



## **Financial Analysis of Energy Projects using RELCoST**

April 2010



# RELCOST Financial

## User's Manual

April 2010



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*RELCOST Financial* was developed as a stand-alone tool for evaluating the financial viability of energy projects. It was originally developed to supplement *HeatMap*®, which is software for district energy, combined heat and power (CHP), and geothermal system analysis, planning, design and operation. Principal sponsors of *HeatMap* include:

- Washington State University Extension Energy Program
- U.S. Department of Energy
- U.S. Department of Defense
- New York State Energy Research and Development Authority
- Swedish Council for Building Research
- Swedish Trade Office
- Ministry for Natural Resources Canada

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# 1. Program Overview

The *RELCOST Financial* model, a Microsoft Excel® spreadsheet template, is used for evaluating the financial viability of energy projects. It can be used to evaluate a variety of factors key to project success, such as the minimum power sales or carbon offset price, the optimum mix of equity and capital to attract investors, or sensitivity to incentives.<sup>1</sup>

Financial modeling is used throughout the development phase of an energy project by stakeholders including lenders, equity investors, policy analysts and project developers. Each stakeholder has individual interests and needs that can greatly differ. Lenders need to make corporate financial projections to see how the project will perform in the short, medium and long term to judge the likelihood the project's loan can be repaid. Equity investors want corporate financial projections to see if they will make enough profit to justify investing. Governments and policy analysts may want to see that the project is selling energy at a fair price. Developers seek to prioritize projects and technology alternatives to direct limited capital.

*RELCOST* provides three general methods to evaluate the viability of a project: life cycle cost analysis, use of pro forma statements, and use of financial ratios. Life cycle cost results calculated by *RELCOST* are the net present value, equity and project internal rate of return, benefit cost ratio, and discounted and simple paybacks. Pro forma financial statements (Income Statement, Cash Flow Statement, Balance Sheet, and Sources/Uses of Funds Statement) are created for each project year in the 20-year analysis period. Use of financial ratios and other financial performance indicators enable the *RELCOST* user to evaluate project financial outcomes under various model scenarios.

Results are displayed on a Financial Scorecard in a stop-light chart (Red-Yellow-Green) for quick assessment. A palette of sensitivity factors for many inputs is side by side with the Financial Scorecard to facilitate conducting "What If" evaluations. Adjusting sensitivity factors on key project inputs enables the user to determine those factors that represent the greatest amount of risk to the project, obtain guidance on key points of negotiation, identify break-even values, and examine alternative scenarios.

Flexible user inputs include capital costs for construction, funding (equity, grants, and loans), operating costs (purchased fuels, labor, materials/expendables, etc.), taxes and fees (depreciation, tax credits, franchise costs, tax rates, etc.), cost escalation factors, income from energy, power and co-product sales, and income from sales of carbon offsets, renewable energy credits and renewable energy production incentives. Input worksheets are summarized in Table 1 and output worksheets in Table 2.

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## Section 1. Program Overview

