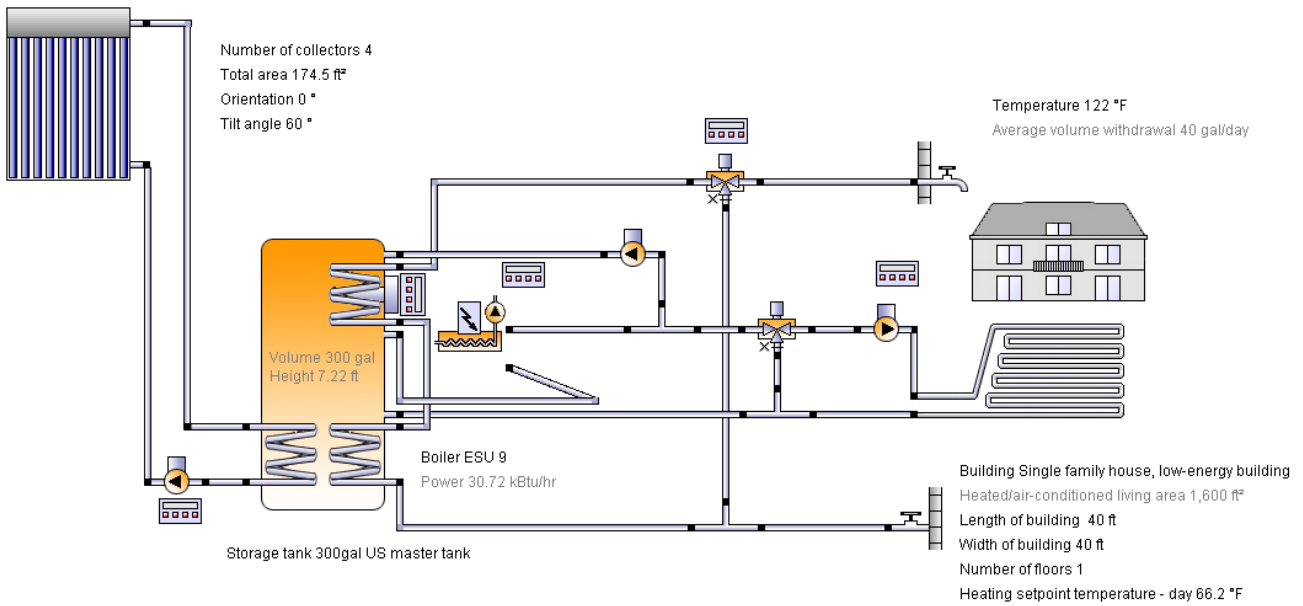


**Project**

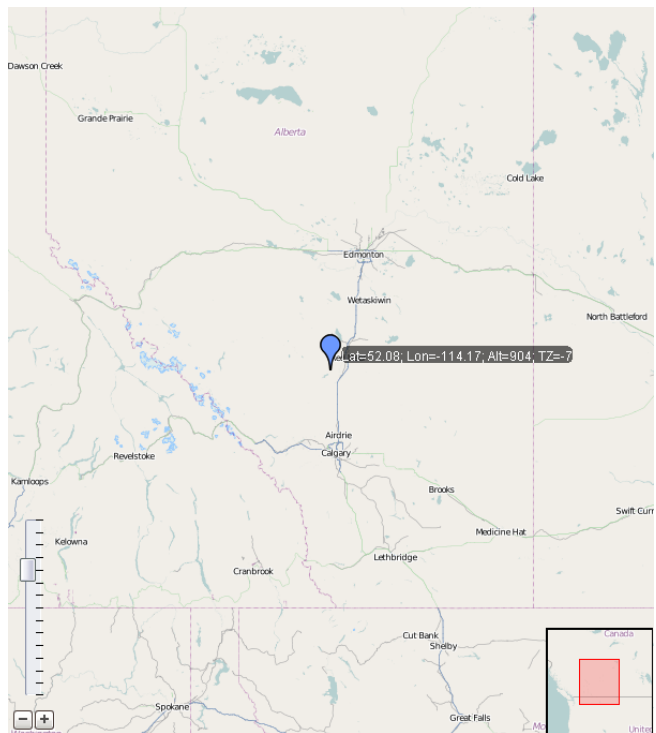
**9b: Space heating (solar thermal, modular heat generator)**



