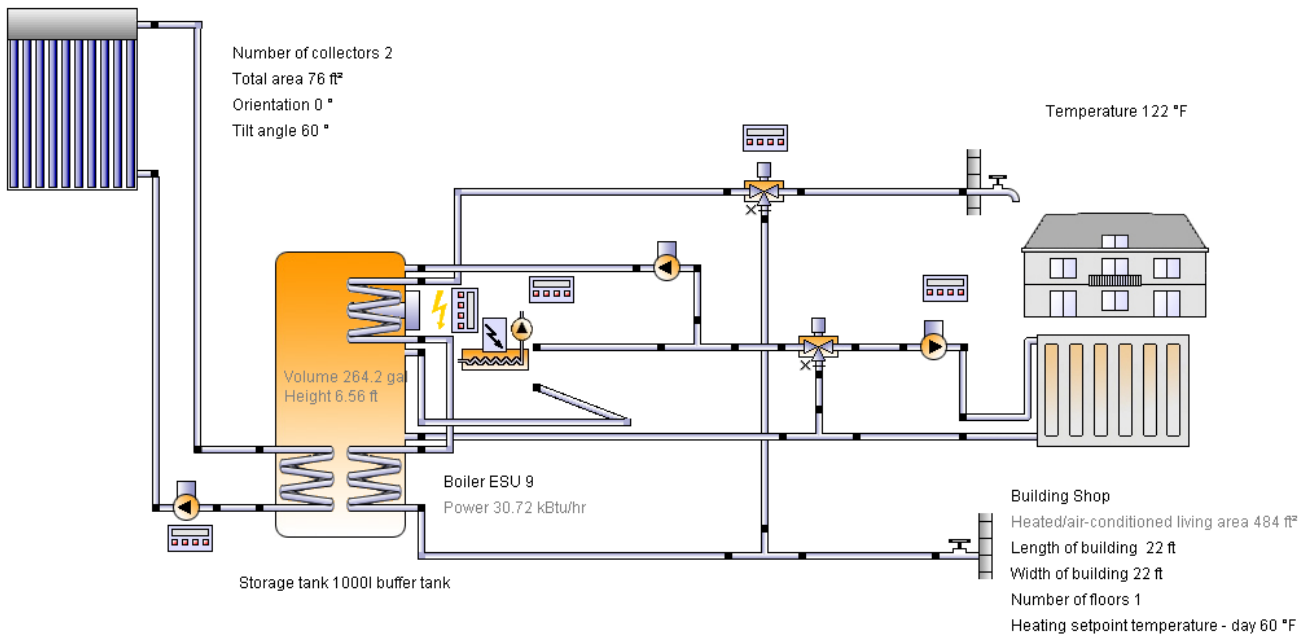


**Project**

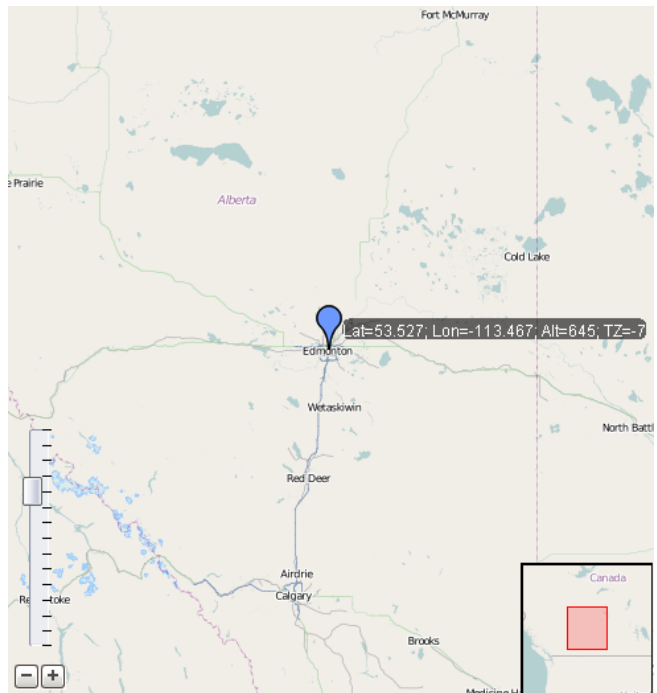
**9b: Space heating (solar thermal, modular heat generator)**



