Financial and Risk Analysis with RETScreen® Software

RETSCREEN® INTERNATIONAL
Clean Energy Project Analysis Course

Photo Credit: Green Mountain Power Corporation/ NRELPix
Objectives

• 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

- **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

- 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?

**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®

- 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

- 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

3.8 years to Equity payback
<table>
<thead>
<tr>
<th></th>
<th>Simple Payback</th>
<th>Net Present Value (NPV)</th>
<th>Internal Rate of Return (IRR &amp; ROI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meaning</strong></td>
<td># of years to recoup additional costs from annual savings</td>
<td>Total value of project in today’s dollars</td>
<td>Interest yield of project during its lifetime</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>3 year simple payback</td>
<td>$1.5 million NPV</td>
<td>17 % IRR</td>
</tr>
<tr>
<td><strong>Criteria</strong></td>
<td>Payback &lt; n years</td>
<td>Positive indicates profitable project</td>
<td>IRR &gt; hurdle rate</td>
</tr>
<tr>
<td><strong>Comment</strong></td>
<td>• Misleading</td>
<td>• Good measure</td>
<td>• Can be fooled when cashflow goes positive-negative-positive</td>
</tr>
</tbody>
</table>
## Comparison of Indicators: Remote Telecommunications Example

<table>
<thead>
<tr>
<th></th>
<th>Simple Payback</th>
<th>Net Present Value (NPV)</th>
<th>Internal Rate of Return (IRR &amp; ROI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV vs genset*</td>
<td>9 years</td>
<td>$4,800</td>
<td>22%</td>
</tr>
<tr>
<td>Decision</td>
<td>Genset</td>
<td>PV</td>
<td>PV</td>
</tr>
</tbody>
</table>

* Discount rate of 12%; 50% debt financed over 15 years at 7% interest rate
Dealing with Uncertainty: Sensitivity and Risk Analysis

- 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?
Sensitivity Analysis

- Shows how the profitability of a 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?

<table>
<thead>
<tr>
<th>Initial costs ($)</th>
<th>Avoided cost of energy ($/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0760</td>
</tr>
<tr>
<td></td>
<td>-20%</td>
</tr>
<tr>
<td>24,934,372</td>
<td>11.5%</td>
</tr>
<tr>
<td>28,051,168</td>
<td>7.5%</td>
</tr>
<tr>
<td>31,167,965</td>
<td>4.1%</td>
</tr>
<tr>
<td>34,284,761</td>
<td>1.0%</td>
</tr>
<tr>
<td>37,401,558</td>
<td>-1.9%</td>
</tr>
</tbody>
</table>

- Yes, it is 15.2%
  - Combinations of initial costs and avoided cost of energy below threshold are shaded.
Risk Analysis: Monte Carlo Simulation

- 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±0.7%
### Risk Analysis: Level of Risk

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

<table>
<thead>
<tr>
<th>Median Level of Risk</th>
<th>Minimum within level of confidence</th>
<th>Maximum within level of confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>10%</td>
<td>14.6%</td>
<td>29.8%</td>
</tr>
<tr>
<td>22.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Distribution of After-tax IRR and ROI**

- Frequency of After-tax IRR and ROI (%)
- Minimum: 14.6%
- Median: 22.3%
- Maximum: 29.8%
- Level of confidence = 90%

Conclusions

- **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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For further information please visit the RETScreen Website at www.retscreen.net