



Financial and Risk Analysis with RETScreen® Software

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Clean Energy Project Analysis Course



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Objectives



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- Introduce the RETScreen® methodology for assessing the financial viability of a potential clean energy project
 - ▶ Overview important financial (input) parameters
 - ▶ Review key indicators of financial viability
 - ▶ Highlight differences between initial costs, simple payback and key financial indicators
- Demonstrate the RETScreen® Financial Summary Worksheet
- Introduce sensitivity analysis and risk analysis with RETScreen®



Initial Cost versus Ongoing Costs: Remote Telecommunications Example

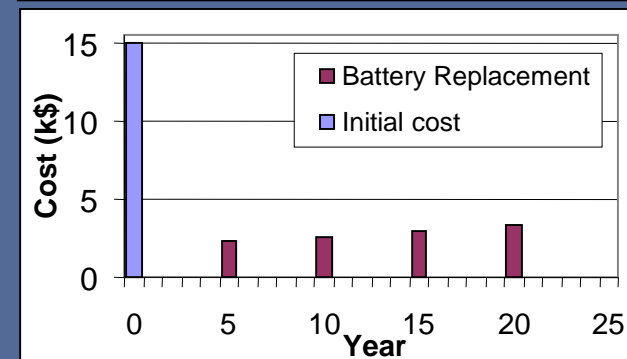
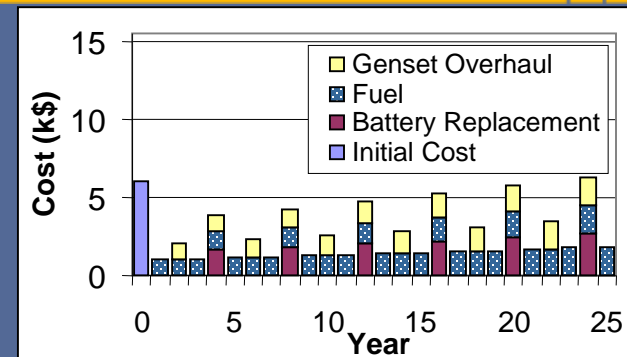


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- Genset+battery (base case):
 - ▶ Initial cost: \$6,000
 - ▶ Annual cost: \$1,000 for fuel*
 - ▶ Battery replacement every 4 years (\$1,500)*
 - ▶ Genset overhaul every 2 years (\$1,000)*

- Photovoltaics+battery (proposed case):
 - ▶ Initial cost: \$15,000
 - ▶ Battery replacement every 5 years (\$2,000)*



