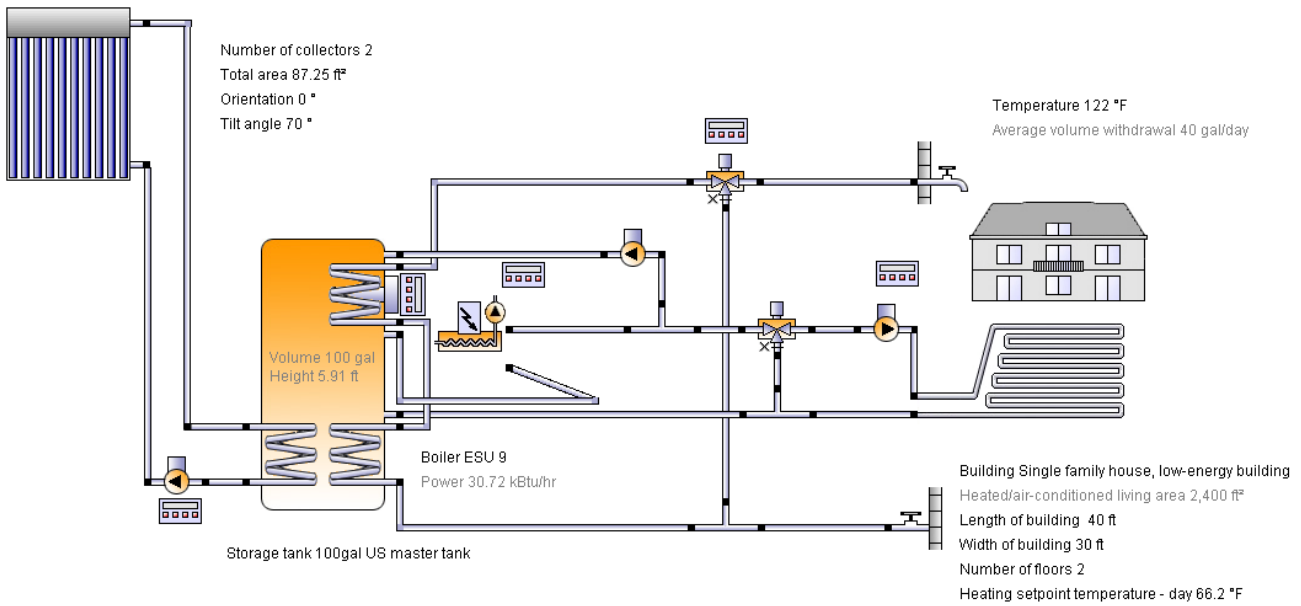


**Project**

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



**Location of the system**

**Map section**

St John's NFLD  
 Longitude: -52.866°  
 Latitude: 47.532°  
 Elevation: 525 ft

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**This report has been created by:**

Elliott William  
 303 47 Str.E  
 S7K 5H2 Saskatoon

**Comments on the project**

2 WSE58 ST dumping excess heat to heating radiator

**Photograph of property**



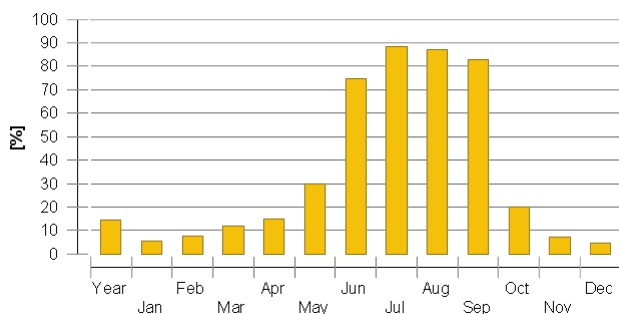
## System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	61,651.1 kBtu
Total energy consumption [Quse]	69,331.3 kBtu
System performance (Quse / Etot)	1.12
Comfort demand	Energy demand covered