**Location of the system**

Edmonton  
 Longitude: -113.467°  
 Latitude: 53.527°  
 Elevation: 2,116 ft

**Map section**



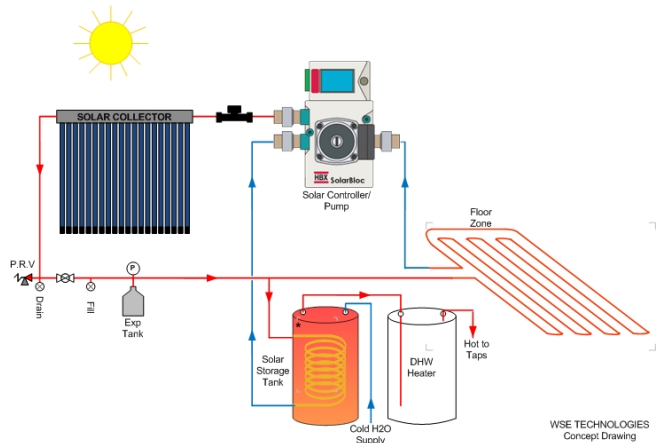
**This report has been created by:**

William Elliott  
 303 47 Str.E  
 S7K 5H2 Saskatoon

## Comments on the project

Budgetary price is based on using 2 WSE58 Super Tubes based on our January Special price of \$750 each. Sol0100 controller, variable speed pump, 3 way valve, btu meter and integrated controls \$995.  
 We are offering a new dissipator which could be used to heat the garage  
 Price I am using analysis is \$3200,

## Photograph of property



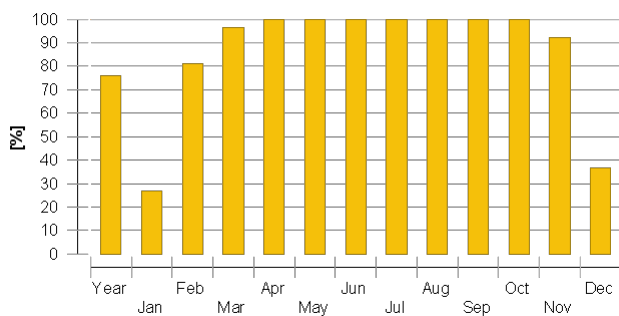
## System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	4,781.6 kBtu
Total energy consumption [Quse]	4,361.2 kBtu
System performance (Quse / Etot)	0.91
Comfort demand	Energy demand covered

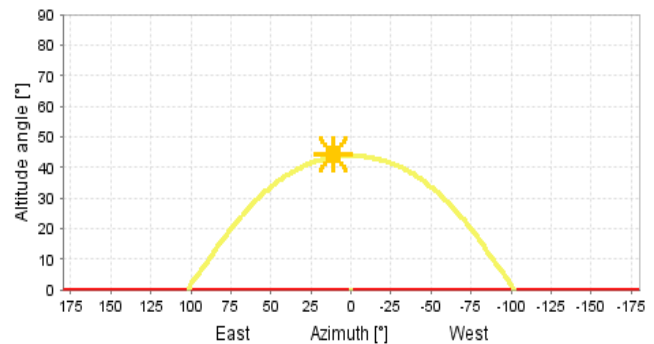
## Overview solar thermal energy (annual values)

Collector area	76 ft <sup>2</sup>
Solar fraction total	76%
Solar fraction hot water [SF <sub>n</sub> Hw]	0 %
Solar fraction building [SF <sub>n</sub> Bd]	0 %
Total annual field yield	11,444 kBtu
Collector field yield relating to gross area	151 kBtu/ft <sup>2</sup> /Year
Collector field yield relating to aperture area	168 kBtu/ft <sup>2</sup> /Year
Max. energy savings	11,444 kBtu
Max. reduction in CO <sub>2</sub> emissions	3,966.2 pound