*Inflation rate and energy escalation rate of 2.5%

Determining Financial Viability: Remote Telecommunications Example

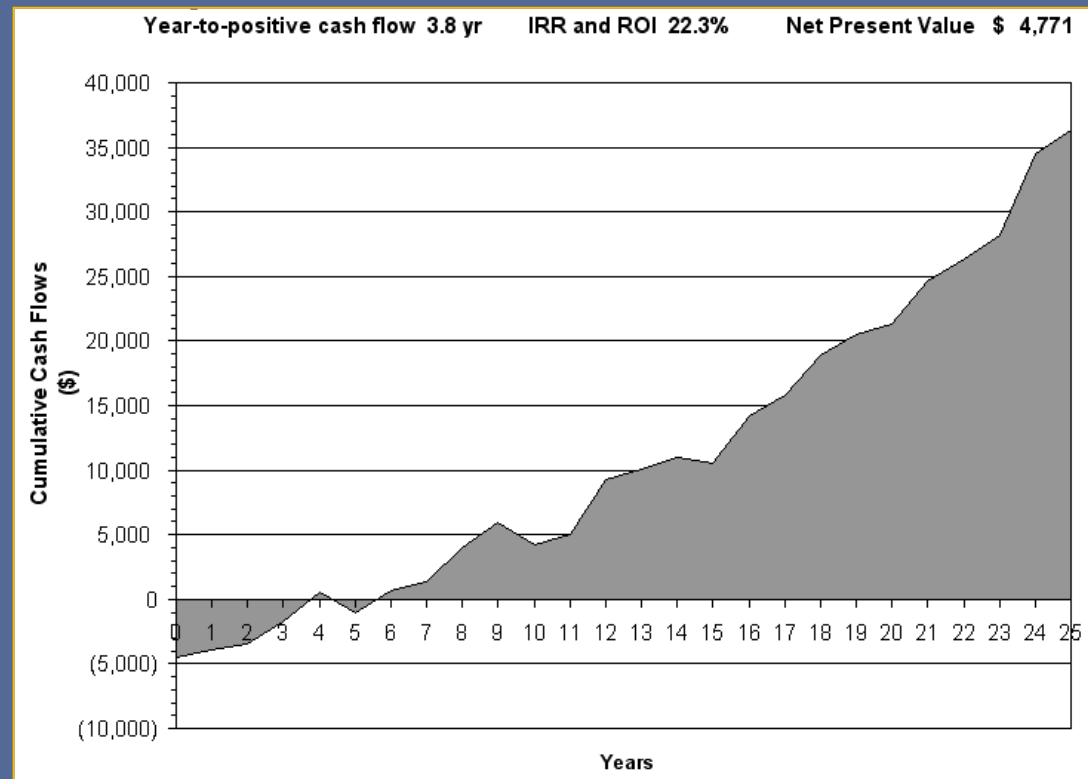


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- How can we compare the genset & the PV system?
 - ▶ Genset: lower initial costs
 - ▶ Photovoltaics: lower annual and periodic costs

- RETScreen® calculates indicators that look at revenues and expenses over the life of the project!



Cashflow Calculations: What does RETScreen® do?



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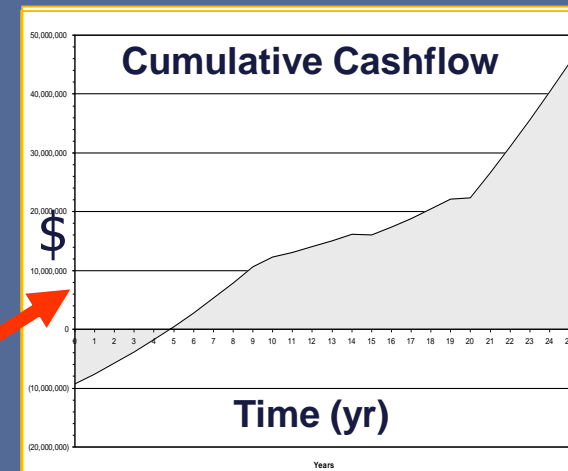
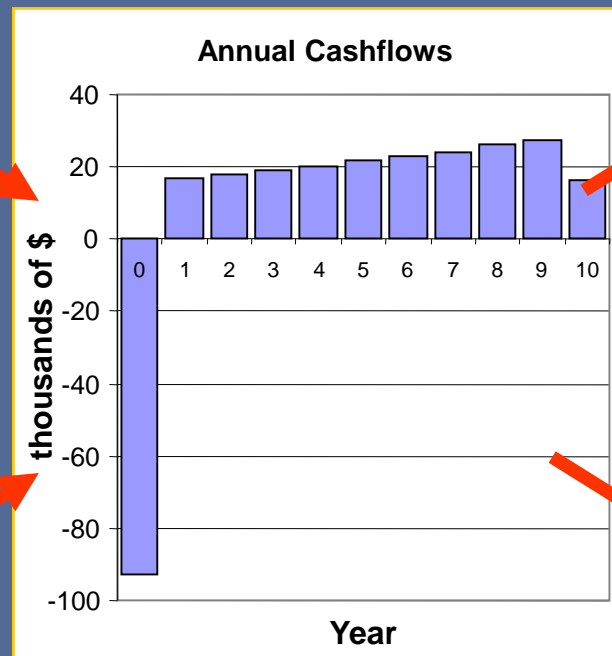
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Cash Inflows

Fuel Savings
O&M Savings
Periodic Savings
Incentives
Production Credits
GHG Credits

Cash Outflows

Equity Investment
Annual Debt Payments
O&M Payments
Periodic Costs



Indicators

Net Present Value
Simple Payback
IRR
Debt Service Coverage
Etc.