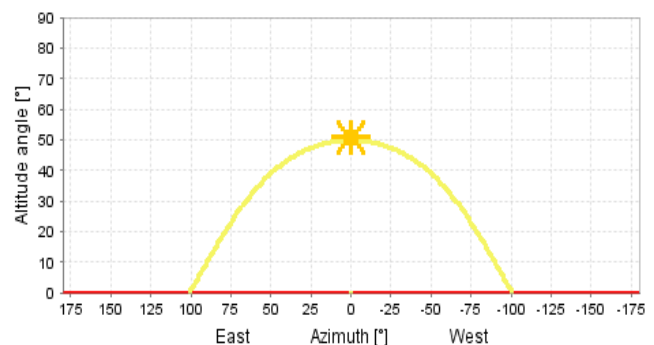
## Overview solar thermal energy (annual values)

Collector area	87 ft <sup>2</sup>
Solar fraction total	14.4%
Solar fraction hot water [SFnHw]	37.8 %
Solar fraction building [SFnBd]	8.6 %
Total annual field yield	10,728 kBtu
Collector field yield relating to gross area	123 kBtu/ft <sup>2</sup> /Year
Collector field yield relating to aperture area	131 kBtu/ft <sup>2</sup> /Year
Max. energy savings	10,727.8 kBtu
Max. reduction in CO2 emissions	3,718 pound

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



## Horizon line



## Meteorological data-Overview

Outdoor temperature 24h	41.6 °F
Annual global irradiance	366.3 kBtu/ft <sup>2</sup>
Annual diffuse irradiance	183.9 kBtu/ft <sup>2</sup>

## Financial analysis - Solar thermal

Purchase costs	3,000 CAD
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## Financial analysis - Solar thermal

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	3,000 CAD
Annual fuel cost savings	628.805 CAD
Solar energy cost per kWh	0.03 CAD
Payback period	5 years
Present value of the system	68,824.43 CAD
Net present value	65,824.43 CAD

## Component overview (annual values)

Boiler	ESU 9	
Power	kBtu/hr	30.72
Total efficiency	%	107.3
Energy from/to the system [Qaux]	kBtu	64,004.9
Fuel and electrical energy consumption [Eaux]	kBtu	59,652.2
Energy savings solar thermal	kBtu	10,727.8
CO savings solar thermal	pound	3,718
Fuel savings solar thermal	kBtu	10,730.6

Collector North America	WSE58ST	
Data Source		u138368
Number of collectors		2
Number of arrays		8
Total area	ft <sup>2</sup>	87.25
Total aperture area	ft <sup>2</sup>	81.698
Tilt angle	°	70
Orientation	°	0
Collector field yield [Qsol]	kBtu	10,727.8
Irradiance onto collector area [Esol]	kBtu	33,341.4
Collector efficiency [Qsol / Esol]	%	32.2
Direct irradiance after IAM	kBtu	19,544.5
Diffuse irradiance after IAM	kBtu	16,816.2

Building	Single family house, low-energy building	
Heated/air-conditioned living area	ft <sup>2</sup>	2,400
Heating setpoint temperature	°F	66.2
Heating energy demand excluding DHW [Qdem]	kBtu	61,463.9
Specific heating energy demand excluding DHW [Qdem]	kBtu/ft <sup>2</sup>	25.6
Solar gain through windows	kBtu	67,754.5
Total energy losses	kBtu	156,844.3

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	61,413.7

Hot water demand	Constant	
Withdraw volume	gal/d	40.2
Temperature setting	°F	122
Energy from/to the system [Quse]	kBtu	7,867.4