**Table 1. Summary of Worksheets Requiring Input**

Worksheet	Inputs	Results and Calculated Values
General	<ul style="list-style-type: none"> <li>• Project summary</li> <li>• Financial assumptions</li> <li>• Dispatch factor and availability</li> <li>• Project notes</li> </ul>	<ul style="list-style-type: none"> <li>• Plant operating factors</li> </ul>
WhatIf	<ul style="list-style-type: none"> <li>• Escalation forecast (none, likely, aggressive, conservative)</li> <li>• Sensitivity factors</li> </ul>	<ul style="list-style-type: none"> <li>• Financial scorecard</li> <li>• Graphs</li> </ul>
Financial Indicators	<ul style="list-style-type: none"> <li>• “Stop light” rules for financial scorecard</li> </ul>	--
Capital Expenditures	<ul style="list-style-type: none"> <li>• Three user-defined categories for cost estimates</li> <li>• Contingency and contractor profit factors</li> </ul>	<ul style="list-style-type: none"> <li>• Total expenditures</li> </ul>
Depreciation	<ul style="list-style-type: none"> <li>• Depreciation base, salvage value and schedule for tax and shareholder purposes</li> </ul>	<ul style="list-style-type: none"> <li>• Depreciation</li> </ul>
Funding Plan	<ul style="list-style-type: none"> <li>• Borrowed funds, equity, grants</li> </ul>	--
Purchased Fuels	<ul style="list-style-type: none"> <li>• Descriptions, purchased units and unit costs</li> </ul>	<ul style="list-style-type: none"> <li>• Purchased fuel costs</li> </ul>
O&M	<ul style="list-style-type: none"> <li>• Four user-defined categories for O&amp;M expenses</li> <li>• Operating labor, insurance, property taxes</li> <li>• Operating reserve account deposits and withdrawals</li> </ul>	<ul style="list-style-type: none"> <li>• Total O&amp;M costs, including inflation, escalation, plant operating factors, and sensitivity factor</li> </ul>
MajorExpense	<ul style="list-style-type: none"> <li>• Expenses such as major overhauls</li> </ul>	<ul style="list-style-type: none"> <li>• Total costs, including inflation, escalation, plant operating factors, and sensitivity factor</li> </ul>
Sales	<ul style="list-style-type: none"> <li>• Nine user-defined categories for sales products (e.g., electricity, heat, biogas, co-products, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Revenues from sales, including inflation, escalation, plant operating factors, and sensitivity factor</li> </ul>
Offsets, RECs	<ul style="list-style-type: none"> <li>• Carbon offsets, renewable energy credits (RECs), and production incentives</li> </ul>	<ul style="list-style-type: none"> <li>• Revenues from offsets and incentives related to sales, including inflation, escalation, plant operating factors</li> </ul>
Taxes & Fees	<ul style="list-style-type: none"> <li>• Federal, state and local tax rates</li> <li>• Tax credits</li> <li>• Franchise fees, percent</li> <li>• Royalty payment</li> </ul>	<ul style="list-style-type: none"> <li>• Income tax payments</li> <li>• Net income before taxes (reference)</li> <li>• Franchise fees</li> </ul>
Dividends	<ul style="list-style-type: none"> <li>• Maximum payout</li> <li>• Percent of net profit after taxes</li> </ul>	<ul style="list-style-type: none"> <li>• Net profit after taxes (reference)</li> <li>• Dividend payments</li> </ul>
Cash Accounts	<ul style="list-style-type: none"> <li>• Interest rates on cash account and operating reserve account</li> <li>• Floats for accounts receivable &amp; payable</li> </ul>	<ul style="list-style-type: none"> <li>• Deposits, withdrawals and balances of cash account and operating reserve account</li> </ul>
Cost Escalation	<ul style="list-style-type: none"> <li>• Escalation factors for likely, conservative and aggressive forecasts</li> </ul>	<ul style="list-style-type: none"> <li>• Total escalation factors including forecast factors &amp; general inflation</li> </ul>
Cost Allocation	<ul style="list-style-type: none"> <li>• Allocation of costs to multiple revenue streams</li> </ul>	--
Depreciation_Factors	<ul style="list-style-type: none"> <li>• Depreciation factors used in calculating depreciation</li> </ul>	
Spider_Diagram	<ul style="list-style-type: none"> <li>• Sensitivity factors on selected parameters, such as CapEx or sales price, and results of a selected performance measure, such as net present value</li> </ul>	<ul style="list-style-type: none"> <li>• Spider diagram</li> </ul>

## Section 1. Program Overview

**Table 2. Summary of Output Worksheets\***

<b>Output Worksheet</b>	<b>Description</b>
Funding Schedule	<ul style="list-style-type: none"> <li>• Amounts borrowed and annual payments on interest and principal of borrowed funds</li> <li>• Amounts of equity investments and grants</li> </ul>
O_Purchased_Fuels	<ul style="list-style-type: none"> <li>• Quantities and costs of purchased fuels (escalated and non-escalated)</li> </ul>
O_Operating_Costs	<ul style="list-style-type: none"> <li>• Variable and fixed operating costs (escalated and non-escalated)</li> </ul>
O_Operating_Income	<ul style="list-style-type: none"> <li>• Income from sales, environmental credits and production incentives (escalated and non-escalated, with and without sensitivity factors)</li> </ul>
O_IncomeStatement (Tax) O_IncomeStatement (SH)	<ul style="list-style-type: none"> <li>• Income statement: gross income, operating income, net profit before and after tax</li> <li>• Sales income detail</li> <li>• Cost of sales detail</li> <li>• Operating expenses detail</li> </ul>
O_BalanceSheet (Tax) O_BalanceSheet (SH)	<ul style="list-style-type: none"> <li>• Assets, liabilities and shareholder funds</li> </ul>
O_UseOfFunds	<ul style="list-style-type: none"> <li>• Sources of funds</li> <li>• Uses of funds</li> </ul>
O_CashFlow	<ul style="list-style-type: none"> <li>• Cash flow summary for operations and financing activities</li> </ul>

\* The names of worksheets intended to be printed out as forms begin with “O\_”. The worksheets “Calcs\_Life\_Cycle\_Cost,” and “Calcs\_Financial Indicators,” “\_Data,” are used as calculation space and do not contain input or output.