Financial (Input) Parameters Used by RETScreen®



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- Project life
- Discount rate: rate used to convert future cash flows to the present
- Inflation rate
- Other cost/credit escalation rates (fuel, electricity, GHG credits, feed in tariffs)

- Part of costs paid for by debt and by equity
- Debt ratio, debt interest rate and debt term

- Incentives

- Income tax

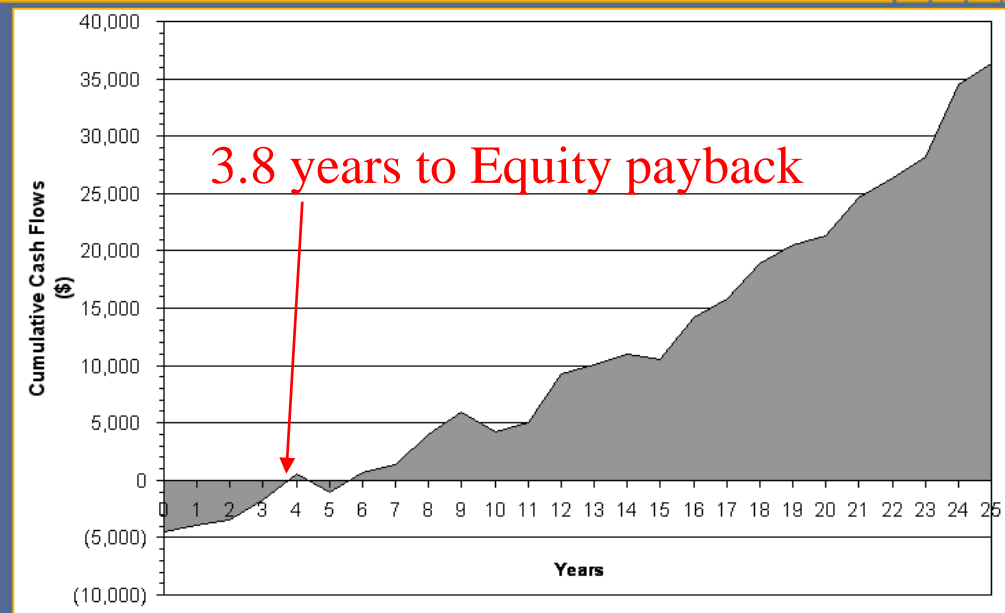
Some Financial Analysis Outputs



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- Cumulative cash flow graph
- Indicators of Project Profitability
 - Net present value
 - IRR (Internal rate of return) on equity
- Indicators of quickness of return
 - Simple payback
 - Equity payback



- Indicators of interest to banks
 - IRR on Assets
 - Debt service coverage

Key (Output) Indicators of Financial Viability



	Simple Payback	Net Present Value (NPV)	Internal Rate of Return (IRR & ROI)
Meaning	# of years to recoup additional costs from annual savings	Total value of project in today's dollars	Interest yield of project during its lifetime
Example	3 year simple payback	\$1.5 million NPV	17 % IRR
Criteria	Payback < n years	Positive indicates profitable project	IRR > hurdle rate
Comment	<ul style="list-style-type: none"> • Misleading • Ignores financing & long-term cashflows • Use when cashflow is tight 	<ul style="list-style-type: none"> • Good measure • User must specify discount rate 	<ul style="list-style-type: none"> • Can be fooled when cashflow goes positive-negative-positive

