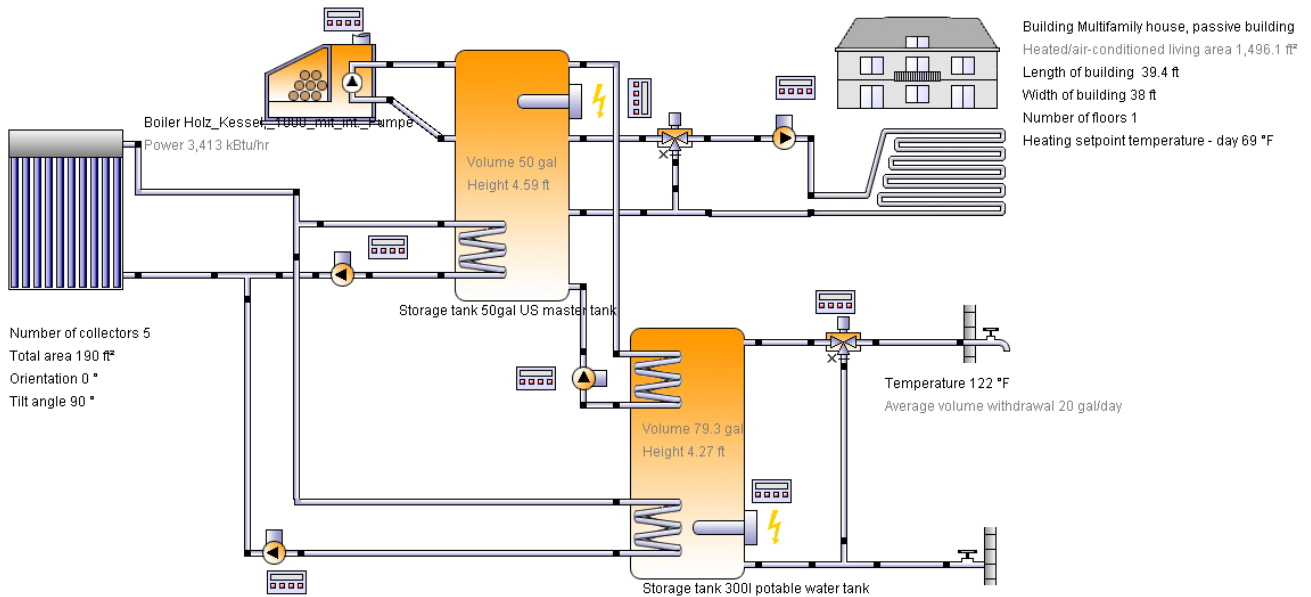


Project

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



Location of the system

Map section

Saskatoon Area
Longitude: -106.523°
Latitude: 52.174°
Elevation: 0 ft

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This report has been created by:

William Elliott
303 47 Str.E
S7K 5H2 Saskatoon

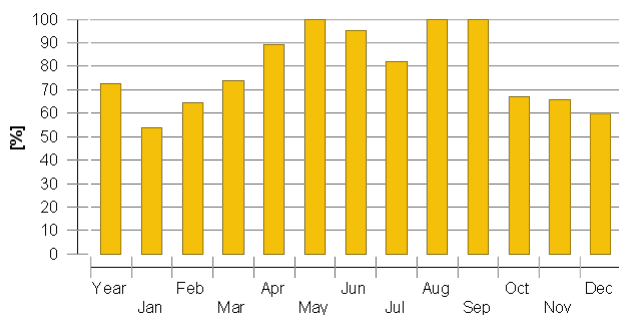
System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	32,705.1 kBtu
Total energy consumption [Quse]	23,212.9 kBtu
System performance (Quse / Etot)	0.71
Comfort demand	Energy demand of the building not met

