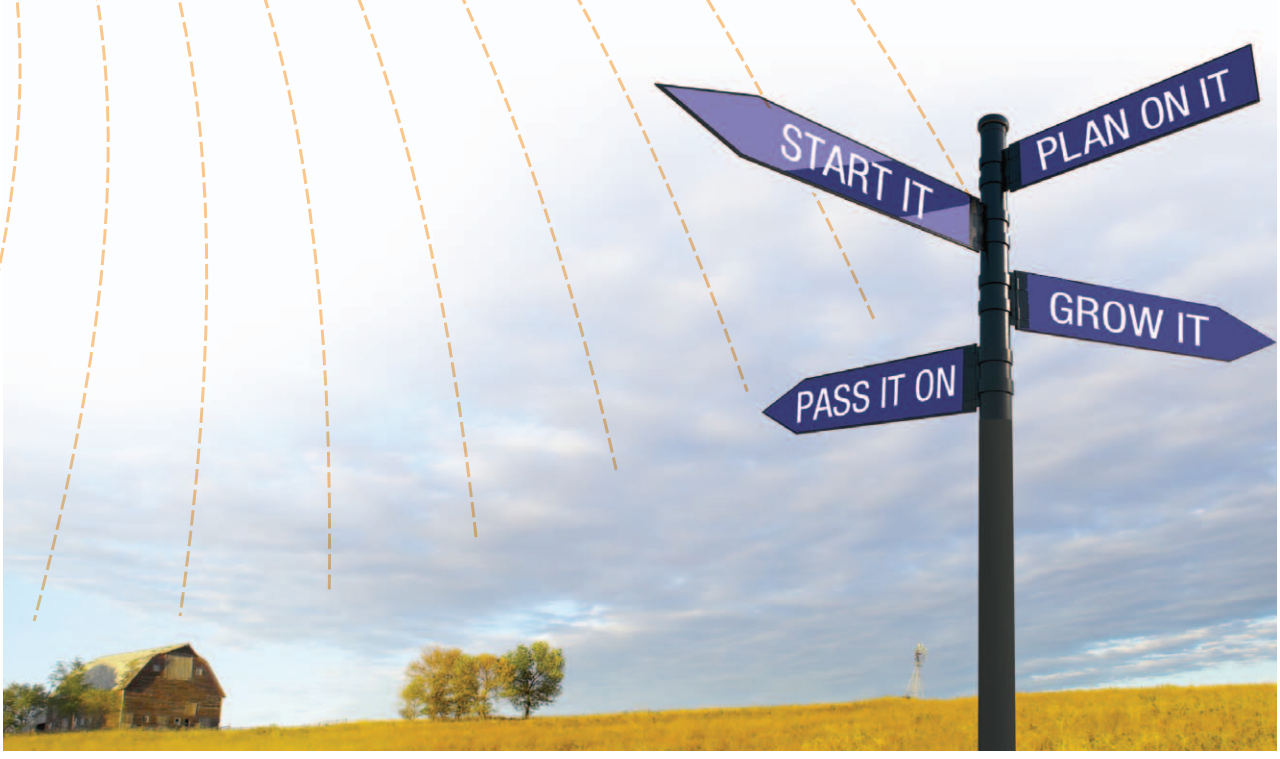
Guidelines for Estimating Solar Thermal Energy Production Costs 2012 in Manitoba



Manitoba

Guidelines For Estimating

Solar Thermal Energy Production Costs

Based on 4 (7500 BTU) Tube Type Solar Collectors

Date: November, 2012

This guide is designed to provide you with planning information and a format for calculating costs of production for on-farm solar thermal energy production for water or space heating. Sale of excess heat energy beyond consumption are not included. Adjustments will be necessary when applying these figures to your own enterprise.

The budget estimates are based on a number of assumptions which are clearly defined in the supporting pages. Input costs are based on industry information. Proper equipment management in the production process and compliance to all applicable environmental requirements is assumed.

Disclaimer: This budget is only a guide and is not intended as an in depth study of the cost of production of the Manitoba solar thermal energy industry. Interpretation and utilization of this information is the responsibility of the user. If you require assistance with developing your individual budget, please contact your local MAFRI Business Development Specialist.