Comparison of Indicators: Remote Telecommunications Example

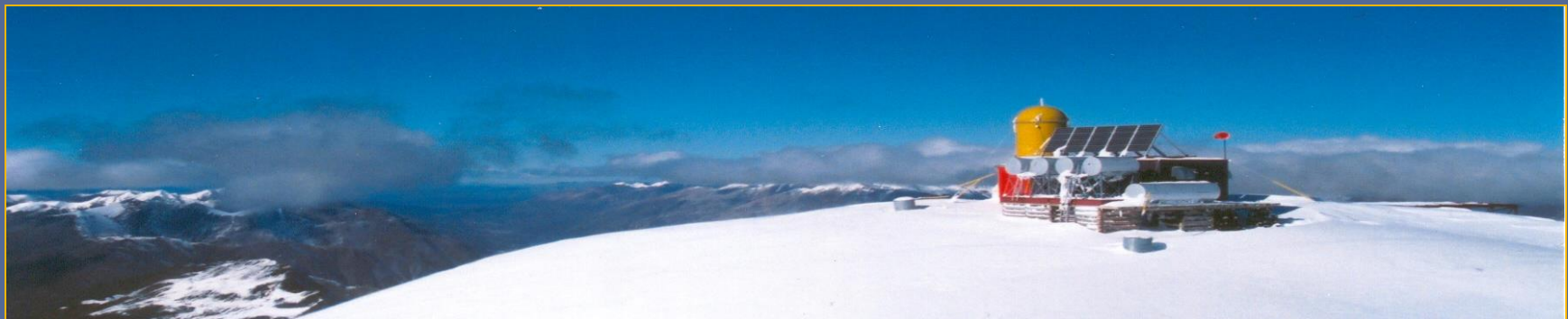


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	Simple Payback	Net Present Value (NPV)	Internal Rate of Return (IRR & ROI)
PV vs genset*	9 years	\$4,800	22%
Decision	Genset	PV	PV

* Discount rate of 12%; 50% debt financed over 15 years at 7% interest rate



Dealing with Uncertainty: Sensitivity and Risk Analysis



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- At the preliminary feasibility stage, there is much uncertainty about many input parameters

- How is the profitability of the project affected by errors in the values provided by the user?

RETScreen® Sensitivity and Risk Analysis - Wind Energy Project

Use sensitivity analysis sheet? Yes
 Perform risk analysis too? Yes
 Project name: Wind Farm
 Project location: Andhra, India

Perform analysis on: After-tax IRR and ROI
 Sensitivity range: 20%
 Threshold: 15.0 %
[Click here to Calculate Sensitivity Analysis](#)

Sensitivity Analysis for After-tax IRR and ROI

RE delivered (MWh)	Avoided cost of energy (\$/kWh)				
	0.0760 -20%	0.0855 -10%	0.0950 0%	0.1045 10%	0.1140 20%
32,548	4.2%	8.2%	11.8%	15.2%	18.5%
36,614	8.8%	12.3%	16.7%	20.4%	24.1%
40,682	13.1%	17.4%	21.6%	25.7%	29.8%
44,750	17.3%	22.0%	26.7%	31.1%	35.6%
48,818	21.5%	26.5%	31.6%	36.5%	41.5%

Initial costs (\$)	Avoided cost of energy (\$/kWh)				
	0.0760 -20%	0.0855 -10%	0.0950 0%	0.1045 10%	0.1140 20%
24,524,375	36.2%	31.4%	26.5%	21.6%	16.8%
	26.2%	20.8%	15.4%	10.5%	5.6%
	21.6%	15.7%	10.3%	5.4%	0.5%
	17.2%	11.6%	6.3%	1.4%	-3.5%
	14.7%	10.2%	5.0%	0.0%	-4.6%

Risk Analysis for After-tax IRR and ROI

Parameter	Unit	Value	Range (+/-)	Minimum	Maximum
Avoided cost of energy	\$/kWh	0.0950	15%	0.0808	0.1093
RE delivered	MWh	40,682	15%	34,580	46,785
Initial costs	\$	31,161,365	20%	24,934,372	37,401,558
Annual costs	\$	770,000	15%	654,500	885,500
Debt ratio	%	19.0%	5%	16.5%	21.5%
Debt interest rate	%	14.0%	30%	9.8%	18.2%
Debt term	yr	25	0%	25	25
RE production credit	\$/MWh	0.025	30%	0.020	0.030

[Click here to Calculate Risk Analysis](#)