## Solar fraction: fraction of solar energy to system [SF<sub>n</sub>]



## Horizon line



## Meteorological data-Overview

Outdoor temperature 24h	39.2 °F
Annual global irradiance	411.3 kBtu/ft <sup>2</sup>
Annual diffuse irradiance	154.6 kBtu/ft <sup>2</sup>

## Financial analysis - Solar thermal

Purchase costs	3,200 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	3,200 CAD
Annual fuel cost savings	670.785 CAD
Solar energy cost per kWh	0.03 CAD
Payback period	5 years
Present value of the system	73,419.281 CAD
Net present value	70,219.281 CAD

## Component overview (annual values)

<b>Boiler</b>	<b>ESU 9</b>	
Power	kBtu/hr	30.72
Total efficiency	%	82
Energy from/to the system [Qaux]	kBtu	3,623.6
Fuel and electrical energy consumption [Eaux]	kBtu	4,418.6
Energy savings solar thermal	kBtu	11,444
CO savings solar thermal	pound	3,966.2
Fuel savings solar thermal	kBtu	11,446.9

<b>Collector North America</b>	<b>WSE58Super Tube</b>	
Data Source		u138368
Number of collectors		2
Number of arrays		8
Total area	ft <sup>2</sup>	76
Total aperture area	ft <sup>2</sup>	68
Tilt angle	°	60
Orientation	°	0
Collector field yield [Qsol]	kBtu	11,444
Irradiation onto collector area [Esol]	kBtu	41,858.8
Collector efficiency [Qsol / Esol]	%	27.3
Direct irradiation after IAM	kBtu	31,079.7
Diffuse irradiation after IAM	kBtu	15,191.3

<b>Building</b>	<b>Shop</b>	
Heated/air-conditioned living area	ft <sup>2</sup>	484
Heating setpoint temperature	°F	61.5
Heating energy demand excluding DHW [Qdem]	kBtu	4,060.3
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft <sup>2</sup>	8.4
Solar gain through windows	kBtu	28,695.8
Total energy losses	kBtu	92,635.8