On-Farm 4 x 7500 BTU Solar Thermal Energy Production Costs November, 2012

Based on a $12100 total capital cost & $0.0694 kwHr Manitoba Hydro rate

A. Energy Produced - estimated range	**Minimum**		**Maximum**	
1.01 Total Annual Energy Produced	**43,471,500**	**BTU**	**65,371,500**	**BTU**
	12,737	**kWHr**	**19,154**	**kWHr**
1.02 Cost / installed kW - net energy output	**$8,322**		**$5,534**	

B. Operating Costs	**Cost/kWHr**	**Cost/kWHr**	**Total Cost**	**Your Cost**
2.01 Maintenance	$0.0024	$0.0016	$30	
2.02 Insurance	$0.0048	$0.0032	$61	
2.03 Property Taxes	$0.0000	$0.0000	$0	
Subtotal Operating Costs	**$0.0071**	**$0.0048**	**$91**	
2.04 Operating Interest	$0.0002	$0.0002	$3	
Total Operating Costs	**$0.0074**	**$0.0049**	**$94**	
C. Fixed Costs				
3. Depreciation				
3.01 Buildings	$0.0013	$0.0009	$17	
3.02 Machinery & Equipment	$0.0407	$0.0270	$518	
4. Investment				
4.01 Buildings	$0.0008	$0.0005	$10	
4.02 Machinery & Equipment	$0.0124	$0.0082	$158	
4.03 Land	$0.0000	$0.0000	$0	
Total Fixed Costs	**$0.0552**	**$0.0367**	**$703**	
Total Operating and Fixed Costs	**$0.0626**	**$0.0416**	**$797**	
D. Labour	$0.0000	$0.0000	$0	
Total Cost of Production $ per kWHr	**$0.0626**	**$0.0416**	**$797**	
or				
Total Cost of Production $ per million BTU	**$18.3339**	**$12.1919**	**$797**	

E. Value	**Based on: 12737 kWHr per year**		**19154 kWHr per year**		
Total Value	**Per kWHr**	**Total**	**Per kWHr**	**Total**	
5.01 Estimated Annual On-Farm Energy Valu	**$0.0738**	**$941**	**$0.0738**	**$1,414**	
Total Value - Cost of Production	**$0.0113**	**$144**	**$0.0322**	**$617**	

	Based on: 12737 kWHr per year	**19154 kWHr per year**	
Breakeven price	**$kWHr**	**$kWHr**	
A. Operating Costs	$0.0074	$0.0049	
B. Operating & labour Costs	$0.0074	$0.0049	
C. Operating & Fixed Costs	$0.0626	$0.0416	
D. Operating, Fixed & Labour Costs	$0.0626	$0.0416	
Breakeven Price $/kWHr = Cost ÷ kWHrs			
Estimated Return on Assets (ROA)			
without MB Hydro rate inflation	7.8% * [1]	11.7%	
with 2.9% annual MB Hydro rate inflation	10.8% * [2]	16.2%	
Simple Payback Calculation			
A. Without MB Hydro rate inflation	12.9 Years[1]	8.6 Years	
B. With 2.9% annual MB Hydro rate inflation	9.3 Years[2]	6.2 Years	
Desired Simple Payback = 5 Years			
C. Max.Capital Cost w/o Hydro rate inflation	$4,703 * [1]	$7,072	
D. Max. Capital Cost w/ 2.9% Hydro inflation	$6,516 * [2]	$9,799	

1. Based on Hydro rate @ $0.0694 per kWh plus PST & GST.
2. Based on 20 year average Hydro rate @ $0.096 per kWh plus PST & GST.

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Solar Thermal Energy Production Costs - Input

Assumptions

1. This budget outlines the cost of production for a on-farm solar thermal hot water production operatio
2. Buildings and equipment are valued at new cost.
3. Solar Insolation is based on Natural Resources Canada solar resource maps.
4. Annual BTU production could vary from significantly from minimum or maximum estimates.
5. All heat energy produced is for farm use only.