## 2. Getting Started

### ***Saving to a New File Name***

Be sure to save the original *RELCOST* spreadsheet in a back-up folder. When beginning a new project, create a separate folder for the project and save the spreadsheet to a new file name.

### ***Setting Up Excel***

The first time you use *RELCOST*, you must make sure certain calculation options are selected in Excel, as shown in Figure 1 and Figure 2.

In Excel 2003:

1. Go to the “Tools” menu and select “Options”. Then click on the “Calculation” tab.
2. Under “Calculation” select “Automatic”.
3. Check “Iteration”.
  - a. Set the maximum iterations to 100.
  - b. Set the maximum change to 0.0001.
4. Click on OK to accept the changes and close.

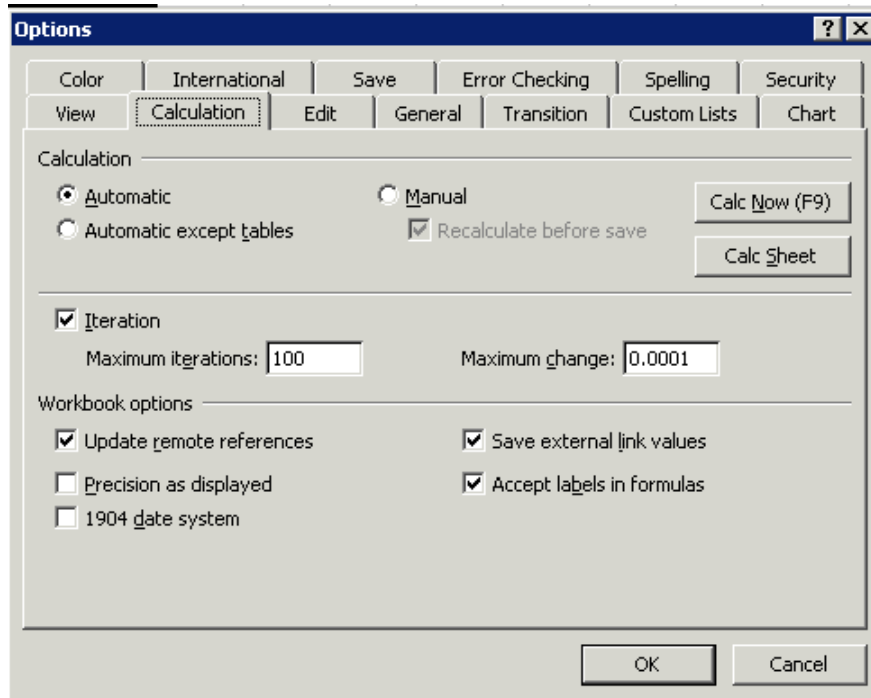
In Excel 2007:

1. Go to the “Excel Options” from the Office Button.
2. Click on the “Formulas”.
3. Under “Calculation Options”,
  - a. Set Workbook Calculation to “Automatic”.
  - b. Set the maximum iterations to 100.
  - c. Set the maximum change to 0.0001.
4. Click on OK to accept the changes and close.