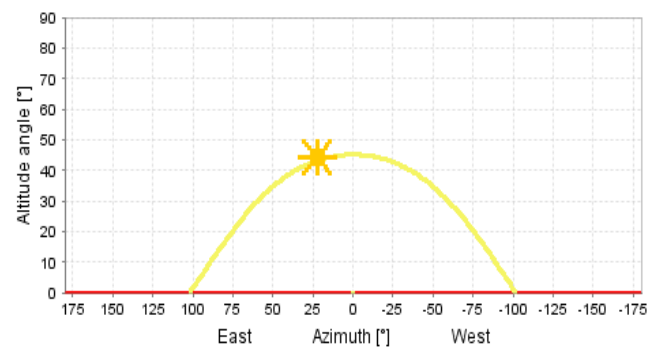
Overview solar thermal energy (annual values)

Collector area	190 ft ²
Solar fraction total	72.6%
Solar fraction hot water [SFnHw]	67.4 %
Solar fraction building [SFnBd]	47.6 %
Total annual field yield	21,442 kBtu
Collector field yield relating to gross area	113 kBtu/ft ² /Year
Collector field yield relating to aperture area	126 kBtu/ft ² /Year
Max. fuel savings	4,433.3 pound: [Firewood]
Max. energy savings	28,589.4 kBtu
Max. reduction in CO2 emissions	266 pound

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



Horizon line



Meteorological data-Overview

Outdoor temperature 24h	37.7 °F
Annual global irradiance	429.1 kBtu/ft ²
Annual diffuse irradiance	160.7 kBtu/ft ²

Financial analysis - Solar thermal

Purchase costs	5,750 CAD
Life span	40 years
Proportional incentives	0 %
Incentives per area	0 CAD
Fixed incentives	0 CAD
Inflation	2 %
Interest	5 %

Financial analysis - Solar thermal

Increase of energy prices	6 %
Electricity	0.116 CAD/kWh
Firewood	0.227 CAD/pound; 0.035 CAD/kBtu
Effective purchase cost after grants	5,750 CAD
Annual fuel cost savings	1,005.452 CAD
Solar energy cost per kWh	0.03 CAD
Payback period	6 years
Present value of the system	72,651.461 CAD
Net present value	66,901.461 CAD

Component overview (annual values)

Boiler 2	Holz_Kessel,_1000_mit_int._Pumpe	
Power	kBtu/hr	3,413
Total efficiency	%	26.9
Energy from/to the system [Qaux]	kBtu	8,098
Fuel and electrical energy consumption [Eaux]	kBtu	30,113.9
Energy savings solar thermal	kBtu	28,589.4
CO savings solar thermal	pound	266
Fuel savings solar thermal	pound	4,433.3

Collector North America 2	WSE58Super Tube	
Data Source		u138368
Number of collectors		5
Number of arrays		1
Total area	ft ²	190
Total aperture area	ft ²	170
Tilt angle	°	90
Orientation	°	0
Collector field yield [Qsol]	kBtu	21,442.1
Irradiation onto collector area [Esol]	kBtu	90,627.2
Collector efficiency [Qsol / Esol]	%	23.7
Direct irradiation after IAM	kBtu	49,126.1
Diffuse irradiation after IAM	kBtu	32,298.6

Building	Multifamily house, passive building	
Heated/air-conditioned living area	ft ²	1,496.1
Heating setpoint temperature	°F	67.9
Heating energy demand excluding DHW [Qdem]	kBtu	30,642.8
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft ²	20.5
Solar gain through windows	kBtu	37,066.5
Total energy losses	kBtu	73,046.5

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	18,432.8

Hot water demand	Constant	
Withdraw volume	gal/d	20.2
Temperature setting	°F	122
Energy from/to the system [Quse]	kBtu	4,740

Pump Space heating loop pump	Pump, medium	
Circuit pressure drop	psi	2.77
Flow rate	gpm	9.6
Fuel and electrical energy consumption [Epar]	kBtu	1,510.7

Pump Solar loop pump 1	Pump, medium	
Circuit pressure drop	psi	0.314
Flow rate	gpm	1
Fuel and electrical energy consumption [Epar]	kBtu	733.2

Pump Potable water tank loading pump	Pump, small	
Circuit pressure drop	psi	0.22
Flow rate	gpm	4.4
Fuel and electrical energy consumption [Epar]	kBtu	1.3

Pump Solar loop pump 2	Pump, medium	
Circuit pressure drop	psi	0.44
Flow rate	gpm	2.1
Fuel and electrical energy consumption [Epar]	kBtu	346.1

