



# RETScreen® International

www.retscreen.net

Clean Energy Project Analysis Software

## Project information

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Project name	Manitoulin Residential Solar Water Heating
Project location	Manitoulin Island, Ontario Canada
Prepared for	Residents of Manitoulin Island
Prepared by	Glenn Black, Pioneer Systems
Project type	Heating
Technology	Solar water heater
Analysis type	Method 1
Heating value reference	Higher heating value (HHV)
Show settings	<input checked="" type="checkbox"/>
Language - Langue	English - Anglais
User manual	English - Anglais
Currency	\$
Units	Metric units

## Site reference conditions

[Select climate data location](#)

Climate data location	Gore Bay Airport
Show data	<input checked="" type="checkbox"/>

	Unit	Climate data location	Project location
Latitude	°N	45.9	45.9
Longitude	°E	-82.6	-82.6
Elevation	m	193	193
Heating design temperature	°C	-21.4	
Cooling design temperature	°C	25.5	
Earth temperature amplitude	°C	21.4	

Month	Air temperature	Relative humidity	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days	Cooling degree-days
	°C	%	kWh/m <sup>2</sup> /d	kPa	m/s	°C	°C-d	°C-d
January	-10.0	81.0%	1.56	99.2	5.0	-11.5	868	0
February	-9.6	79.0%	2.67	99.3	4.4	-9.8	773	0
March	-4.0	78.0%	4.16	99.2	4.7	-3.9	682	0
April	3.8	72.5%	5.07	99.1	4.7	5.2	426	0
May	10.4	70.0%	5.94	99.2	4.2	11.4	236	12
June	15.3	72.5%	6.43	99.1	3.9	16.0	81	159
July	19.1	72.5%	6.36	99.2	3.9	17.9	0	282
August	18.2	76.0%	5.19	99.3	3.9	16.7	0	254
September	13.8	77.0%	3.65	99.4	4.4	12.5	126	114
October	8.1	76.5%	2.37	99.3	5.0	6.7	307	0
November	1.9	80.0%	1.36	99.2	5.3	0.0	483	0
December	-5.5	82.0%	1.13	99.2	5.3	-7.8	729	0
<b>Annual</b>	5.2	76.4%	3.83	99.2	4.6	4.5	4,711	821
Measured at	m				10.0	0.0		



[Complete Energy Model sheet](#)

RETScreen Energy Model - Heating project

Heating project					
Technology					
<b>Solar water heater</b>					
<b>Load characteristics</b>					
Application	<input checked="" type="checkbox"/> Swimming pool <input checked="" type="checkbox"/> Hot water				
	<b>Unit</b>	<b>Base case</b>	<b>Proposed case</b>		
Load type		House			
Number of units	Occupant	4			
Occupancy rate	%	100%			
Daily hot water use - estimated	L/d	240			
Daily hot water use	L/d	240	240		
Temperature	°C	45	45		
Operating days per week	d	7	7		
<input type="checkbox"/> <b>Percent of month used</b>					
Supply temperature method		User-defined			
Water temperature - minimum	°C	1			
Water temperature - maximum	°C	4			
	<b>Unit</b>	<b>Base case</b>	<b>Proposed case</b>	<b>Energy saved</b>	<b>Incremental initial costs</b>
Heating	MWh	4.3	4.3	0%	\$ 300
<b>Resource assessment</b>					
Solar tracking mode		Fixed			
Slope	°	45.0			
Azimuth	°	0.0			
<input type="checkbox"/> <b>Show data</b>					
<b>Solar water heater</b>					
Type	Glazed				\$ 1,250
Manufacturer	EnerWorks				
Model	COL-4x8-NL-SG1-SH10				
Gross area per solar collector	m <sup>2</sup>	2.87			
Aperture area per solar collector	m <sup>2</sup>	2.69			
Fr (tau alpha) coefficient		0.70			
Fr UL coefficient	(W/m <sup>2</sup> )/°C	4.04			
Temperature coefficient for Fr UL	(W/m <sup>2</sup> )/°C <sup>2</sup>	0			
Number of collectors		2		2	
Solar collector area	m <sup>2</sup>	5.74			
Capacity	kW	3.77			
Miscellaneous losses	%	2.0%			
<b>Balance of system &amp; miscellaneous</b>					
Storage		Yes			
Storage capacity / solar collector area	L/m <sup>2</sup>	50			
Storage capacity	L	270.0			
Heat exchanger	yes/no	Yes			
Heat exchanger efficiency	%	98.0%			
Miscellaneous losses	%	2.0%			
Pump power / solar collector area	W/m <sup>2</sup>	0.37			
Electricity rate	\$/kWh	0.120			
<b>Summary</b>					
Electricity - pump	MWh	0.0			
Heating delivered	MWh	3.4			
Solar fraction	%	78%			
<input type="checkbox"/> <b>Heating system</b>					
Project verification		<b>Base case</b>	<b>Proposed case</b>		
Fuel type		Electricity	Electricity		
Seasonal efficiency		91%	91%		
Fuel consumption - annual	MWh	4.8	1.0		
Fuel rate	\$/kWh	0.120	0.120		
Fuel cost	\$	573	125		

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**Emission Analysis**

Base case electricity system (Baseline)		GHG emission factor (excl. T&D)	T&D losses	GHG emission factor
Country - region	Fuel type	tCO2/MWh	%	tCO2/MWh
Canada	All types	0.211	15.0%	0.248

**GHG emission**

Base case	tCO2	1.2
Proposed case	tCO2	0.3

<b>Gross annual GHG emission reduction</b>	tCO2	0.9
GHG credits transaction fee	%	2.0%

**Net annual GHG emission reduction** tCO2 0.9 is equivalent to 0.2 Cars & light trucks not used

**GHG reduction income**

GHG reduction credit rate	\$/tCO2	12.00
GHG reduction credit duration	yr	20
GHG reduction credit escalation rate	%	3.0%

**Financial Analysis**

**Financial parameters**

Inflation rate	%	3.0%
Project life	yr	25
Debt ratio	%	0%

**Initial costs**

Heating system	\$	1,550	100.0%
Other	\$		0.0%
<b>Total initial costs</b>	\$	1,550	100.0%

**Incentives and grants**

	\$		0.0%
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**Annual costs and debt payments**

O&M (savings) costs	\$	50
Fuel cost - proposed case	\$	126
Other	\$	
<b>Total annual costs</b>	\$	176

**Annual savings and income**

Fuel cost - base case	\$	573
GHG reduction income - 20 yrs	\$	11
Other	\$	
<b>Total annual savings and income</b>	\$	584

**Financial viability**

Pre-tax IRR - assets	%	30.0%
Simple payback	yr	3.8
Equity payback	yr	3.6

