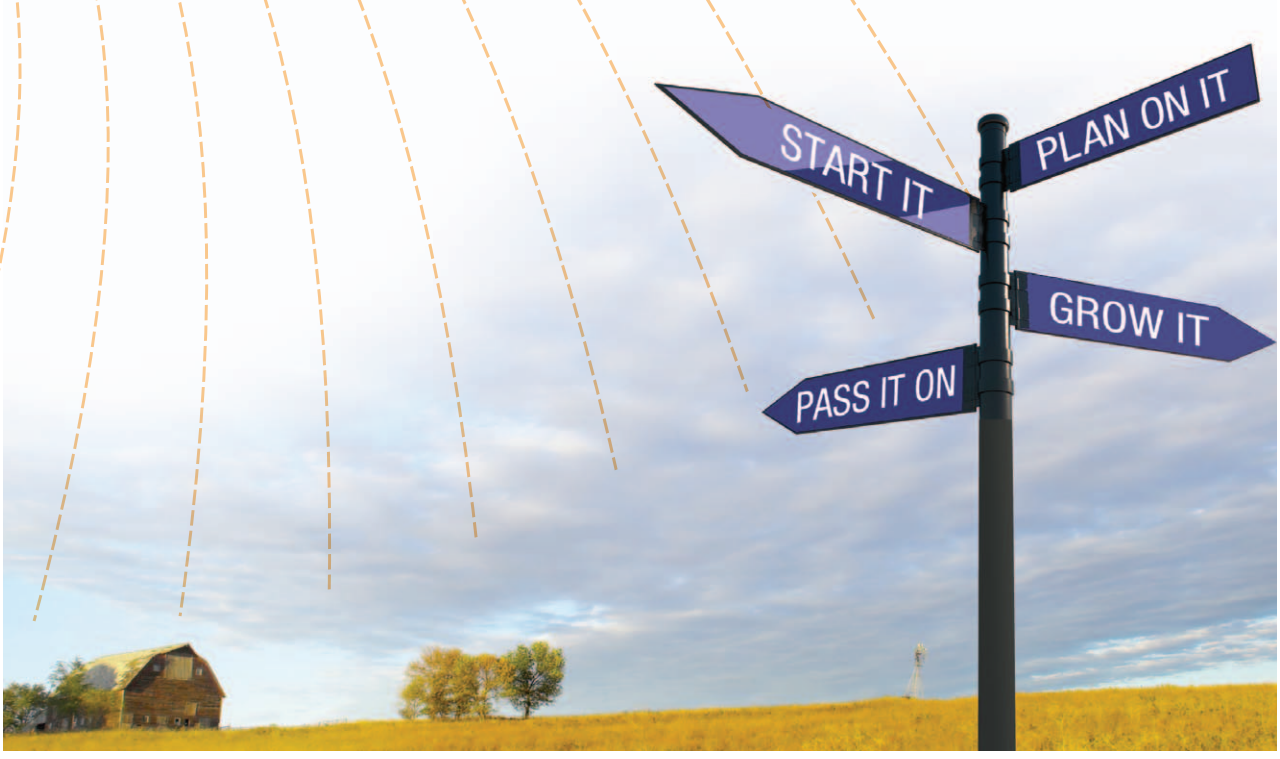
Guidelines for Estimating On-Farm Wind Energy Production Costs 2012

in Manitoba



Manitoba

Guidelines For Estimating

On-Farm Wind Energy Production Costs

Based on 3.5 kW wind turbine

Date: November, 2012

This guide is designed to provide you with planning information and a format for calculating costs of production for on-farm wind power production. Sale of electricty excess power 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 wind power 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 3.5 kW Wind Turbine Production Costs November, 2012

Based on a $30000 total capital cost & $0.0694 kwHr Manitoba Hydro rate

A. Energy Produced - estimated range	Minimum		Maximum	
1.01 Total Annual Electricity Produced	4,273	kWHr	10,682	kWHr
Capacity Factor	13.94%		34.84%	
1.02 Cost / installed kW - net power output	$61,506		$24,602	