**Location of the system**

Red Deer  
 Longitude: -114.17°  
 Latitude: 52.08°  
 Elevation: 2,966 ft

**Map section**



**This report has been created by:**

Elliott William  
 303 47 Str.E  
 S7K 5H2 Saskatoon

## Comments on the project

Using 4 of our new WSE58 Super tubes

## Photograph of property



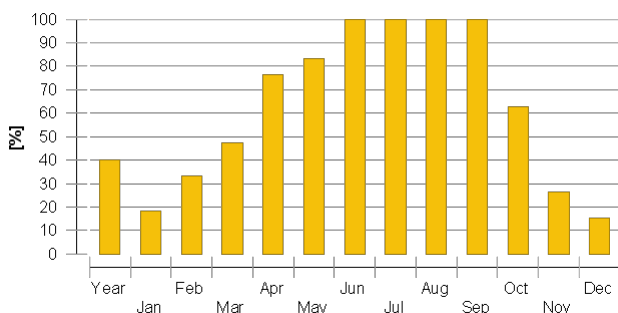
## System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	40,249.5 kBtu
Total energy consumption [Quse]	58,738.5 kBtu
System performance (Quse / Etot)	1.46
Comfort demand	Energy demand covered

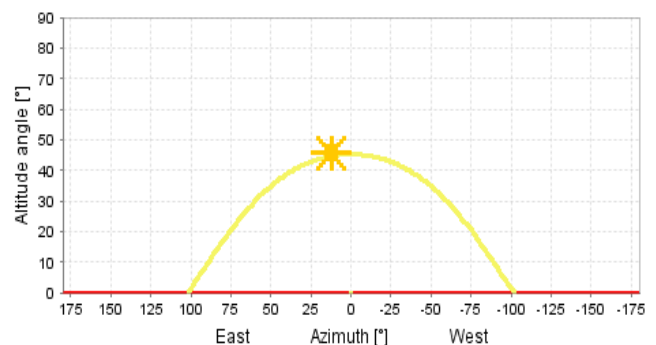
## Overview solar thermal energy (annual values)

Collector area	175 ft <sup>2</sup>
Solar fraction total	40%
Solar fraction hot water [SFnHw]	66.4 %
Solar fraction building [SFnBd]	28.4 %
Total annual field yield	27,434 kBtu
Collector field yield relating to gross area	157 kBtu/ft <sup>2</sup> /Year
Collector field yield relating to aperture area	168 kBtu/ft <sup>2</sup> /Year
Max. energy savings	27,433.8 kBtu
Max. reduction in CO2 emissions	9,507.9 pound

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



## Horizon line



## Meteorological data-Overview

Outdoor temperature 24h	37.2 °F
Annual global irradiance	414.6 kBtu/ft <sup>2</sup>
Annual diffuse irradiance	146.3 kBtu/ft <sup>2</sup>

## Financial analysis - Solar thermal

Purchase costs	4,800 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
Effective purchase cost after grants	4,800 CAD
Annual fuel cost savings	1,608.015 CAD
Solar energy cost per kWh	0.02 CAD
Payback period	3 years
Present value of the system	176,331.703 CAD
Net present value	171,531.703 CAD

## Component overview (annual values)

Boiler	ESU 9	
Power	kBtu/hr	30.72
Total efficiency	%	106.5
Energy from/to the system [Qaux]	kBtu	41,207.4
Fuel and electrical energy consumption [Eaux]	kBtu	38,702.4
Energy savings solar thermal	kBtu	27,433.8
CO savings solar thermal	pound	9,507.9
Fuel savings solar thermal	kBtu	27,440.8

Collector North America	WSE58ST	
Data Source		u138368
Number of collectors		4
Number of arrays		8
Total area	ft <sup>2</sup>	174.5
Total aperture area	ft <sup>2</sup>	163.396
Tilt angle	°	60
Orientation	°	0
Collector field yield [Qsol]	kBtu	27,433.8
Irradiance onto collector area [Esol]	kBtu	97,928.6
Collector efficiency [Qsol / Esol]	%	28
Direct irradiance after IAM	kBtu	74,586.6
Diffuse irradiance after IAM	kBtu	33,646.1

Building	Single family house, low-energy building	
Heated/air-conditioned living area	ft <sup>2</sup>	1,600
Heating setpoint temperature	°F	66.2
Heating energy demand excluding DHW [Qdem]	kBtu	50,664.6
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft <sup>2</sup>	31.7
Solar gain through windows	kBtu	52,599.3
Total energy losses	kBtu	119,261.5