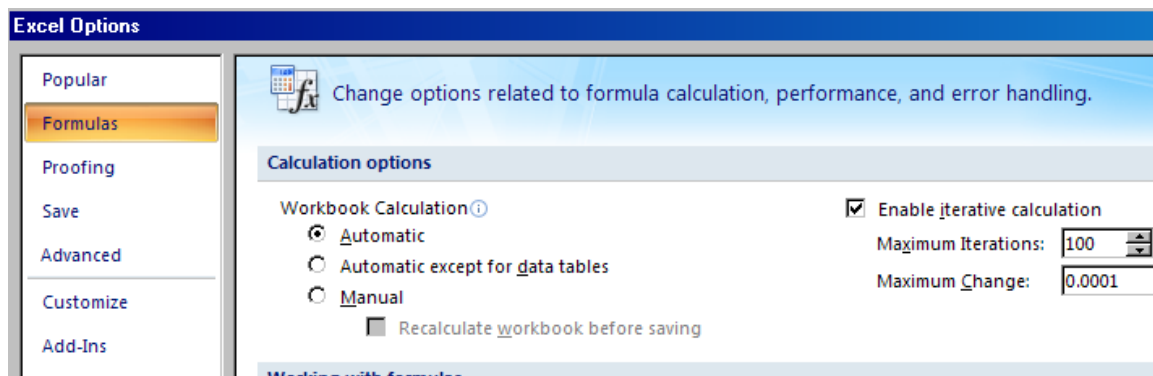
Also, in Excel 2007, enable macros:

1. Go to the “Excel Options” from the Office Button.
2. Click on the “Trust Center”.
3. Click on “Trust Center Settings”
4. Click on “Macros”
5. Select either
  - a. “Enable all macros”, or
  - b. “Disable all macros with notification”. If you select this option, Excel will show “Security Warning: Some active content has been disabled” when you open a *RELCOST* file. From the warning, go to “Options” and select “Enable this content”

**Figure 1. Microsoft Excel 2003 Calculation Options**



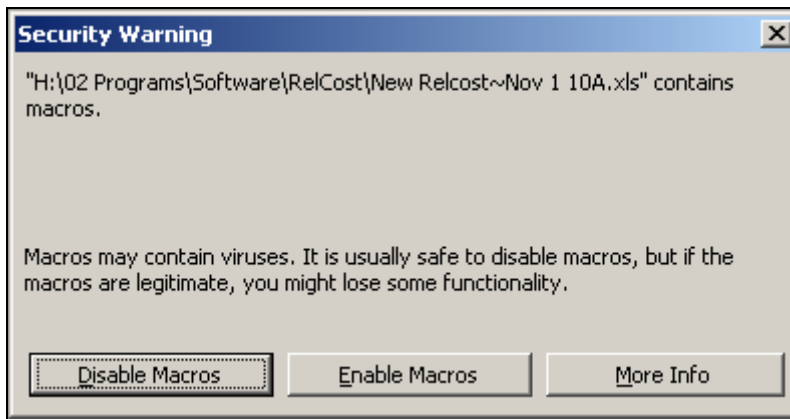
**Figure 2. Microsoft Excel 2007 Calculation Options**



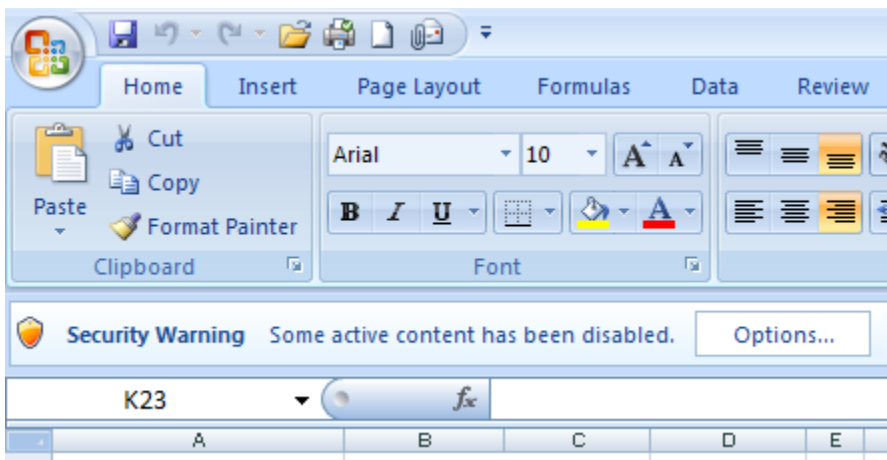
### ***Starting a RELCOST Model***

When opening RELCOST in Excel 2003 you will see an Excel security warning as shown in Figure 3. Select “Enable Macros” to continue. (In Excel 2007, the security warning will appear as in Figure 4 if macros are not enabled.)