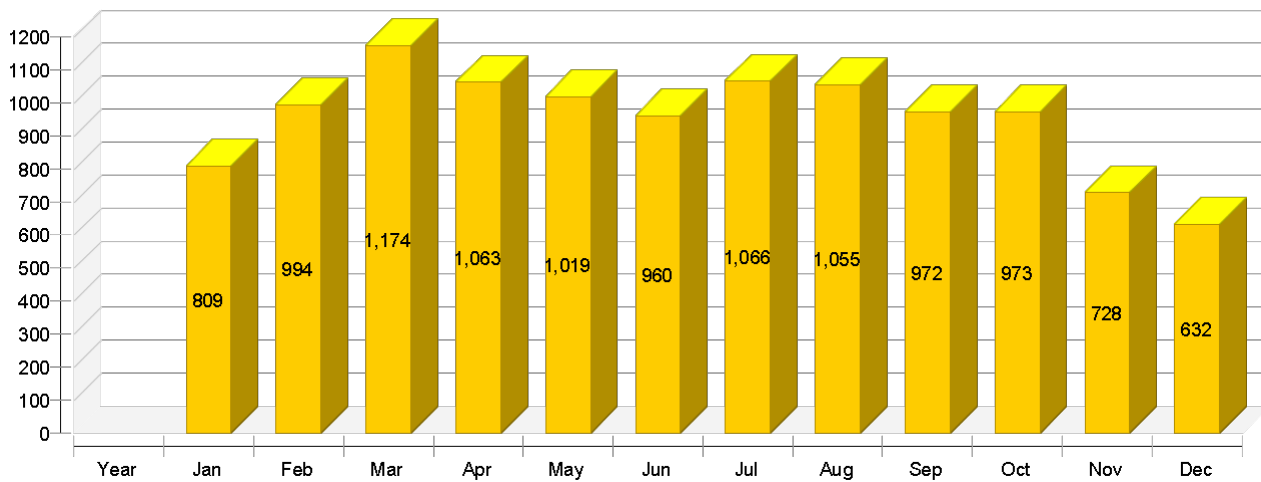
<b>Convector Floor heating</b>		<b>Radiator 1000W</b>	
Number of heating/cooling modules	-		10
Power per heating module under standard conditions	kBtu/hr		3
Nominal inlet temperature	°F		122
Nominal return temperature	°F		104
Net energy from/to heating/cooling modules	kBtu		4,262.6
<b>Hot water demand</b>		<b>Constant</b>	
Temperature setting	°F		122
<b>Pump Solar loop pump</b>		<b>Pump, small</b>	
Circuit pressure drop	psi		0.07
Flow rate	gpm		1.1
Fuel and electrical energy consumption [Epar]	kBtu		265.6
<b>Pump Space heating loop pump</b>		<b>Pump, medium</b>	
Circuit pressure drop	psi		1.406
Flow rate	gpm		2.9
Fuel and electrical energy consumption [Epar]	kBtu		54
<b>Pump Loading tank pump</b>		<b>Pump, medium</b>	
Circuit pressure drop	psi		1.871
Flow rate	gpm		4.4
Fuel and electrical energy consumption [Epar]	kBtu		43.5
<b>Storage tank Buffer tank</b>		<b>1000l buffer tank</b>	
Volume	gal		264.2
Height	ft		6.56
Material			Steel
Insulation			Rigid PU foam
Thickness of insulation	in		3.1
Heat loss	kBtu		3,749.8
Connection losses	kBtu		4,007.7

## Loop

Solar loop		
Fluid mixture		Ethylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	7.5
Pressure on top of the circuit	psi	58.016

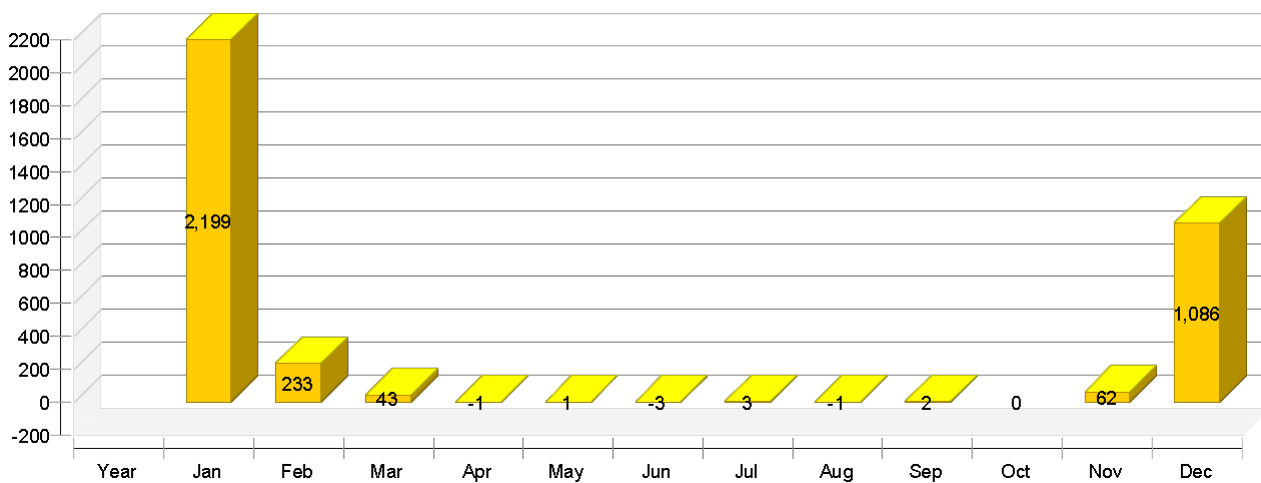
## Solar thermal energy to the system [Qsol]

