Introduction to RETScreen

Presentation at the 2014 NOFNEC By: Chris Price, Bimose Tribal Council & Laura Sayers, Shibogama FNC September 30, 2014

Overview

- 1. What is RETScreen?
- 2. Why do we use RETScreen?
- 3. RETScreen Software
- 4. RETScreen Worksheets
- 5. Interpreting RETScreen & Examples
- 6. RETScreen Training

What is RETScreen?

"RETScreen 4 is an Excel-based clean energy project analysis software tool that helps decision makers quickly and inexpensively determine the technical and financial viability of potential renewable energy, energy efficiency and cogeneration projects"

(Source: RETScreen International <u>www.retscreen.net</u>)

Why do we use RETScreen?

- "Pre-feasibility" study for renewable energy, energy efficiency projects.
- Gives us an idea on whether a project proposals is worth looking into further
- Inexpensive first step to project planning (software is free to download)
- AANDC ecoENERGY funding program requires proposals to include a RETScreen Analysis.

Where can we get RETScreen Software?

- <u>www.retscreen.net</u>
- "Click here to download RETScreen Suite"
- Save or Run RETScreenSuite.exe
- Run the .exe file and it will download to your computer.

• "RETScreen 4" is current version.



RETScreen 4 - Software





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"ENERGY MODEL" worksheet collects data on renewable energy technology and the costs of energy offset.

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"COST ANALYSIS" worksheet collects data on CAPITAL and O&M Costs

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"EMISSION ANALYSIS" estimates the reduction in Greenhouse Gases (GHG)

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"FINANCIAL ANALYSIS" summarizes overall costs, cost of energy offset, interprets fuel savings, calculates payback period and annual costs savings

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RETScreen Sensitivity and Risk Analysis - Power project

Sensitivity analysis

Risk analysis

"RISK ANALYSIS" allows for sensitivity and risk analysis on key financial parameters. These are optional and inputs on this worksheet to not impact the others

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Cost Analysis Emission Analysis Financial Analysis Risk Analysis Tools

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/ Energy Model

"TOOLS" allows users to input further details and calculations. This worksheet is optional.

Interpreting RETScreen & Examples

What if we want to build one of these:



10MW Solar Farm

Example #1



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	November	1.36	2.94	354.5	894.4	
	December	1.13	3.17	354.5	1,030.4	
	Annual	3.72	4.69	354.50	16,670.1	
Annual solar radiation - horizontal	MWh/m ²	1.36				
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Photovoltaio						
Type	Γ	mono-Si				
Power capacity	kW	10 000 00				
Manufacturer		Heliene				
Model		mono-Si-HEE300M-285W		1 unit(s)		
Efficiency	%	97.0%				
Nominal operating cell temperature	°C	45				
Temperature coefficient	%/°C	0.40%				
Start Energy Model Cost Analysis	Emission Analysis / Financial An	alysis / Risk Analysis / Tools				
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Nonlina operating center preduce Temperature coefficient % / °C Solar collector area m² 10,309 Miscellaneous losses % 0.0% Miscellaneous losses % 0.0% Inverter Efficiency Capacity Miscellaneous losses % 97.0% Capacity Miscellaneous losses % Summary Capacity factor % 19.0% Electricity exported to grid Complete Cost Analysis sheet M 4 + M Start Energy Model / Cost Analysis / Emission Analysis / Financial Analysis / Tools / Particel Index / Tools	Nominal operating cell temperature	20 °C	JT.070							
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Photovoltaic Specifications: Type Capacity Manufacturer Model