Solar Thermal Energy Production

Solar collector output per hour - BTU	7,500	
Number of solar collectors installed in heat syste	4	
Max. Solar Insolation (hrs/day or kWh/m^2/day)	5.97	
Min. Solar Insolation (hrs/day or kWh/m^2/day)	3.97	
Capital incentive or grant	$0	
MB Hydro residential rate	$0.0694	/ kWhr
Manitoba Sales Tax on Hydro	1.4	%
Federal GST Tax	5.0	%
Estimated Hydro rate annual inflation	2.9	%

Other Operating Costs

Maintenance	0.25	%
Labour Rate	$17.50	/ hour
Hours inspection per week	0.00	
Insurance	0.5	%
Property taxes	0.0	%
Investment Rate	2.50	%
Operating Interest Rate	5.50	%
Expected Solar Thermal Equipment Lifespan	20	years
Desired Simple Payback	5.0	years

Capital Costs

Buildings	Original Value	Salvage Value	Useful Life
Collector Mounts / Racks	$400	30 %	25 years
Collector Mounts installation	$200	30 %	25 years
Total	**$600**	**30.0** %	**25.0** years
Machinery & Equipment			
Solar Collector and Controllers	$10,700	10 %	20 years
Heat System (installation)	$800	10 %	20 years
Capital grant or incentive	$0		
Total	**$11,500**	**10.0** %	**20.0** years
Total Bldg., Mach. & Equip	**$12,100**		
Total Land Value	$0		
Total Capital Investment	**$12,100**		

Assumptions

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Solar Thermal Energy Production Worksheet

A. Energy Produced

1.01 Minimum Annual Production

		7,500	Collector output (BTU/hr)	
	x	4	Collectors (intalled/system)	
	x	3.97	Solar Insolation (hrs/day)	
	x	365	Days per year	
Total	**=**	**43,471,500**	**BTU per Year**	
	÷	3,413	kWh per BTU	
Total	**=**	**12,737**	**kWh per Year**	

Maximum Annual Production

		7,500	Collector output (BTU/hr)	
	x	4	Collectors (intalled/system)	
	x	5.97	Solar Insolation (hrs/day)	
	x	365	Days per year	
Total	**=**	**65,371,500**	**BTU per Year**	
	÷	3,413	kWh per BTU	
Total	**=**	**19,154**	**kWh per Year**	

1.02 Cost per installed kW - net energy output (minimum estimated annual production)

		12,737	kWh per Year	
	÷	365	Days per year	
	÷	24	Days per year	
		1.4540	Net energy output (kW)	
		$12,100	Total solar thermal installed cost	
	÷	1.4540	Net energy output (kW)	
Total	**=**	**$8,321.87**	**Cost per installed kW**	

Cost per installed kW - net energy output (maximum estimated annual production)

		19,154	kWh per Year	
	÷	365	Days per year	
	÷	24	Days per year	
		2.1865	Net energy output (kW)	
		$12,100	Total solar thermal installed cost	
	÷	2.1865	Net energy output (kW)	
Total	**=**	**$5,533.98**	**Cost per installed kW**	

B. Operating Costs

2.01 Maintenance

		$600	capital cost - buildings	
	+	$11,500	capital cost - equipment	
	=	$12,100	Total bldg. & equipment	
	x	0.25%	Maintenance rate	
	=	**$30**	**Total Maintenance**	

2.02 Insurance

$600	capital cost - buildings	
+ $11,500	capital cost - equipment	
= $12,100	Total bldg. & equipment	
x 0.5%	Insurance rate	
= $61	**Total Insurance**	

2.03 Property Taxes

$600	capital cost - buildings	
+ $0	capital cost - land	
= $600	Total bldg. & land	
x 0.0%	Property tax rate	
= $0	**Total Property tax**	

2.04 Operating Interest

(Operating interest is charged on one half of the subtotal operating costs)

$91	subtotal operating costs	
÷ 2.00	average	
x 5.50	% operating interest rate	
= $3	**Operating Interest**	

Capital Costs

Buildings		
Collector Mounts / Racks	$400	
Collector Mounts installation	$200	
Total Building Cost	**$600**	
Machinery & Equipment		
Solar Collector and Controllers	$10,700	
Heat System (installation)	$800	
Capital grant or incentive	$0	
Total Machinery & Equipment Cost	**$11,500**	
Total Bldg., Mach. & Equip.	**$12,100**	
Total Land Value	**$0**	
Total Capital Investment	**$12,100**	