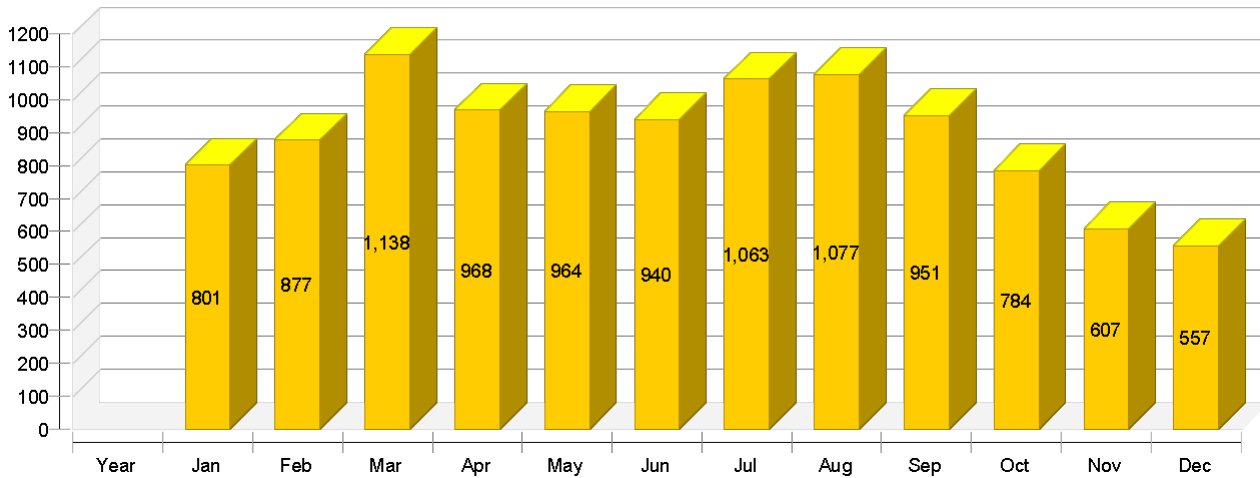
<b>Pump Solar loop pump</b>	<b>Pump, small</b>	
Circuit pressure drop	psi	0.103
Flow rate	gpm	1.3
Fuel and electrical energy consumption [Epar]	kBtu	288.5
<b>Pump Space heating loop pump</b>	<b>Pump, medium</b>	
Circuit pressure drop	psi	1.033
Flow rate	gpm	3.9
Fuel and electrical energy consumption [Epar]	kBtu	986.5
<b>Pump Loading tank pump</b>	<b>Pump, medium</b>	
Circuit pressure drop	psi	1.59
Flow rate	gpm	4.4
Fuel and electrical energy consumption [Epar]	kBtu	723.9
<b>Storage tank Buffer tank</b>	<b>100gal US master tank</b>	
Volume	gal	100
Height	ft	5.91
Material		Enameled steel
Insulation		Flexible polyurethane foam
Thickness of insulation	in	4
Heat loss	kBtu	1,008.2
Connection losses	kBtu	1,209.3

## Loop

<b>Solar loop</b>		
Fluid mixture		Ethylene mixture
Fluid concentration	%	33.3
Fluid domains volume	gal	4.8
Pressure on top of the circuit	psi	58.016

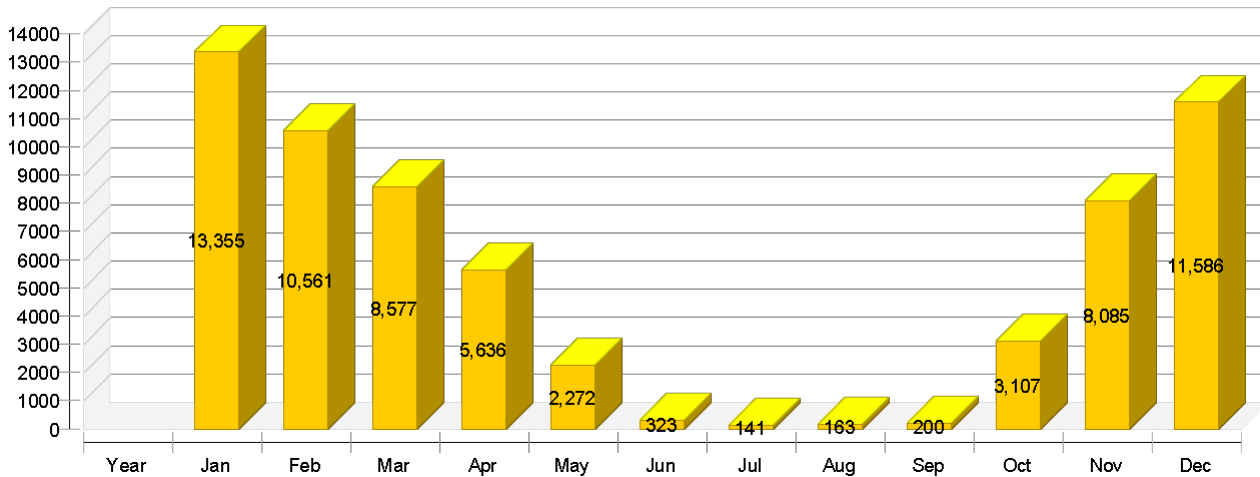
Solar thermal energy to the system [Qsol]