**Figure 3. Microsoft Excel 2003 Security Warning – Select “Enable Macros”**



**Figure 4. Microsoft Excel 2007 Security Warning if Macros Are Not Enabled – Click on “Options” to Enable Macros for This Session**



### ***Input & Output Cell Colors***

In general, cells for data input are blue and cells providing output are green (see Figure 5). Cells containing background information or calculations are left white.

**Figure 5. Input & Output Cell Colors**

Inputs
Outputs



### 3. Model Inputs

Information on the project is input in the 18 worksheets summarized in Table 1.

#### ***“General” Tab***

A description of the project, financial assumptions and plant operating factors are entered on the “General” tab, as shown in Figure 6, Figure 7, and Figure 9. Space at the bottom of this sheet is reserved for entering detailed notes about the project and analysis.

The project life specified here is used in the life cycle cost analysis. Note the federal tax class life for calculation depreciation is specified on the “Depreciation” tab by selecting the appropriate depreciation schedule.

**Figure 6. Project Summary and General Information**

PROJECT SUMMARY	
Project	ABC Industrial Plant
Location	Washington State
Description	Topping Cycle CHP Project
Notes	Electricity generated by Comb Cycle Gas Turbine & Steam Turbine. Low pressure steam from steam turbine is used in plant.
Scenario	
GENERAL	
Project Life	20 years
First Year of Project	2010

**Figure 7. Financial Assumptions: Discount and General Inflation Rates**

FINANCIAL ASSUMPTIONS	
Discount rate	6.00%
General inflation rate	3%

#### **Discount Rate**

The discount rate is the opportunity cost of capital as a percentage of the value of the capital. That is, it represents the return on investment forgone elsewhere by committing capital to the project under consideration. The discount rate is used to calculate the present value of future cash flows and so quantifies the time value of money and allows for meaningful comparisons across years. For example, a discount rate of 10% means that an investor is indifferent to whether he receives \$1.00 today versus \$1.10 a year from

## Section 3. Model Inputs

today. The discount rate is used in calculating a project's net present value, benefit-cost ratio, levelized costs and other financial indicators of a project's performance.

### Selecting a Discount Rate

Selecting an appropriate discount rate is very important in project evaluation. Many planners maintain that an appropriate determination of the discount rate is even more important than accurate estimates of investment and operating costs. As an example of its importance, capital intensive projects with lower fuel costs, such as many renewable energy projects, are disadvantaged by high discount rates compared to less capital intensive projects with high fuel costs. This is illustrated by comparing the levelized cost of energy produced in the two scenarios compared in Figure 8. In one, initial capital expenditures are high and fuel costs are low and in the other capital expenditures are low and fuel costs high, all else being equal.

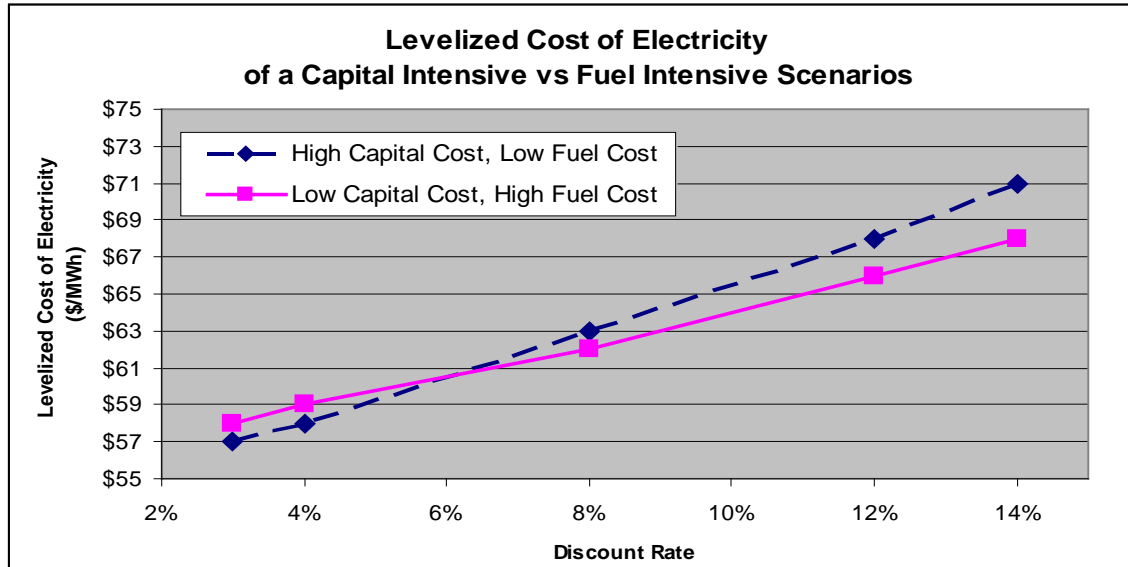
The discount rate that is chosen depends on the interested stakeholders and the type of project. For example, a government project might use the federal discount rate, which is the interest rate charged to commercial banks on loans they receive from their regional Federal Reserve Bank's lending facility. Aggressive private investors might use a discount rate of 12%. More conservative private investors might use a money market rate of about 7%. Equity investors may choose a discount rate of about 7% above the return on government bonds, which historically have averaged about 3% annually. A project with a variety of interests might use a melded rate.