C. Fixed Costs

3. Depreciation $\frac{\text{Original Cost - Salvage Value}}{\text{Useful Life}}$

3.01 Buildings

$600	original cost	
- $180	salvage value	
÷ 25.00	years useful life	
= $17		

3.02 Machinery & Equipment

$11,500	original cost	
- $1,150	salvage value	
÷ 20.00	years useful life	
= $518		

4. Investment $\frac{\text{Original Cost + Salvage Value}}{}$ **x Investment Rate**

2

4.01 Buildings

	$600	original cost	
+	$180	salvage value	
÷	2.00	average	
x	2.50	% investment rate	
=	**$10**		

4.02 Machinery & Equipment

	$11,500	original cost	
+	$1,150	salvage value	
÷	2.00	average	
x	2.50	% investment rate	
=	**$158**		

4.03 Land

	$0	land	
x	2.50	% investment rate	
=	**$0**		

D. Labour

	x	0	Hours inspection per week	
	x	$17.50	Labour Rate per hour	
Total	**=**	**$0**	**Labour**	

5. Value

5.01 Minimum Estimated Annual On-Farm Energy value

		$0.0694	MB Hydro rate per kWHr	
	x	1.4%	Manitoba Sales Tax - Hydro	
	x	5.0%	Federal GST	
	x	12,737.0	kWHr energy produced/year	
Total	**=**	**$940.52**	**Energy Value**	

Maximum Estimated Annual On-Farm Energy value

		$0.0694	MB Hydro rate per kWHr	
	x	1.4%	Manitoba Sales Tax - Hydro	
	x	5.0%	Federal GST	
	x	19,153.7	kWHr energy produced/year	
Total	**=**	**$1,414.34**	**Energy Value**	

Summary Calculations

Future Estimated Average MB Hydro rate

$0.0962 MB Hydro rate per kWHr

(Based on 20 year average rates and 2.9% annual rate increase)

Future Estimated MB Hydro rate

$0.1229 MB Hydro rate per kWHr

(Rate in 20 years with 2.9% annual rate increase)

Future Minimum Estimated Average Annual On-Farm Energy value

		$0.0962	MB Hydro rate per kWHr	
	x	1.4%	Manitoba Sales Tax - Hydro	
	x	5.0%	Federal GST	
	x	12,737.0	kWHr energy produced/year	
Total	**=**	**$1,303.27**	**Energy Value**	

Future Maximum Estimated Average Annual On-Farm Energy value

	$0.0962	MB Hydro rate per kWHr	
x	1.4%	Manitoba Sales Tax - Hydro	
x	5.0%	Federal GST	
x	19,153.7	kWHr energy produced/year	
Total **=**	**$1,959.82**	**Energy Value**	

Estimated Return on Asset (ROA) - without MB Hydro rate inflation

$940.52	Energy Value - minimum range	
÷ $12,100	Total Capital Investment	
= 7.8%	**ROA**	

Estimated Return on Asset (ROA) - without MB Hydro rate inflation

$1,414.34	Energy Value - maximum range	
÷ $12,100	Total Capital Investment	
= 11.7%	**ROA**	

Estimated Return on Asset (ROA) - with 2.9% annual MB Hydro rate inflation

$1,303.27	Energy Value - minimum range	
÷ $12,100	Total Capital Investment	
= 10.8%	**ROA**	

Estimated Return on Asset (ROA) - with 2.9% annual MB Hydro rate inflation

$1,959.82	Energy Value - maximum range	
÷ $12,100	Total Capital Investment	
= 16.2%	**ROA**	

Simple Payback Calculation - without MB Hydro rate inflation

$12,100	Total Capital Investment	
÷ $941	Energy Value - minimum range	
= 12.9	**Years Payback**	

Simple Payback Calculation - without MB Hydro rate inflation

$12,100	Total Capital Investment	
÷ $1,414	Energy Value - maximum range	
= 8.6	**Years Payback**	

Simple Payback Calculation- with 2.9% annual MB Hydro rate inflation

$12,100	Total Capital Investment	
÷ $1,303	Energy Value - minimum range	
= 9.3	**Years Payback**	

Simple Payback Calculation- with 2.9% annual MB Hydro rate inflation

$12,100	Total Capital Investment	
÷ $1,960	Energy Value - maximum range	
= 6.2	**Years Payback**	

For further information contact your local MAFRI office.

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For more information

- Contact your local Manitoba Agriculture, Food and Rural Initiatives (MAFRI) Growing Opportunities (GO) Office.
- Visit us at **manitoba.ca/agriculture**.

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