kBtu



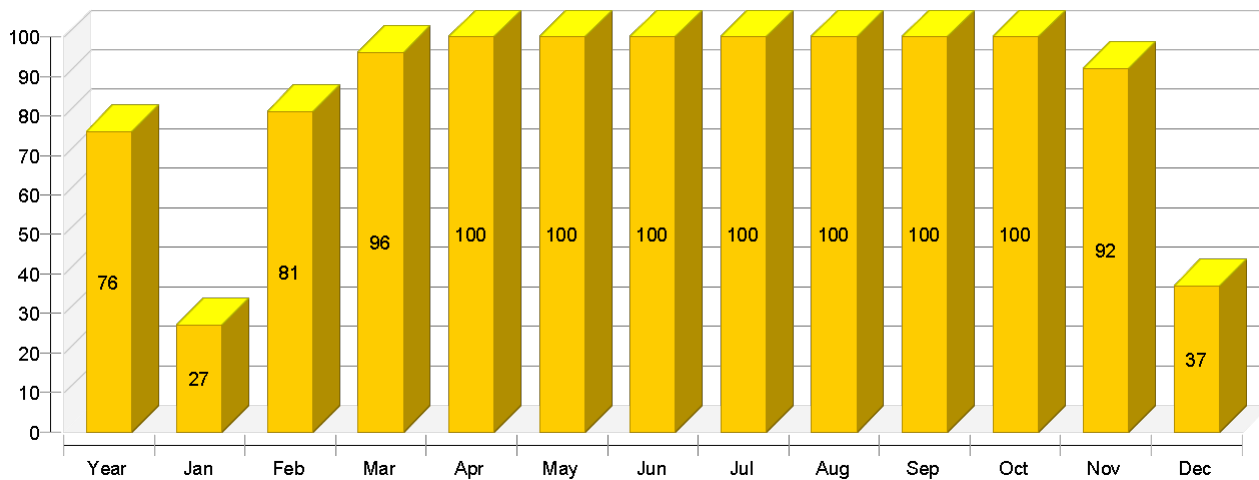
## Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu



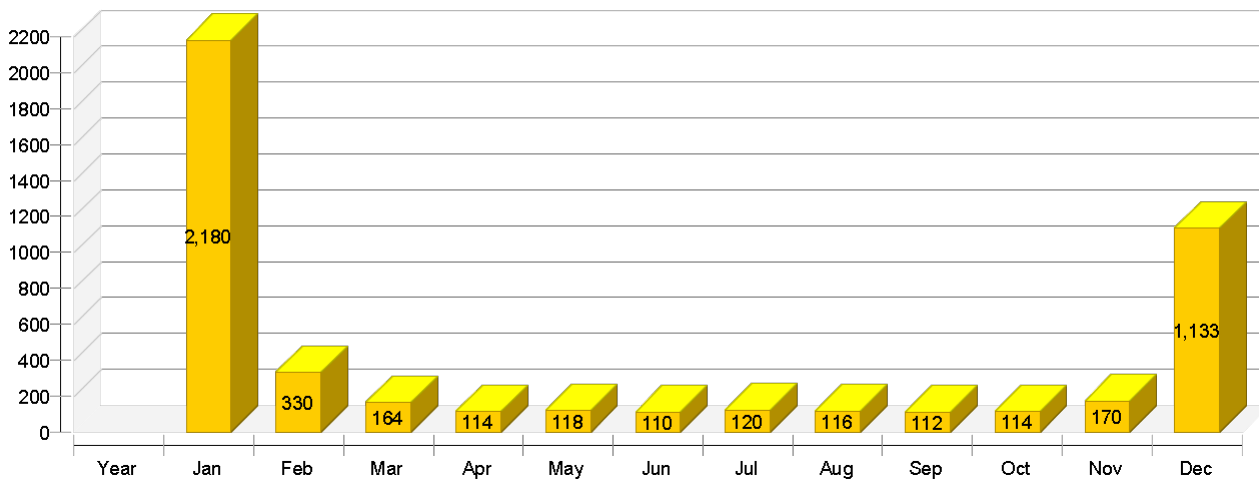
**Solar fraction: fraction of solar energy to system [SFn]**