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	1,076.8
Connection losses	kBtu	1,144.4

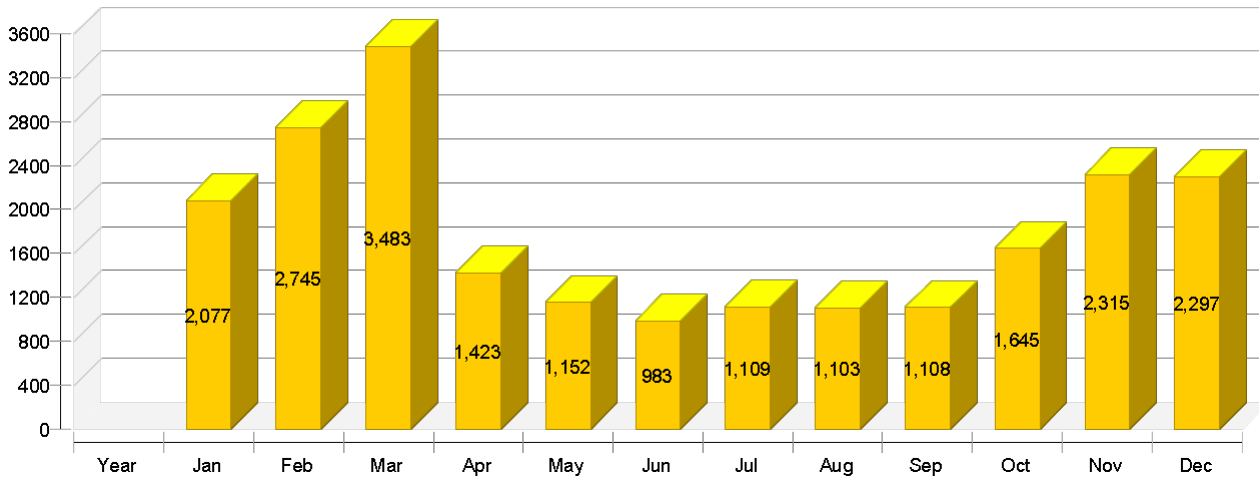
Storage tank Buffer tank	50gal US master tank	
Volume	gal	50
Height	ft	4.59
Material		Enameled steel
Insulation		Flexible polyurethane foam
Thickness of insulation	in	4
Heat loss	kBtu	746
Connection losses	kBtu	1,597.2

Loop

Solar loop		
Fluid mixture		Propylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	9.5
Pressure on top of the circuit	psi	58.016

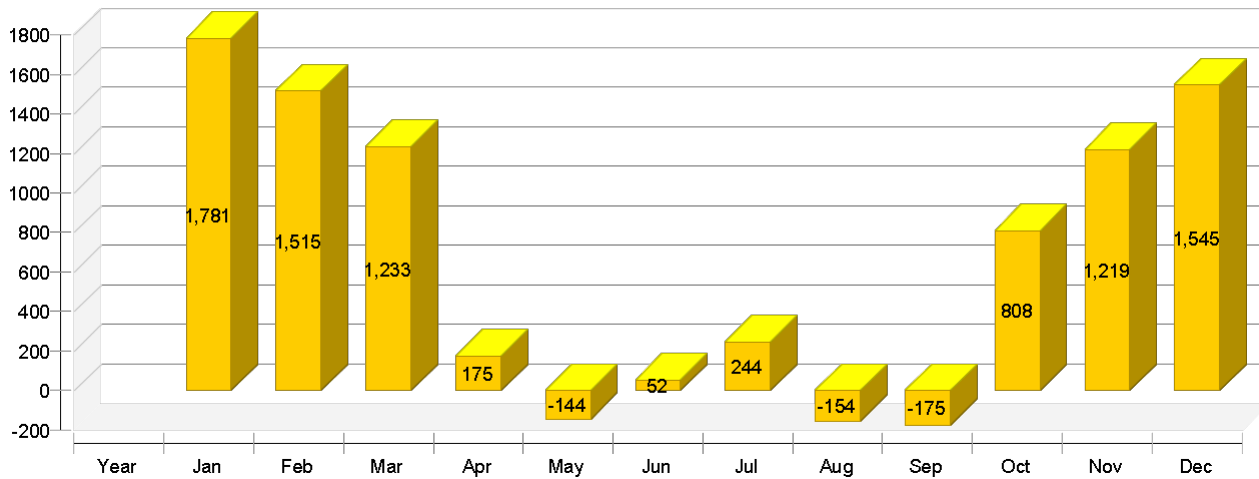
Solar thermal energy to the system [Qsol]