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	50,599.6

Hot water demand	Constant	
Withdraw volume	gal/d	40.2
Temperature setting	°F	122
Energy from/to the system [Quse]	kBtu	8,073.9

<b>Pump Solar loop pump</b>	<b>Pump, small</b>	
Circuit pressure drop	psi	0.266
Flow rate	gpm	2.7
Fuel and electrical energy consumption [Epar]	kBtu	267.3

<b>Pump Space heating loop pump</b>	<b>Pump, medium</b>	
Circuit pressure drop	psi	0.895
Flow rate	gpm	3.9
Fuel and electrical energy consumption [Epar]	kBtu	803.7

<b>Pump Loading tank pump</b>	<b>Pump, medium</b>	
Circuit pressure drop	psi	1.549
Flow rate	gpm	4.4
Fuel and electrical energy consumption [Epar]	kBtu	476.1

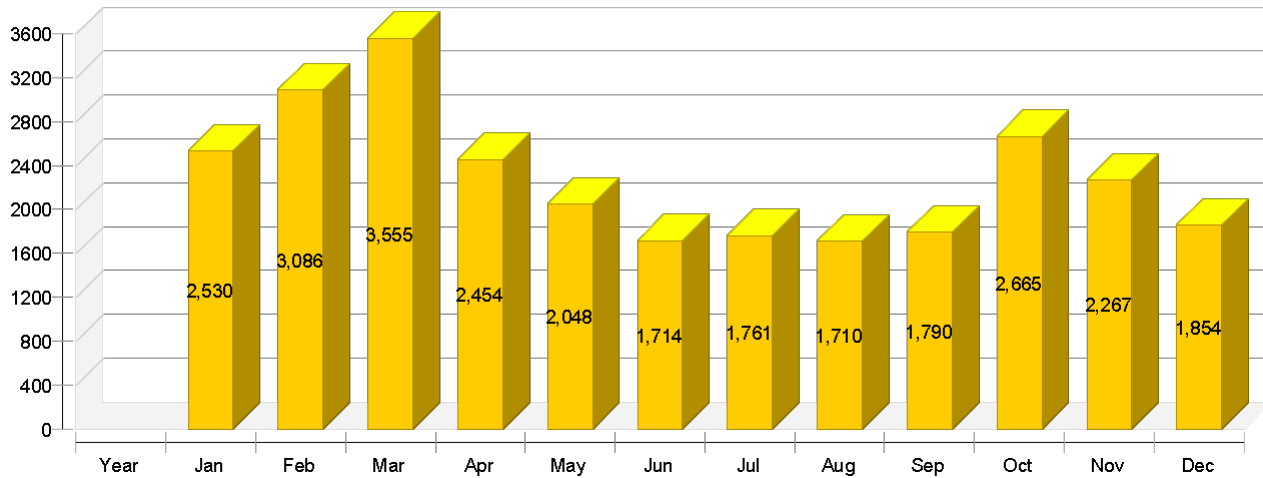
<b>Storage tank Buffer tank</b>	<b>300gal US master tank</b>	
Volume	gal	300
Height	ft	7.22
Material		Enameled steel
Insulation		Flexible polyurethane foam
Thickness of insulation	in	4
Heat loss	kBtu	2,715.3
Connection losses	kBtu	3,561.2

## Loop

<b>Solar loop</b>		
Fluid mixture		Ethylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	12.7
Pressure on top of the circuit	psi	58.016