B. Operating Costs	Cost/kWHr	Cost/kWHr	Total Cost	Your Cost
2.01 Maintenance	$0.0176	$0.0070	$75	
2.02 Misc. Administration	$0.0000	$0.0000	$0	
2.03 Insurance	$0.0351	$0.0140	$150	
2.04 Property Taxes	$0.0000	$0.0000	$0	
Subtotal Operating Costs	**$0.0527**	**$0.0211**	**$225**	
2.05 Operating Interest	$0.0014	$0.0006	$6	
Total Operating Costs	**$0.0541**	**$0.0216**	**$231**	
C. Fixed Costs				
3. Depreciation				
3.01 Buildings	$0.0463	$0.0185	$198	
3.02 Machinery & Equipment	$0.2266	$0.0906	$968	
4. Investment				
4.01 Buildings	$0.0323	$0.0129	$138	
4.02 Machinery & Equipment	$0.0693	$0.0277	$296	
4.03 Land	$0.0000	$0.0000	$0	
Total Fixed Costs	**$0.3745**	**$0.1498**	**$1,600**	
Total Operating and Fixed Costs	**$0.4285**	**$0.1714**	**$1,831**	
D. Labour	$0.0000	$0.0000	$0	
Total Cost of Production	**$0.4285**	**$0.1714**	**$1,831**	

E. Value	Based on:	4273 kWHr per year		10682 kWHr per year		
Total Value		**Per kWHr**	**Total**	**Per kWHr**	**Total**	
5.01 Estimated Annual On-Farm Energy Valu		**$0.0738**	**$316**	**$0.0738**	**$789**	
Total Value - Cost of Production		**($0.3547)**	######	**($0.0976)**	######	

	Based on:	4273 kWHr per year	10682 kWHr per year	
Breakeven price		**$kWHr**	**$kWHr**	
A. Operating Costs		$0.0541	$0.0216	
B. Operating & labour Costs		$0.0541	$0.0216	
C. Operating & Fixed Costs		$0.4285	$0.1714	
D. Operating, Fixed & Labour Costs		$0.4285	$0.1714	

Breakeven Price $/kWHr = Cost ÷ kWHrs

Estimated Return on Assets (ROA)		
without MB Hydro rate inflation	1.1% * 1	2.6%
with 2.9% annual MB Hydro rate inflation	1.5% * 2	3.6%
Simple Payback Calculation		
A. Without MB Hydro rate inflation	95.1 Years[1]	38.0 Years
B. With 2.9% annual MB Hydro rate inflation	68.6 Years[2]	27.4 Years
Desired Simple Payback = 10 Years		
C. Max.Capital Cost w/o Hydro rate inflation	$3,155 * 1	$7,888
D. Max. Capital Cost w/ 2.9% Hydro inflation	$4,372 * 2	$10,930

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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Wind Energy Production Costs - Input

Assumptions

1. This budget outlines the cost of production for on-farm wind electricty generation operation.
2. Buildings and equipment are valued at new cost.
3. Capacity factor is based on Canadian Wind Atlas 90 foot turbine formula.
4. Minimum production based on actual vs. predicted kWHr production case studies.
5. Annual kWHr production could vary from significantly from minimum or maximum estimates due to decreased turbine height, local site factors, or relative turbine efficiency.
6. All electricity produced is for farm use only.

Wind Power Production

Wind turbine size - kilowatts (kW)	3.5	
Max. Capacity factor - Cdn Wind Atlas 90 ft formu	34.84	%
Min. 'Realized' Capacity Factor (% of maximum)	40	%
Days per year	365	
Hours operation per day	24	
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	
Misc. Administration or fees	$0	/ year
Insurance	0.5	%
Property taxes	0.0	%
Investment Rate	2.50	%
Operating Interest Rate	5.50	%
Expected Turbine Lifespan	20	years
Desired Simple Payback	10	years

Capital Costs

Buildings	Original Value	Salvage Value	Useful Life
Tower	$6,000	30 %	30 years
Tower installation	$2,500	30 %	30 years
Total	**$8,500**	**30.0** %	**30.0** years
Machinery & Equipment			
Wind turbine	$20,000	10 %	20 years
Bidirectional Hydro meter	$200	10 %	20 years
Grid tie electrical panel (installatior	$1,300	10 %	20 years
Capital grant or incentive	$0		
Total	**$21,500**	**10.0** %	**20.0** years
Total Bldg., Mach. & Equip	**$30,000**		
Total Land Value	$0		
Total Capital Investment	**$30,000**		

Assumptions

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6. All electricity produced is for farm use only.