The primary U.S. federal discount rate ranged between 2% and 13% from 1971 to 2008, as shown in Figure 10. From 2000 to 2008, the federal discount rate averaged 4%.

Background on the U.S. federal discount rate can be found online at [www.federalreserve.gov/monetarypolicy/discountrate.htm](http://www.federalreserve.gov/monetarypolicy/discountrate.htm).

Updates on the federal discount rate can be found online from the Federal Reserve Bank of New York at [www.newyorkfed.org/markets/statistics/dlyrates/fedrate.html](http://www.newyorkfed.org/markets/statistics/dlyrates/fedrate.html).

**Figure 8. Comparison of Levelized Cost of Electricity for Capital Intensive vs. Fuel Intensive Scenarios**



### General Inflation Rate

The general inflation rate is the rate at which the general level of prices for goods and services is increasing and correspondingly the rate at which purchasing power is decreasing. Inflation is measured by changes in the Consumer Price Index. The U.S. general inflation rate ranged between 1.6% and 13.5% from 1971 to 2008, as shown in Figure 11. Between 2000 and 2008, it averaged 2.8%. Data on the Consumer Price Index is available from the U.S. Bureau of Labor Statistics at [www.bls.gov/cpi/tables.htm](http://www.bls.gov/cpi/tables.htm).

### Plant Operating Factor

The plant operating factor, also referred to as the capacity factor, is the ratio of the energy produced by a plant to the energy that could have been produced at continuous full power operation. The plant operating factor is the product of the dispatch factor and the availability, which are entered on the “General” tab. As an example of these two factors, consider a wind farm. The *dispatch factor* indicates how much of the power that can be generated occurs at times when there is a market for it. *Availability* indicates how much of the time the plant is available to generate power during the times when it can be sold.

The dispatch factor and availability are often related to other factors. The user may optionally choose to enter data in terms of parasitic plant losses, partial year operation factor, resource depletion, transmission loss, scheduled maintenance, and curtailment factor. The dispatch factor and availability would then be calculated by entering the following equations:

### Section 3. Model Inputs

- Dispatch Factor = 1 - Curtailment Factor
- Availability = (1-Parasitic Plant Losses) \* (1-Partial Year Operation Factor) \* (1-Resource Depletion) \*(1- Transmission Loss) \*(1- Scheduled Maintenance)

Table 3 shows typical resource depletion rates for several generation resources. Table 4 shows data for typical plant operating factors of selected community-scale renewable energy technologies. A useful resource for capacity factors of wind projects is the California Energy Commission's Wind Performance Reporting System program available at <http://wprs.ucdavis.edu/>.

**Table 3. Typical Annual Resource Depletion of Renewable Generation Resources**

Generation Resource	Annual Resource Depletion
Geothermal	4%
Hydropower – New Small Scale and Capacity Upgrade of Existing	1%
Ocean Wave	1%
Wind	1%
Combined Cycle Gas Turbine	0.2%
Coal and Biomass Integrated Gasification Combined Cycle ( IGCC)	0.05%
Biomass Combustion	0.10%
Solar Photovoltaic	0.5%