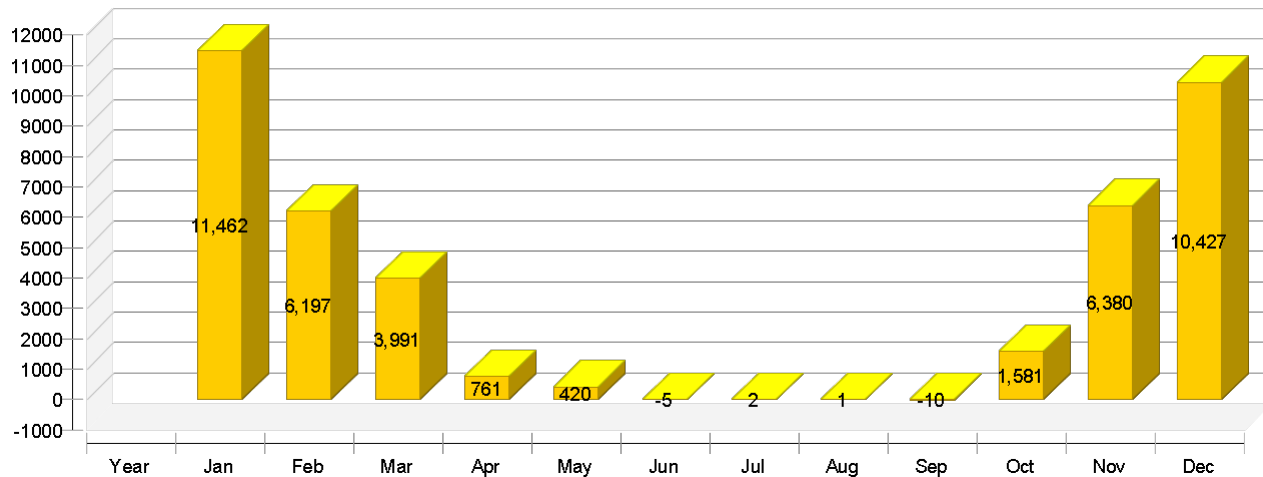
Solar thermal energy to the system [Qsol]

kBtu



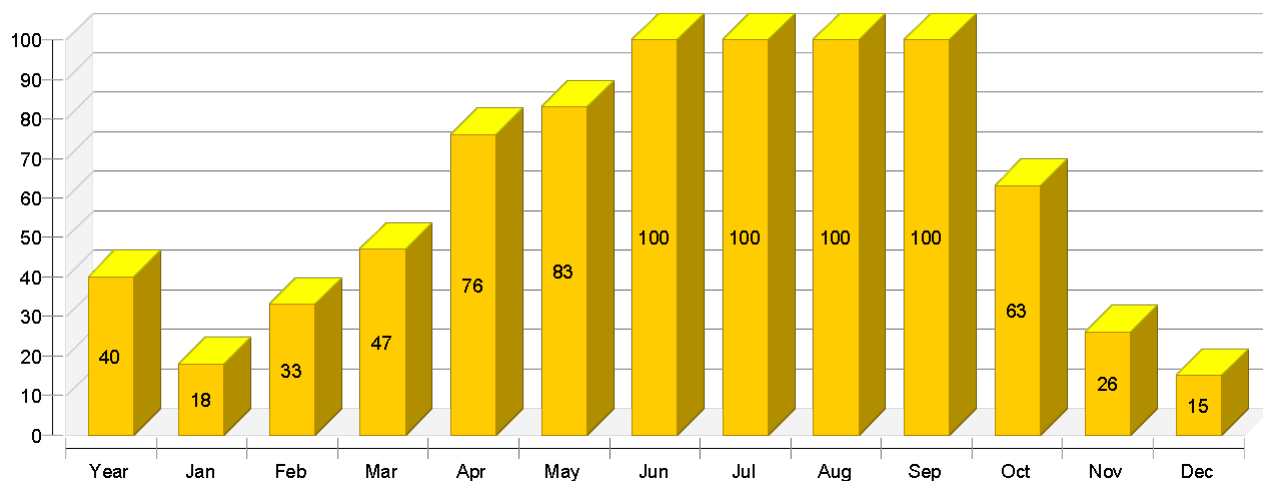
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu



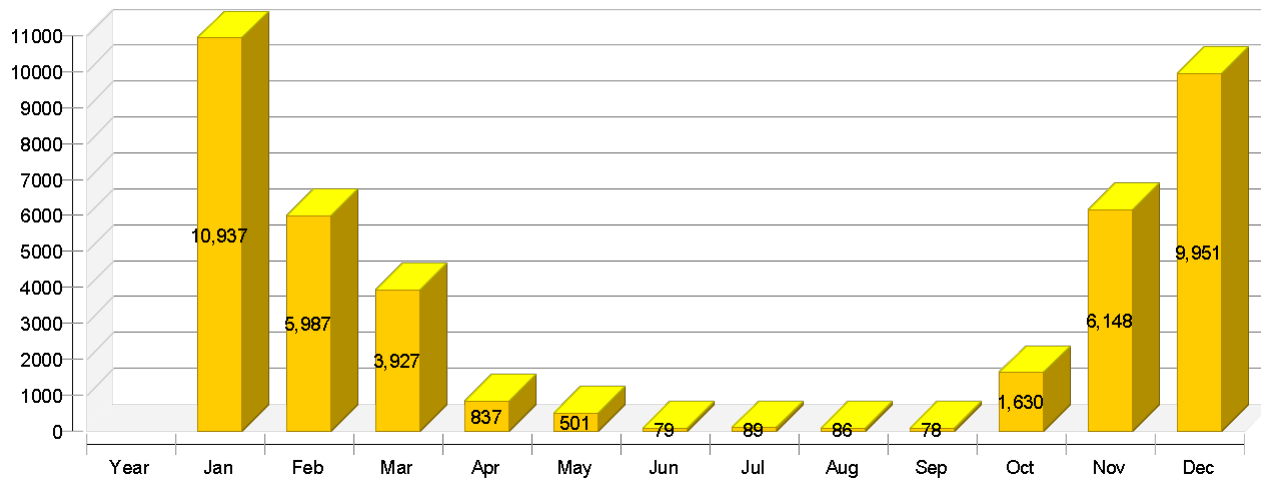
Solar fraction: fraction of solar energy to system [SFn]