kBtu



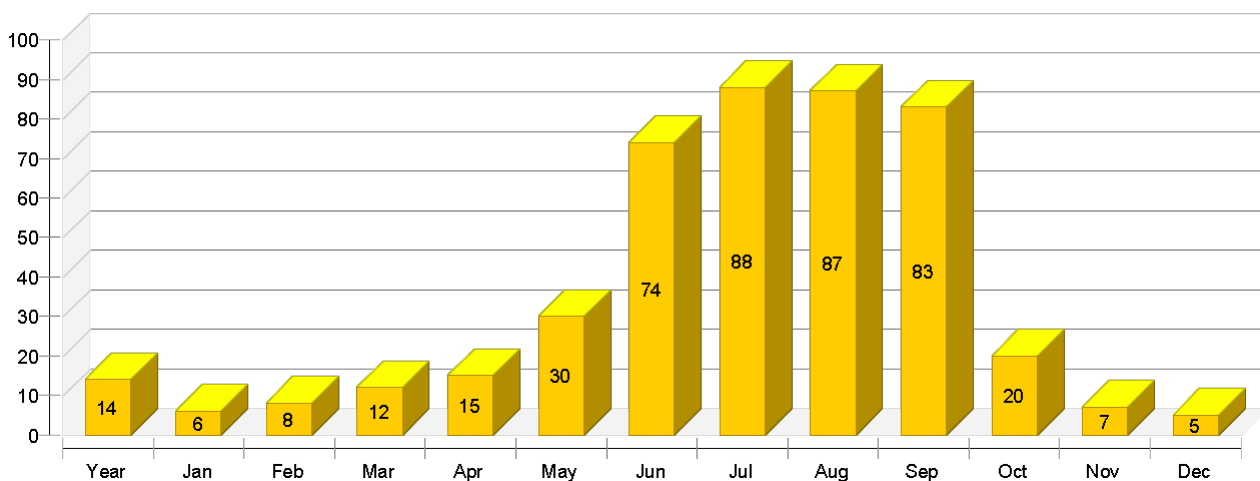
Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu



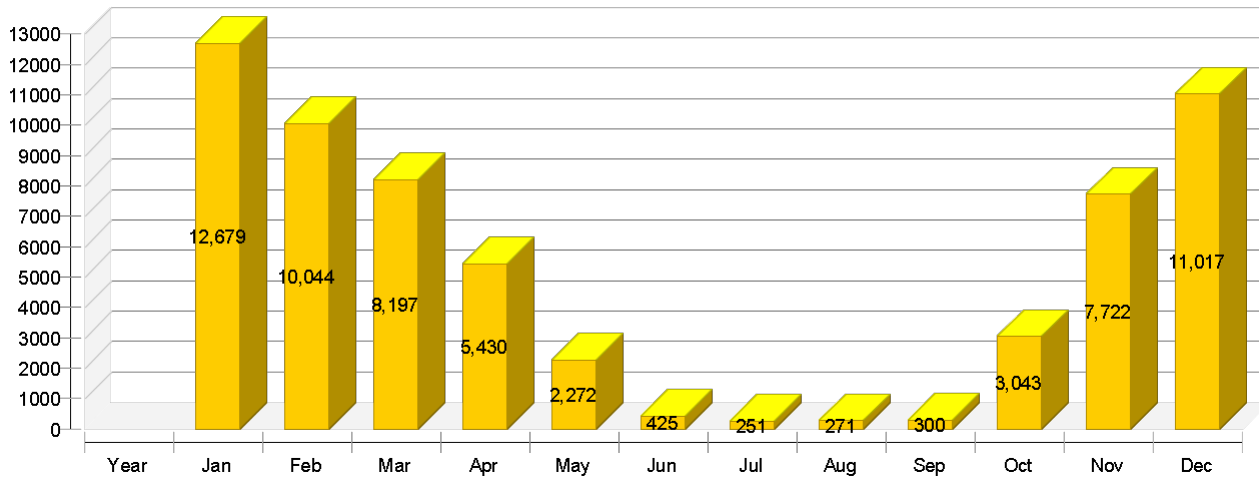
Solar fraction: fraction of solar energy to system [SFn]