Impact on After-tax IRR and ROI

Parameter	Minimum	Maximum
Initial costs	24,934,372	37,401,558
RE delivered	34,580	46,785
Avoided cost of energy	0.0808	0.1093
Annual costs	654,500	885,500
Debt ratio	16.5%	21.5%
Debt interest rate	9.8%	18.2%
Debt term	25	25
RE production credit	0.020	0.030

Debt ratio (%)

0.0950	0.1045	0.1140
70.0%	77.0%	84.0%
26.1%	23.4%	20.5%
23.8%	26.2%	30.2%
21.6%	23.1%	25.6%
19.4%	20.1%	21.3%
17.2%	17.3%	17.4%

Debt term (yr)

0.0950	0.1045	0.1140
0%	10%	20%
25.1%		
23.8%		
21.6%		
20.9%		
19.4%		
17.2%		

Avoided cost of energy (\$/kWh)

0.0950	0.0855	0.0760
11.8%	12.3%	12.8%
16.7%	17.3%	18.0%
21.6%	22.4%	23.2%
26.7%	21.5%	23.4%
31.6%	26.5%	23.8%

Debt credit (\$/kWh)

0.025	0.028	0.030
0%	10%	20%
11.8%	12.3%	12.8%
16.7%	17.3%	18.0%
21.6%	22.4%	23.2%
26.7%	21.5%	23.4%
31.6%	26.5%	23.8%

Distribution of After-tax IRR and ROI

Minimum: 13.9% Median: 20.4% Maximum: 27.3%

Sensitivity Analysis



- Shows how the profitability of project changes when two key input parameters vary simultaneously
- For example:
 - ▶ Initial costs 10% higher than estimated
 - ▶ Avoided cost of energy 20% higher than estimated
 - ▶ Does the IRR exceed the 15% IRR threshold desired by the user?

Initial costs (\$)		Avoided cost of energy (\$/kWh)				
		0.0760 -20%	0.0855 -10%	0.0950 0%	0.1045 10%	0.1140 20%
24,934,372	-20%	11.5%	16.1%	20.4%	24.5%	28.6%
28,051,168	-10%	7.5%	11.8%	15.7%	19.4%	23.1%
31,167,965	0%	4.1%	8.3%	12.0%	15.4%	18.7%
34,284,761	10%	1.0%	5.3%	8.9%	12.2%	15.2%
37,401,558	20%	-1.9%	2.6%	6.2%	9.4%	12.3%

- Yes, it is 15.2%
 - ▶ Combinations of initial costs and avoided cost of energy below threshold are shaded