%



## 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	27434	2530	3086	3555	2454	2048	1714	1761	1710	1790	2665	2267	1854
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### Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu	41207	11462	6197	3991	761	420	-5	2	1	-10	1581	6380	10427
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### Heat generator fuel and electrical energy consumption [Eaux]

kBtu	38702	10579	5758	3756	781	463	62	71	71	61	1540	5930	9631
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### Solar fraction: fraction of solar energy to system [SFn]

%	40	18.1	33.2	47.1	76.3	83	100	99.9	100	100	62.8	26.2	15.1
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### Total fuel and/or electrical energy consumption of the system [Etot]

kBtu	40249	10937	5987	3927	837	501	79	89	86	78	1630	6148	9951
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### Irradiance onto collector area [Esol]

kBtu	97929	7173	8377	10597	9403	8615	8151	8925	8870	8284	8015	6158	5361
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### Electrical energy consumption of pumps [Epar]

kBtu	1547	358	229	171	56	37	17	18	16	17	90	219	320
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### Heat loss to indoor room (including heat generator losses) [Qint]

kBtu	7699	-94	277	628	898	948	993	1047	1044	1035	767	231	-74
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### Heat loss to surroundings (without collector losses) [Qext]

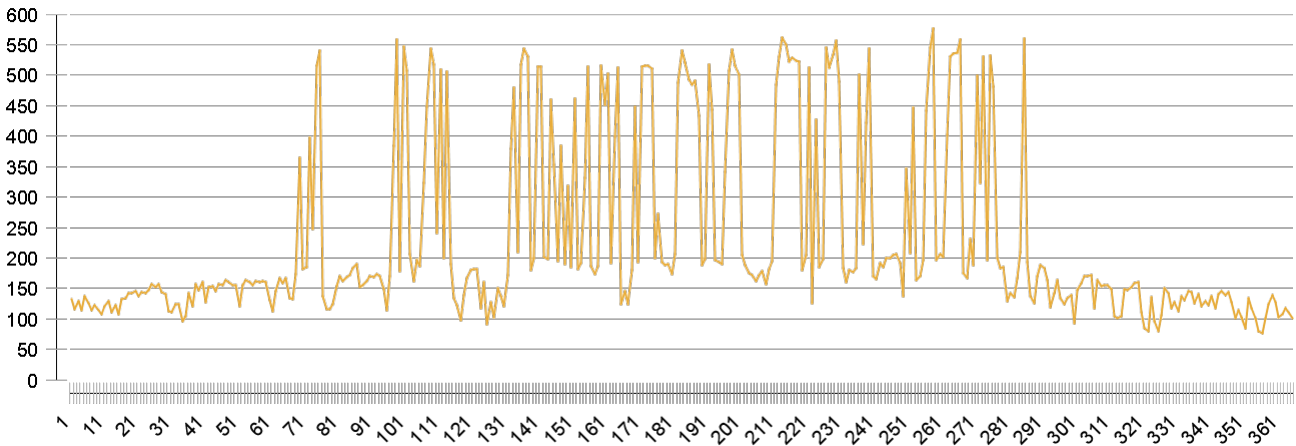
kBtu	1335	110	119	142	122	117	110	114	108	117	108	84	84
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### Total energy consumption [Quse]

kBtu	58738	13450	8671	6627	2258	1456	700	705	689	678	3524	8188	11793
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## Collector North America

Daily maximum temperature [ °F]



## Energy flow diagram