**Figure 9. Plant Operating Factor**

	2011	2012	2013	2014	2015
Project Year	1	2	3	4	5
<b>PLANT OPERATING FACTOR</b>					
Dispatch Factor (a)	100%	100%	100%	100%	100%
Availability (capacity) Factor (b)	44%	83%	83%	83%	83%
Plant Operating Factor	44%	83%	83%	83%	83%
<b>FACTORS AFFECTING DISPATCH FACTOR (Optional, enter in formulas above)</b>					
Curtailment factor (a)	0.0%	0.0%	0.0%	0.0%	0.0%
<b>FACTORS AFFECTING AVAILABILITY (Optional, enter in formulas above)</b>					
Parasitic plant losses (b)	10.0%	10.0%	10.0%	10.0%	10.0%
Partial year operation factor (b)	50.0%	5.0%	5.0%	5.0%	5.0%
Resource depletion (b)	0.1%	0.2%	0.3%	0.4%	0.5%
Transmission loss (b)	2.0%	2.0%	2.0%	2.0%	2.0%
Scheduled maintenance (b)	0.5%	0.5%	0.5%	0.5%	0.5%

## Section 3. Model Inputs

**Table 4. Typical Plant Operating Factors of Selected Energy Technologies for a Sample of Projects in California\***

Technology	Size (MW)	Plant Operating Factor (%)		
		Minimum	Average	Maximum
Advanced Anaerobic Digesters (Food Industry) <sup>1</sup>	<20	83	86	92
Landfill Gas <sup>1</sup>	<20	75	85	90
Biogas - Waste Water Treatment <sup>1</sup>	<20	80	85	93
Solar Photovoltaic – Fixed Tilt <sup>1</sup>	<20	14.1	16.2	17.5
Solar Photovoltaic – Tracking <sup>1</sup>	<20	18.3	21	23
Wind <sup>1</sup>	<20	12	25	37
Hydroelectric – In Conduit <sup>1</sup>	<20	10	51	90
Biomass Combustion	28-38	75	85	90
Geothermal - Binary	15	80	90	95
Hydro – Small Scale	15	12	30	61
Solar	25	26	27	28
Onshore Wind Class 3/4	50	34	37	41
Conventional Combined Cycle Natural Gas	500	50	75	90

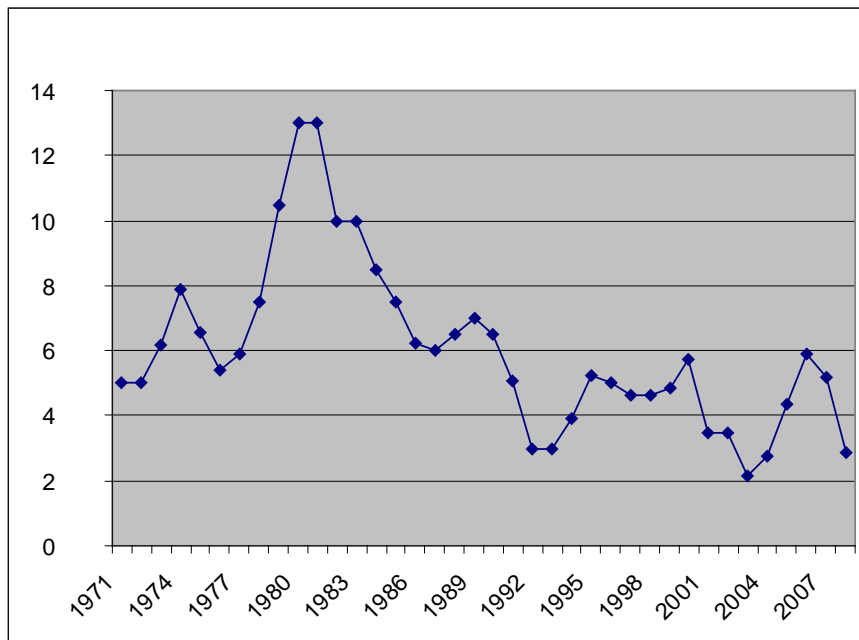
1. *Building and Community Scale Renewable Technology Costs*, KEMA, 2009, [www.energy.ca.gov/2009\\_energy\\_policy/documents/2009-08-25\\_workshop/presentations/index.php](http://www.energy.ca.gov/2009_energy_policy/documents/2009-08-25_workshop/presentations/index.php)

**Table 5. Typical Construction Times for Selected Energy Project Types**

	Year 1 (%)	Year 2 (%)	Year 3 (%)
Natural gas simple and combined cycle	100	0	0
Biomass ICC, small-scale hydro, wave, solar	100	0	0
Coal IGCC	80	20	0
Biomass combustion - stoker	90	10	0
Geothermal - binary	40	40	20
Geothermal - flash	35	35	30
Wind	90	10	0

Source: *Comparative Costs of California Central Station Electricity Generation*, California Energy Commission, August 2009, <http://www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF>.