Risk Analysis: Monte Carlo Simulation

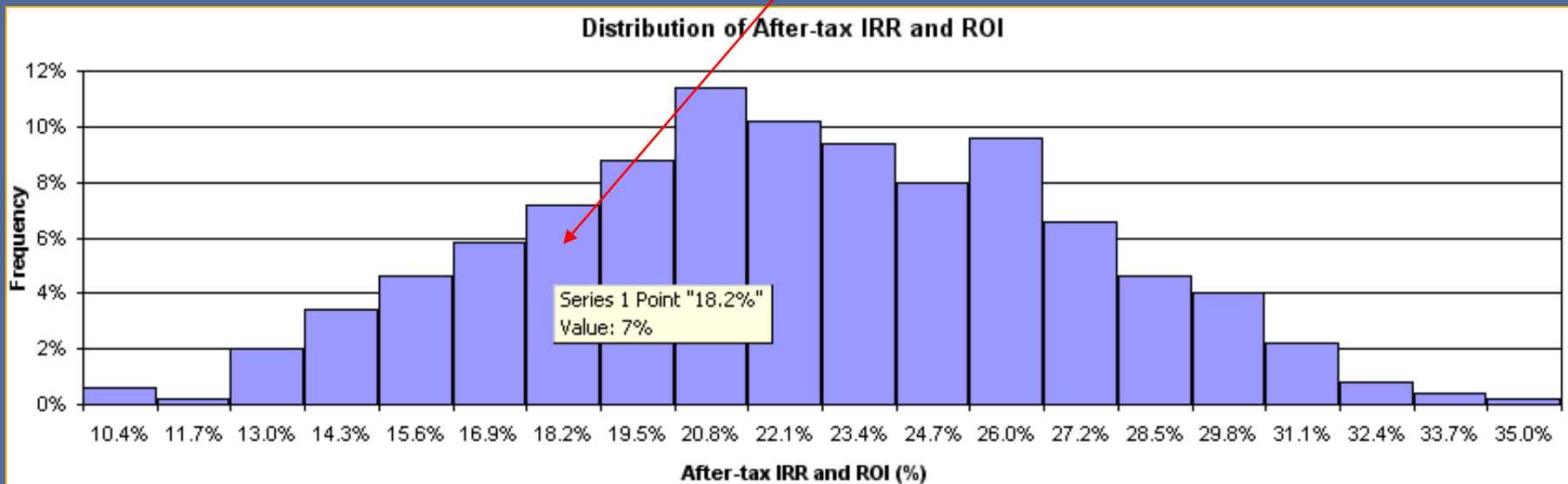


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- RETScreen® calculates the frequency distribution of the financial indicators (IRR, NPV, and year-to-positive cash flow) by calculating the values for 500 combinations of parameters
 - ▶ Parameters vary randomly according to uncertainty specified by user

7% of the time IRR is $18.2 \pm 0.7\%$



Risk Analysis: Level of Risk



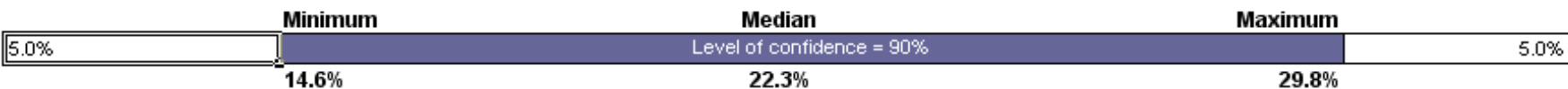
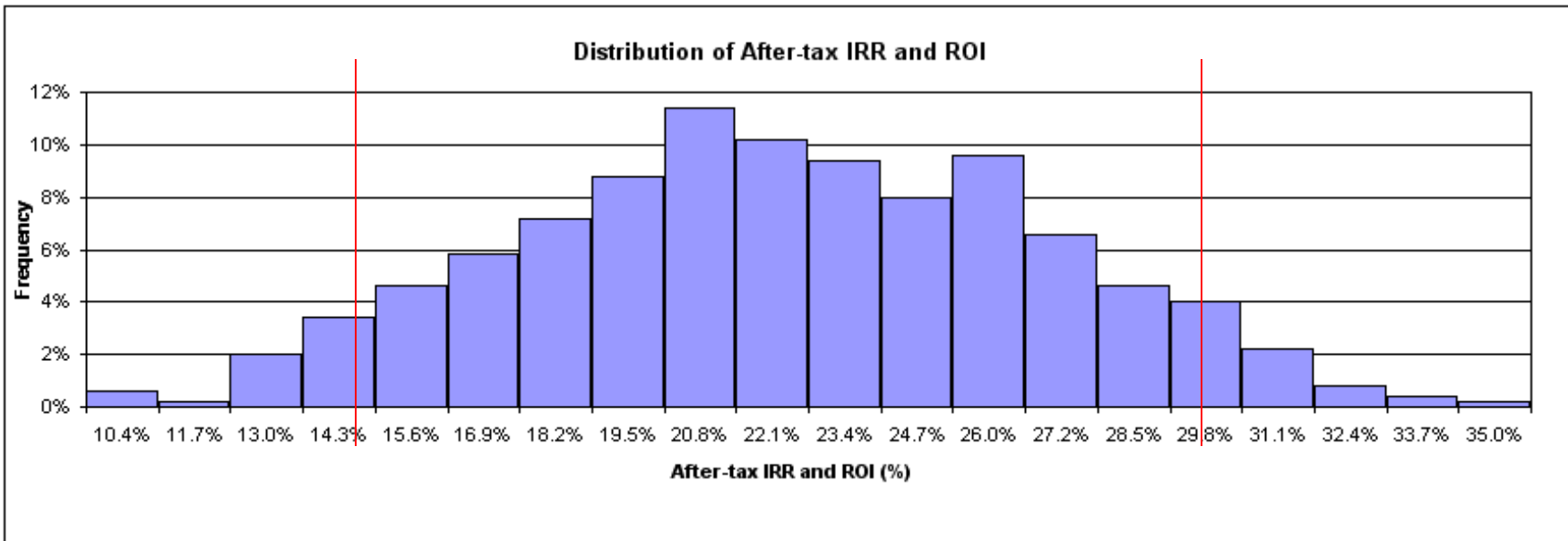
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- There is only a 10% risk that the IRR will fall outside this range