Inverter Specifications

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		0	Cost allocation	on				
itial costs (credits)		Unit	Quantity		Unit cost	Amount	Relative costs	
Feasibility study		onne	quantity		0111 0051	Amount	Relative costs	
Site investigation		p-d				\$ -		
Resource assessment		project				\$ -		
Environmental assessment		p-d				\$ -		
Preliminary design		p-d				\$ -		
Detailed cost estimate		p-d				\$ -		
GHG baseline study & MP		project				\$ -		
Report preparation		p-d				\$ -		
Project management		p-d				\$ -		
Travel & accommodation		p-trip				s -		
Overall		cost	1	S	250 000	\$ 250,000		
				-		\$ -		
Subtotal:						\$ 250,000	0.9%	
Development								
Contract negotiations		p-d				\$ -		
Permits & approvals		p-d				\$ -		
Site survey & land rights		p-d				\$ -		
GHG validation & registration		project				\$ -		
Project financing		p-d				\$ -		
Legal & accounting		p-d				\$ -		
Project management		p-d				\$ -		
Travel & accommodation		p-trip			and the second second	\$ -		
User-defined		cost	1	\$	15,000,000	\$ 15,000,000		
Subtotal:						> - \$ 15,000,000	54.5%	
Engineering						• 15,000,000	04.070	
Site & building design		n-d				s -		
Mechanical design		p-d				\$ -		
Electrical design		p-d				\$ _		
Civil design		p-d				\$ -		
Tenders & contracting		p-d				\$ _		
Construction supervision		p-d		-		s -		
User-defined		cost	1	s	12 250 000	\$ 12 250 000		
		0031		9	12,200,000	\$		
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Feasibility \$25,000

Development \$15,000,000

Engineering 12,250,000

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Power system					
Photovoltaic	kW	10 000 00		\$ -	^
Road construction	km			\$ -	
Transmission line	km			\$ -	_
Substation	project			\$ -	
Energy efficiency measures	project			\$ -	
User-defined	cost			\$ -	
				\$ -	
Subtotal:			-	s -	0.0%
Balance of system & miscellaneous					
Specific project costs	F	uel handling s	ystem		
Delivery equipment	project			\$ -	
Preparation equipment	project			\$ -	
Storage equipment	project			S -	
Distribution equipment	project			\$ -	
Building & yard construction	m²			\$ -	
Spare parts	%			\$ -	
Transportation	project			\$ -	
Training & commissioning	p-d			\$ -	
User-defined	cost			\$ -	
Contingencies	%		\$ 27,500,000	\$ -	
Interest during construction			\$ 27,500,000	\$ -	
Subtotal:	E	Enter number of	fmonths	\$ -	0.0%
Total initial costs				\$ 27,500,000	100.0%
Annual costs (credits)	Unit	Quantity	Unit cost	Amount	
Land loace & resource rental	project			¢	
Droporty taxon	project				
Insurance promium	project				
Parts & Jabour	project			- ¢	
CHC monitoring & verification	project				
Community benefits	project			2	
General & administrative	%		\$	2	
Liser_defined	cost			\$ _	
Contingencies	%		\$ _	\$ _	
Subtotal:	70		4	\$	
Subtotal				•	
Periodic costs (credits)	Unit	Year	Unit cost	Amount	
User-defined	cost			\$ -	
				\$ -	
End of project life	cost			\$ -	
	Cote	Emission Anal	usis shoot		
	0010	LINISSION ANAI	<u>y 313 311001</u>		
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Power System 10MW Photovoltaic

Total Cost of \$27, 500,000

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TScreen Emission Reduction	on Analysis - F	Power project				
Emission Analysis						
D Method 1					Global warming potential of GHG	
Method 2					25 tonnes CO2 = 1 tonne C	H4 (IPCC 2007)
Method 3					298 tonnes CO2 = 1 tonne N	20 (IPCC 2007)
se case electricity system (Ba	sellne)	coo aminaian	CILL and a size	N20 aminaian	Electricity and and the TOL	
	Fuel mix	factor	factor	factor	efficiency loss	es factor
Fuel type	%	kg/GJ	kg/GJ	kg/GJ	% %	tCO2/MWh
Hydro	100.0%	0.0	0.0000	0.0000	100.0% 10.0	% 0.000
Electricity mix	100.0%	0.0	0.0000	0.0000	10.0	% 0.000
 Baseline changes during pro 	Jectille					
se case system GHG summar	y (Baseline)					
Fuel ture	Fuel mix	CO2 emission factor	CH4 emission factor	N2O emission factor	Fuel GHG emi consumption factu	ssion or GHG emission
Flectricity	100.0%	0.0	0 0000	0.0000	16 670 0 0	
Total	100.0%	0.0	0.0000	0.0000	16,670 0.0	00 0.0
posed case system GHG sum	mary (Power p	roject)				
	Fuel mix	CO2 emission	CH4 emission	N2O emission	Fuel GHG emi	SSION or GHG emission
Fuel type	%	ka/GJ	kg/GJ	kg/GJ	MWh tCO2/N	Wh tCO2
Solar	100.0%	0.0	0.0000	0.0000	16,670 0.0	0.0 0.0
Total	100.0%	0.0	0.0000	0.0000	16,670 0.0	0.0 0.0
Electricity expected to prid	MIM	16 670		T&D losses	0	00 00
Electricity exponed to grid	WIYYII	10,070			0 0.0	Total 0.0
C antipation and an time						
g emission reduction summai	У				2	
		Base case	Proposed case		Gross annual	Net annual edits GHG emission
		GHG emission	GHG emission		reduction transacti	on fee reduction
		tCO2	tCO2		tCO2 %	tCO2
Power project		0.0	0.0		0.0 0%	0.0
Net annual GHG emission re	duction	0.0	tCO2	is equivalent to	0.0 Cars & light trucks not used	
			to Financial Analysis			
► ► Start / Energy Mod	el Cost Ana	lysis Emission A	nalysis Financi	al Analysis 🧹 Risk An	alysis / Tools / 🔁 / 🚺 🖣 🗐 📼 📼	
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Because Kenora is completely dependent on Hydro electricity generation, there is no emission offset

