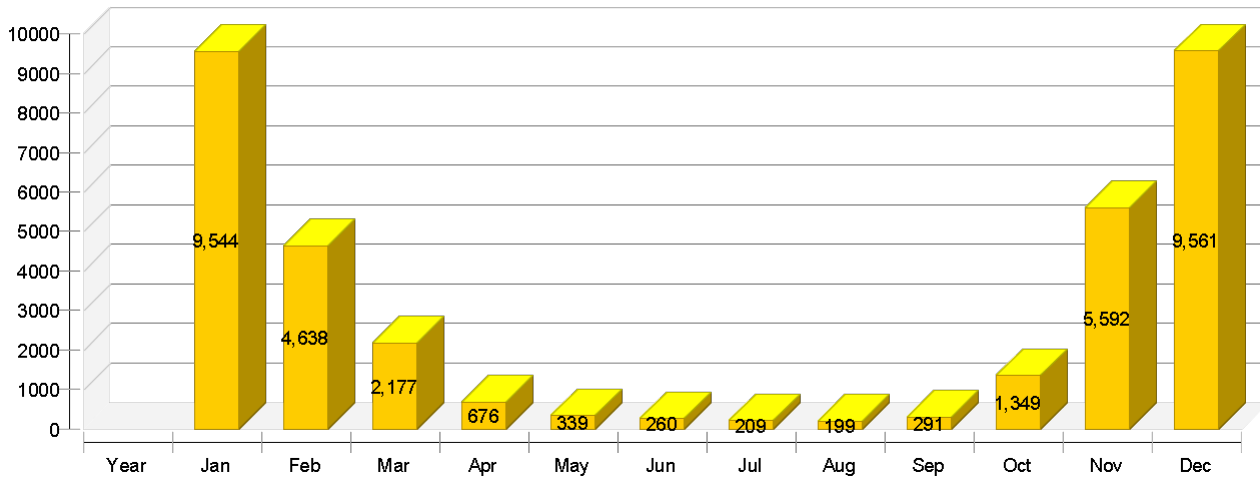
Solar thermal energy to the system [Qsol]

kBtu



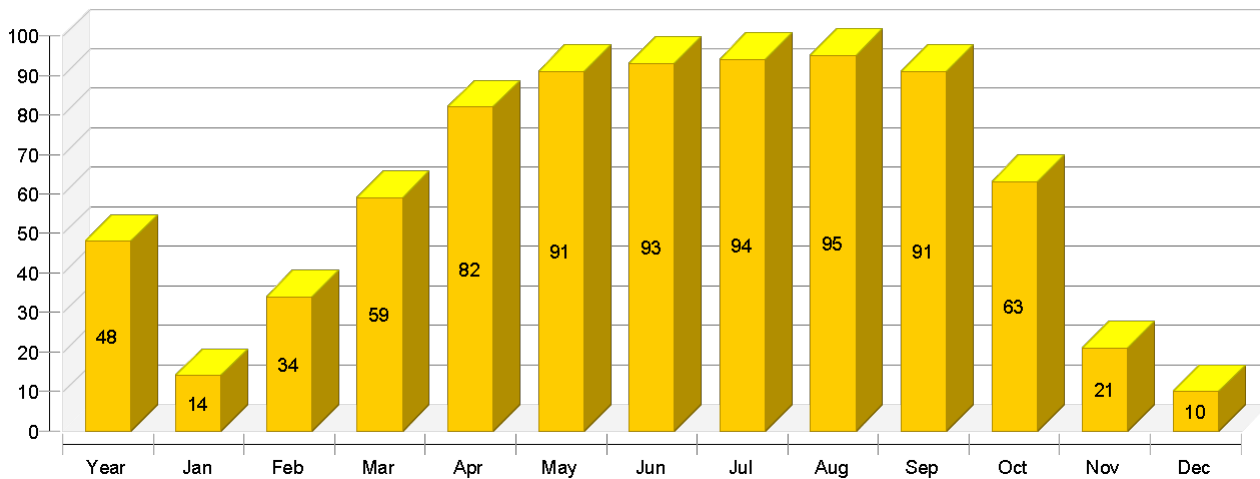
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu



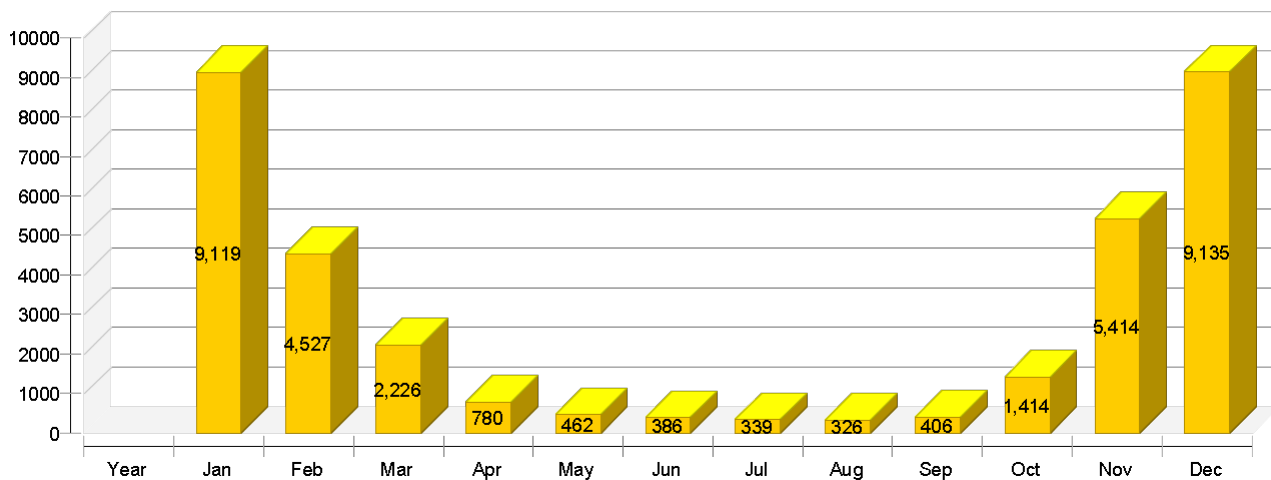
Solar fraction: fraction of solar energy to system [SF_n]

%



Total fuel and/or electrical energy consumption of the system [E_{tot}]

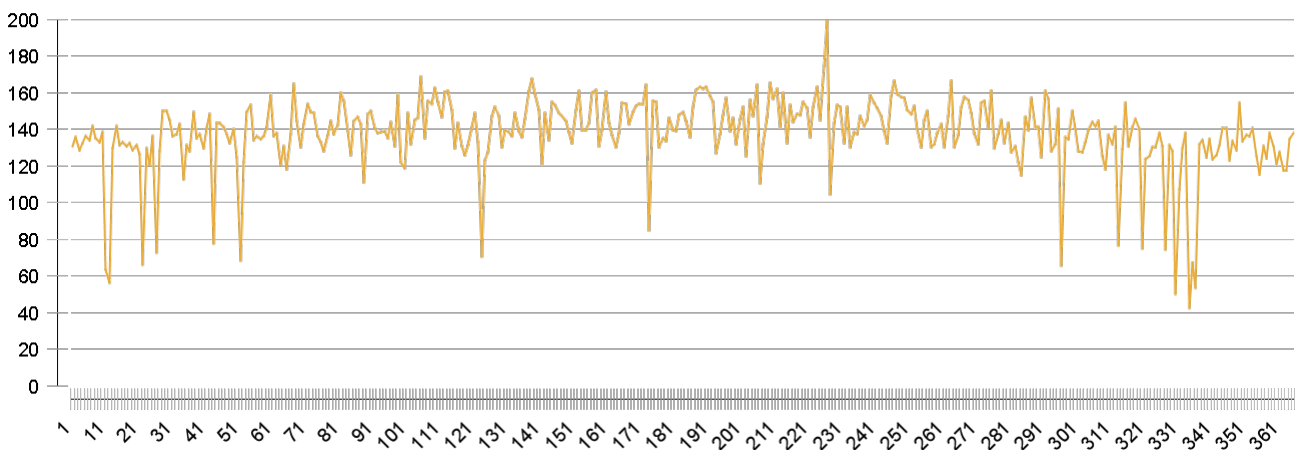
kBtu



Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar thermal energy to the system [Qsol]													
kBtu	31546	1604	2337	3189	3137	3270	3267	3526	3468	2996	2252	1444	1056
Heat generator energy to the system (solar thermal energy not included) [Qaux]													
kBtu	34834	9544	4638	2177	676	339	260	209	199	291	1349	5592	9561
Heat generator fuel and electrical energy consumption [Eaux]													
kBtu	33588	8971	4432	2151	724	406	329	281	271	357	1359	5317	8989
Solar fraction: fraction of solar energy to system [SFn]													
%	47.5	14.4	33.5	59.4	82.3	90.6	92.6	94.4	94.6	91.2	62.5	20.5	9.9
Total fuel and/or electrical energy consumption of the system [Etot]													
kBtu	34532	9119	4527	2226	780	462	386	339	326	406	1414	5414	9135
Irradiation onto collector area [Esol]													
kBtu	79069	4498	5957	8084	7889	8075	7987	8468	8280	7178	5572	3858	3224
Electrical energy consumption of pumps [Epar]													
kBtu	945	148	95	75	56	56	57	58	55	48	55	97	145
Heat loss to indoor room (including heat generator losses) [Qint]													
kBtu	4916	83	314	493	506	517	555	596	599	531	429	255	38
Total energy consumption [Quse]													
kBtu	61355	10626	6555	4924	3490	3190	3129	3270	3186	2870	3264	6638	10214

Collector North America

Daily maximum temperature [°F]



Energy flow diagram