%



## 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	10728	801	877	1138	968	964	940	1063	1077	951	784	607	557
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### Heat generator energy to the system (solar thermal energy not included) [Qaux]

kBtu	64005	13355	10561	8577	5636	2272	323	141	163	200	3107	8085	11586
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### Heat generator fuel and electrical energy consumption [Eaux]

kBtu	59652	12300	9739	7938	5252	2185	391	219	243	274	2940	7486	10686
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### Solar fraction: fraction of solar energy to system [SFn]

%	14.4	5.7	7.7	11.7	14.7	29.8	74.4	88.3	86.9	82.6	20.2	7	4.6
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### Total fuel and/or electrical energy consumption of the system [Etot]

kBtu	61651	12679	10044	8197	5430	2272	425	251	271	300	3043	7722	11017
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### Irradiance onto collector area [Esol]

kBtu	33341	2385	2590	3429	3045	3135	3156	3380	3407	3032	2358	1770	1653
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### Electrical energy consumption of pumps [Epar]

kBtu	1999	379	305	258	178	87	34	32	29	26	103	236	331
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### Heat loss to indoor room (including heat generator losses) [Qint]

kBtu	2098	-375	-221	-14	145	396	513	546	580	553	316	-59	-282
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### Heat loss to surroundings (without collector losses) [Qext]

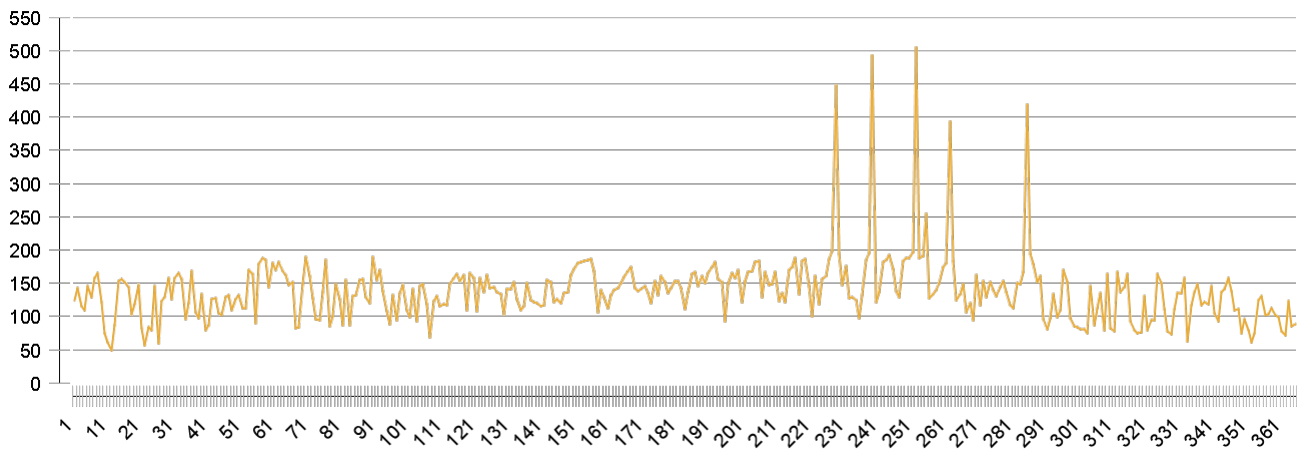
kBtu	1009	76	84	106	91	93	94	94	95	95	74	52	55
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### Total energy consumption [Quse]

kBtu	69331	13780	11057	9224	6182	2746	784	681	666	629	3436	8348	11798
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## Collector North America

Daily maximum temperature [ °F]



## Energy flow diagram