Median
Level of risk
Minimum within level of confidence
Maximum within level of confidence

%	22.3%
%	10%
%	14.6%
%	29.8%



Conclusions



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- RETScreen® accounts for cashflows due to initial costs, energy savings, O&M, fuel costs, taxation, GHG and RE production credits
- RETScreen® automatically calculates important indicators of financial viability
- The sensitivity of the key financial indicators to changes in the inputs can be investigated with RETScreen®
- Indicators that consider profitability over the life of the project, such as the IRR and NPV, are preferable to the simple payback method



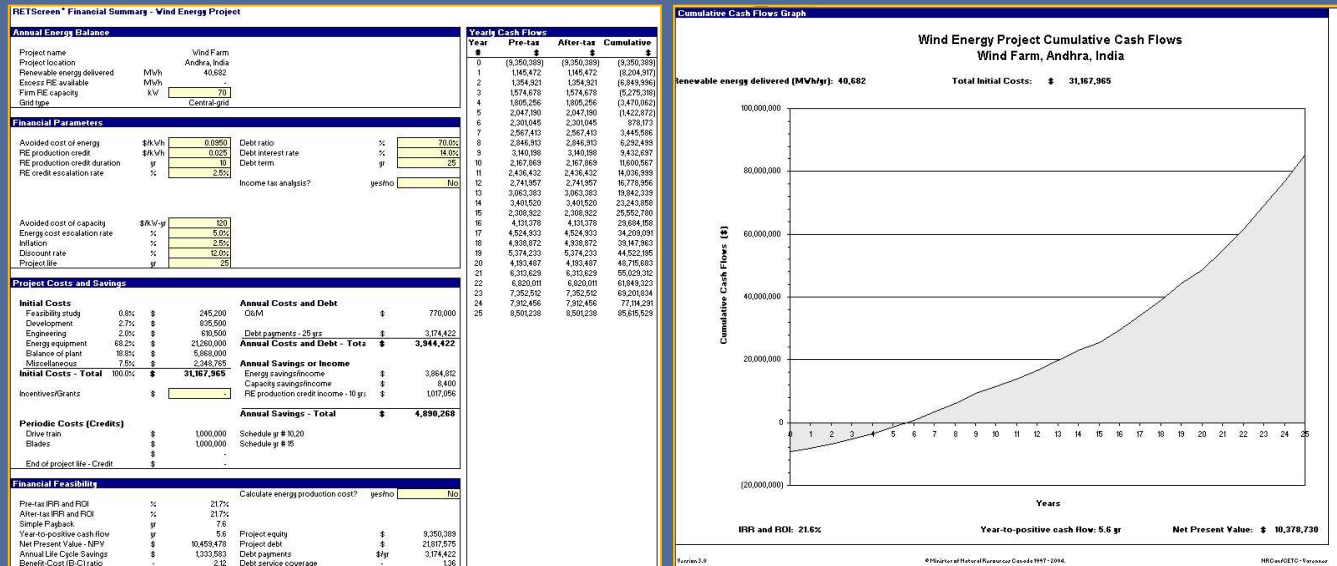
Questions?



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