Wind Energy Production Worksheet

A. Energy Produced

1.01 Minimum Annual Production

	x	34.84%	Max. Capacity factor - Cdn Wind Atlas 90 ft formula
	x	40.00%	Min. 'Realized' Capacity Factor (% of Max.)
	=	13.94%	Capacity factor - annual
		3.5	Wind turbine size - kilowatts (kW)
	x	365	Days per year
	x	24	Hours operation per day
Total	**=**	**4,272.8**	**kWHr electricity produced**

Maximum Annual Production

		3.5	Wind turbine size - kilowatts (kW)
	x	34.84%	Capacity factor - annual
	x	365	Days per year
	x	24	Hours operation per day
Total	**=**	**10,681.9**	**kWHr electricity produced**

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

		13.9%	Capacity factor - annual
	x	3.5	Wind turbine size - kilowatts (kW)
	=	0.4878	Net power output (kW)
		$30,000	Total turbine installed cost
	÷	0.4878	Net power output (kW)
Total	**=**	**$61,506**	**Cost per installed kW - net power output**

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

		34.8%	Capacity factor - annual
	x	3.5	Wind turbine size - kilowatts (kW)
	=	1.2194	Net power output (kW)
		$30,000	Total turbine installed cost
	÷	1.2194	Net power output (kW)
Total	**=**	**$24,602**	**Cost per installed kW - net power output**

B. Operating Costs

2.01 Maintenance

		$8,500	capital cost - buildings
	+	$21,500	capital cost - equipment
	=	$30,000	Total bldg. & equipment
	x	0.3%	Maintenance rate
	=	**$75**	**Total Maintenance**

2.02 Misc. Administration or fees

		$0	misc. administration

2.03 Insurance

$8,500	capital cost - buildings	
+ $21,500	capital cost - equipment	
= $30,000	Total bldg. & equipment	
x 0.5%	Insurance rate	
= $150	**Total Insurance**	

2.04 Property Taxes

$8,500	capital cost - buildings	
+ $0	capital cost - land	
= $8,500	Total bldg. & land	
x 0.0%	Property tax rate	
= $0	**Total Property tax**	

2.05 Operating Interest

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

$225	subtotal operating costs	
÷ 2.00	average	
x 5.50	% operating interest rate	
= $6	**Operating Interest**	

Capital Costs

Buildings		
Tower	$6,000	
Tower installation	$2,500	
Total Building Cost	**$8,500**	
Machinery & Equipment		
Wind turbine	$20,000	
Bidirectional Hydro meter	$200	
Grid tie electrical panel (installation)	$1,300	
Capital grant or incentive	$0	
Total Machinery & Equipment Cost	**$21,500**	
Total Bldg., Mach. & Equip.	**$30,000**	
Total Land Value	**$0**	
Total Capital Investment	**$30,000**	

C. Fixed Costs

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

3.01 Buildings

$8,500	original cost	
- $2,550	salvage value	
÷ 30.00	years useful life	
= $198		

3.02 Machinery & Equipment

$21,500	original cost	
- $2,150	salvage value	
÷ 20.00	years useful life	
= $968		

4. Investment **Original Cost + Salvage Value x Investment Rate**
2

4.01 Buildings

	$8,500	original cost	
+	$2,550	salvage value	
÷	2.00	average	
x	2.50	% investment rate	
=	**$138**		

4.02 Machinery & Equipment

	$21,500	original cost	
+	$2,150	salvage value	
÷	2.00	average	
x	2.50	% investment rate	
=	**$296**		

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	4,272.8	kWHr electricty produced	
Total =	**$315.51**	**Electricity 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	10,681.9	kWHr electricty produced	
Total =	**$788.77**	**Electricity 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	4,272.8	kWHr electricty produced	

Total	**=**	**$437.19**	**Electricity 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	10,681.9	kWHr electricty produced
Total **=**	**$1,092.99**	**Electricity Value**

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

	$315.51	Electricity Value - minimum range
÷	$30,000	Total Capital Investment
=	**1.1%**	**ROA**

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

	$788.77	Electricity Value - maximum range
÷	$30,000	Total Capital Investment
=	**2.6%**	**ROA**

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

	$437.19	Electricity Value - minimum range
÷	$30,000	Total Capital Investment
=	**1.5%**	**ROA**

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

	$1,092.99	Electricity Value - maximum range
÷	$30,000	Total Capital Investment
=	**3.6%**	**ROA**

Simple Payback Calculation - without MB Hydro rate inflation

	$30,000	Total Capital Investment
÷	$316	Electricity Value - minimum range
=	**95.1**	**Years Payback**

Simple Payback Calculation - without MB Hydro rate inflation

	$30,000	Total Capital Investment
÷	$789	Electricity Value - maximum range
=	**38.0**	**Years Payback**

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

	$30,000	Total Capital Investment
÷	$437	Electricity Value - minimum range
=	**68.6**	**Years Payback**

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

	$30,000	Total Capital Investment
÷	$1,093	Electricity Value - maximum range
=	**27.4**	**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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