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RETScreen Financial Analysis - Powe	er project						
Financial parameters			Project costs and savings/incom	e summary		Yearly cash flows	
General Fuel cost escalation rate	%	2.0%	Feasibility study	0.9% \$	250,000	Year Pre-tax After-tax (# \$ \$	
Inflation rate	%	2.1%	Development 5	4.5% \$	15,000,000	0 -27,250,000 -27,250,000	
Discount rate	%	8.0%	Engineering 4	4.5% \$	12,250,000	1 5,909,560 5,909,560	
Project life	yr	30	Power system	0.0% \$	0	2 5,909,560 5,909,560	
Finance	0.10					4 5,909,560 5,909,560	
Incentives and grants	S	250,000				5 5,909,560 5,909,560	
Debt ratio	%	0.0%	Delesso of each of the size			6 5,909,560 5,909,560	
			Balance of system & misc.	0.0% \$	27 500 000	7 5,909,560 5,909,560 8 5,909,560 5,909,560	
				0.076 3	27,500,000	9 5,909,560 5,909,560	
			Incentives and grants	S	250,000	10 5,909,560 5,909,560 11 5,909,560 5,909,560	
			Annual costs and debt payments	1		12 5,909,560 5,909,560	
Income tax analysis			O&M Fuel cost - proposed case	5	0	13 5,909,560 5,909,560 14 5,909,560 5,909,560	
			Total annual costs	\$	0	15 5,909,560 5,909,560 16 5,909,560 5,909,560	
			Periodic costs (credits)			17 5,909,560 5,909,560 18 5,909,560 5,909,560 19 5,909,560 5,909,560 20 5,909,560 5,909,560 21 5,909,560 5,909,560	
Annual income			Annual savings and income Fuel cost - base case Electricity export income	S	5 909 560	22 5,909,560 5,009,560 23 5,909,560 5,909,560 24 5,909,560 5,909,560 25 5,909,560 5,909,560	=
Electricity export income			Licensely export income		5,505,500	26 5,009,560 5,909,560	
Electricity exported to grid Electricity export rate	MWh \$/MWh	16,670 354.50				27 5,909,560 5,909,560 28 5,909,560 5,909,560	
Electricity export income Electricity export escalation rate	\$	5,909,560	Total annual savings and incom	e \$	5,909,560	29 5,909,560 5,909,560 30 5,909,560 5,909,560	
GHG reduction income							
Net GHG reduction	tCO2/yr	0	Financial viability				
Net GHG reduction - 30 yrs	tCO2	0	Pre-tax IRR - equity Pre-tax IRR - assets	%	21.6% 21.6%		
			After-tax IRR - equity	%	21.6%		
			Circle as the sk	70	21.070		
Customer premium income (rebate)	6		Equity payback	yr yr	4.6		
			Net Present Value (NPV) Annual life cycle savings	\$ S/yr	39,278,541 3,489,012		
			Benefit-Cost (B-C) ratio		2.43		
			Energy production cost GHG reduction cost	\$/MWh \$/tCO2	145.20 No reduction		
Other income (cost)			Cumulative cash flows graph				4
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Questions?

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