kBtu



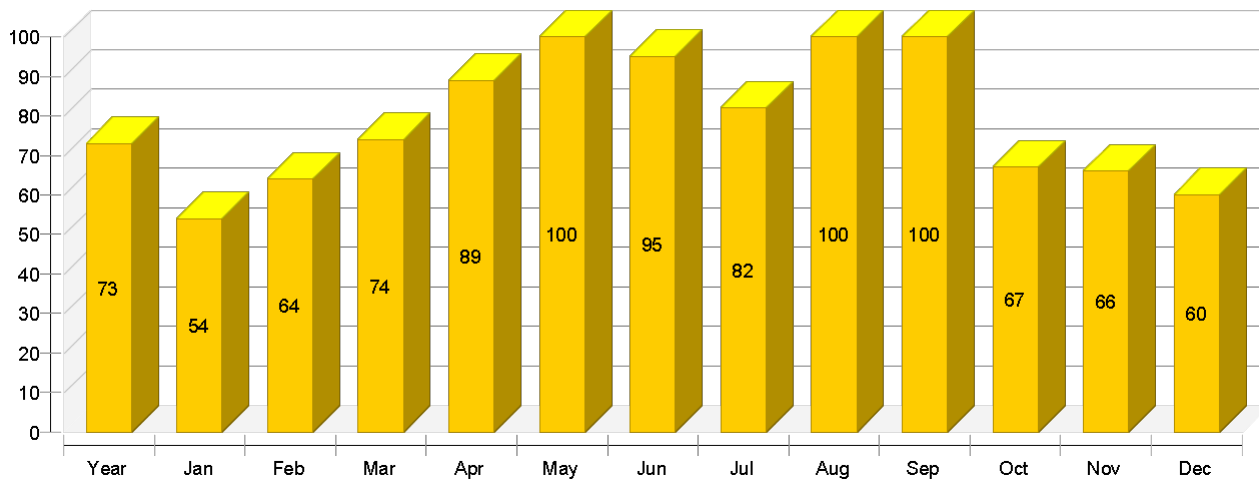
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu



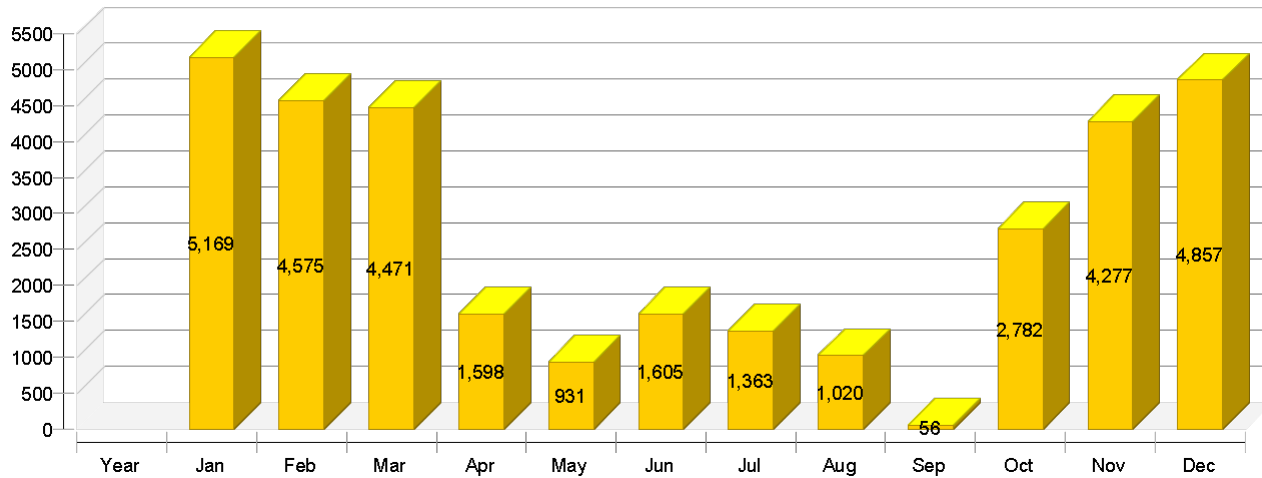
Solar fraction: fraction of solar energy to system [SFn]