**%**



**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	11444	809	994	1174	1063	1019	960	1066	1055	972	973	728	632
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**Heat generator energy to the system (solar thermal energy not included) [Qaux]**

kBtu	3624	2199	233	43	-1	1	-3	3	-1	2	0	62	1086
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**Heat generator fuel and electrical energy consumption [Eaux]**

kBtu	4419	2102	299	137	90	95	88	97	92	92	94	148	1086
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**Solar fraction: fraction of solar energy to system [SFn]**

%	76	26.9	81	96.5	100	99.9	100	99.7	100	99.8	100	92.2	36.8
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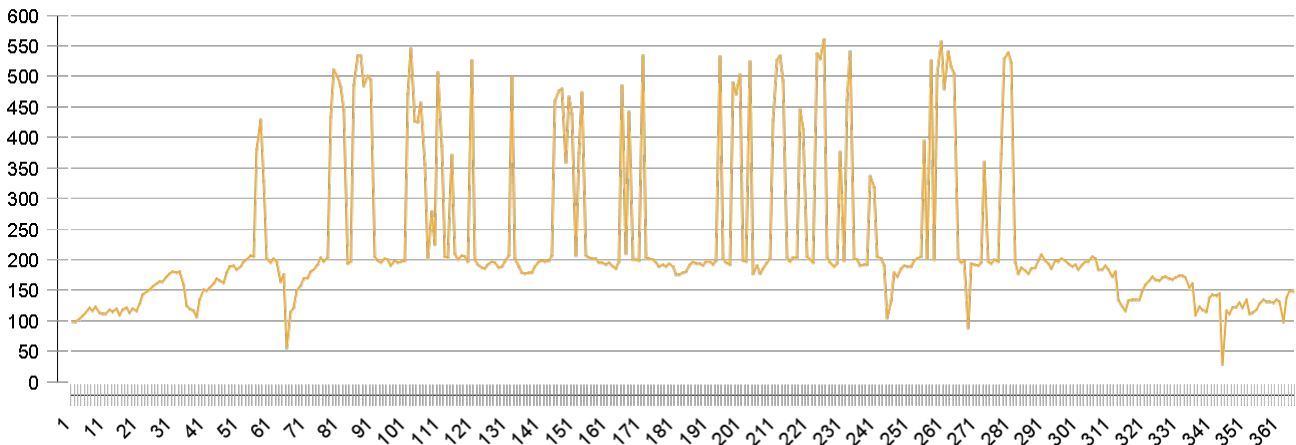
**Total fuel and/or electrical energy consumption of the system [Etot]**

kBtu	4782	2180	330	164	114	118	110	120	116	112	114	170	1133
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Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<b>Irradiation onto collector area [Esol]</b>													
kBtu	41859	2553	3257	4517	4197	3951	3725	4083	4064	3632	3428	2404	2049
<b>Electrical energy consumption of pumps [Epar]</b>													
kBtu	363	78	31	28	24	24	23	23	24	20	20	21	47
<b>Heat loss to indoor room (including heat generator losses) [Qint]</b>													
kBtu	10383	469	748	954	1018	997	982	999	1044	944	955	755	519
<b>Heat loss to surroundings (without collector losses) [Qext]</b>													
kBtu	1565	105	134	158	160	146	138	130	142	123	136	108	86
<b>Total energy consumption [Quse]</b>													
kBtu	4361	2353	408	217	8	8	9	9	11	10	8	133	1185

## Collector North America

### Daily maximum temperature [ °F]



## Energy flow diagram