%



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	21442	2077	2745	3483	1423	1152	983	1109	1103	1108	1645	2315	2297
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Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu	8098	1781	1515	1233	175	-144	52	244	-154	-175	808	1219	1545
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Heat generator fuel and electrical energy consumption [Eaux]

kBtu	30114	4759	4174	4033	1475	858	1543	1300	961	0	2634	3932	4445
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Solar fraction: fraction of solar energy to system [SFn]

%	72.6	53.8	64.4	73.9	89.1	100	95	82	100	100	67.1	65.5	59.8
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Total fuel and/or electrical energy consumption of the system [Etot]

kBtu	32705	5169	4575	4471	1598	931	1605	1363	1020	56	2782	4277	4857
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Irradiation onto collector area [Esol]

kBtu	90627	6703	8501	11278	8011	6804	5677	6599	7371	7844	7712	7114	7015
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Electrical energy consumption of pumps [Epar]

kBtu	2591	410	400	438	124	73	62	63	59	56	148	345	412
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Heat loss to indoor room (including heat generator losses) [Qint]

kBtu	30061	3508	3153	3490	1993	1714	2165	1815	1875	913	2577	3366	3493
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Heat loss to surroundings (without collector losses) [Qext]

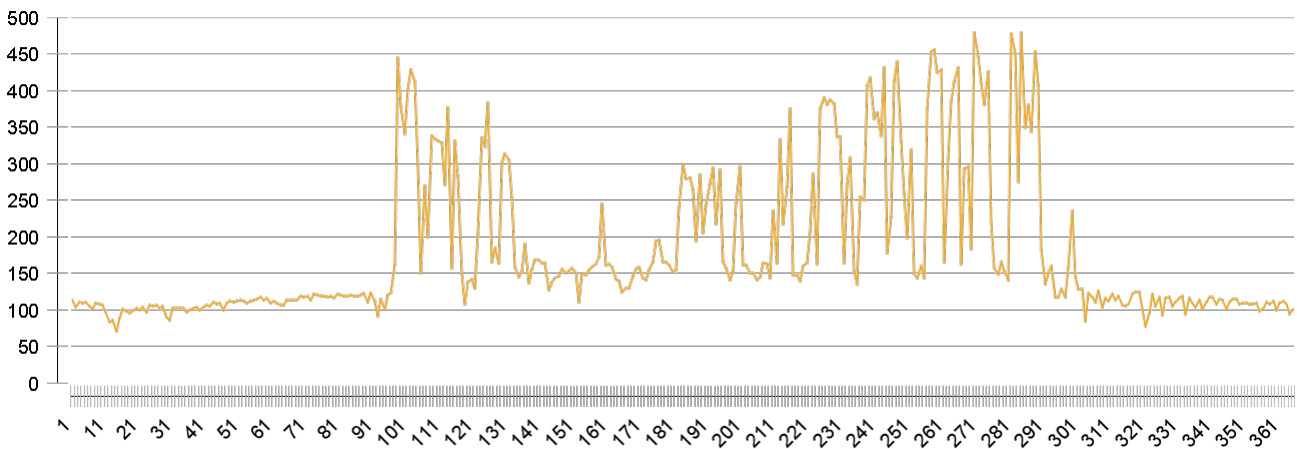
kBtu	940	83	80	98	81	79	67	72	72	77	85	71	74
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Total energy consumption [Quse]

kBtu	23213	3705	4046	4378	1018	482	387	379	365	356	1347	3152	3598
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Collector North America 2

Daily maximum temperature [°F]



Energy flow diagram