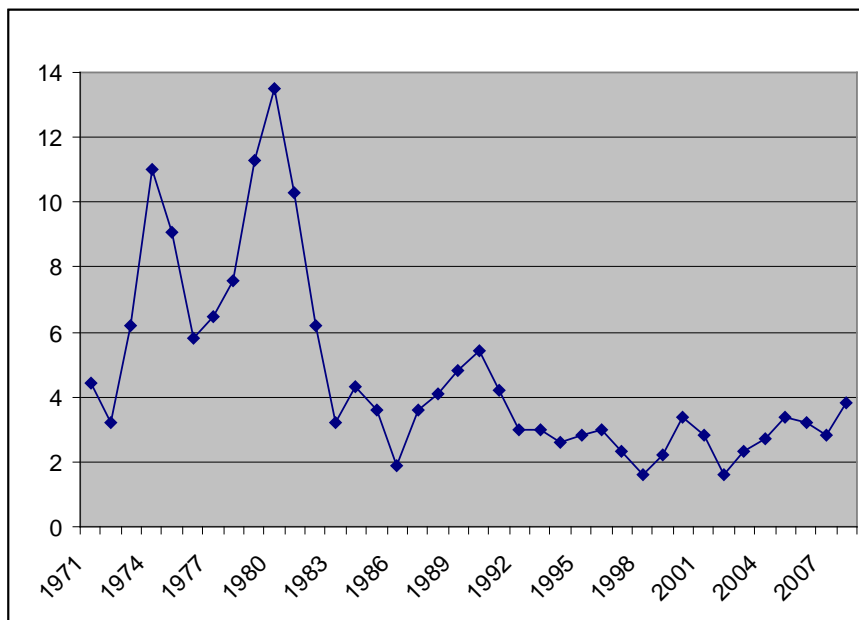
**Figure 10. Primary Federal Discount Rate,\* 1971 to 2008**



From [www.newyorkfed.org/markets/statistics/dlyrates/fedrate.html](http://www.newyorkfed.org/markets/statistics/dlyrates/fedrate.html)

\* Primary credit is available to generally sound depository institutions on a very short-term basis. Secondary credit is available to depository institutions not eligible for primary credit. From 2003 to 2008, the secondary discount rate was 0.5 percentage points greater than the primary discount rate.

**Figure 11. General Inflation Rate, 1971 to 2008\***



\* Extracted from the U.S. Bureau of Labor and Statistics, "Consumer Price Index History Table" [ftp://ftp.bls.gov/pub/special.requests/cpi/cpiat.txt](http://ftp.bls.gov/pub/special.requests/cpi/cpiat.txt).

### ***“WhatIf” and “Financial Indicators” Tabs***

The “WhatIf” tab shows results of life-cycle-cost analysis and other indicators of financial performance. The sensitivity factors on this tab can be used to quickly evaluate alternate scenarios and options, as explained below, with results displayed on the same screen.

The “WhatIf” tab also contains figures graphically showing information from pro forma statements. These are discounted cash flows, cash balance, operating costs and net profit after taxes over a 20-year period.

### **Life-Cycle-Cost Analysis Results**

Results of the life-cycle-cost analysis are provided on the “WhatIf” tab, as shown in Figure 12. In the example shown, the internal rate of return on equity investments was 20.9% with a project life of 20 years and discounted payback was 7.0 years.

For a discussion of internal rate of return, discounted payback, net present value and benefit cost ratio refer to the section “Life Cycle Cost Analysis.” To see comments on how these values are calculated, pass your mouse over the labels in the spreadsheet.

### **Internal Rate of Return Calculator**

The equity and project internal rate of return are not automatically updated when changes are made to the rest of the spreadsheet. To update results, click the red calculator icon to the right of the life-cycle-cost results. When results need updating, the message “**Click the calculator below to update IRR**” will appear in red above the icon.

In most cases there will be only one value for the IRR, but in some cases there are two. If there is not a second value, “Value2” will equal exactly zero.

The solver for the IRR requires an initial guess and searches for a certain number of roots. The defaults are 10% and 3, respectively. If unreasonable or unlikely values for the IRR are displayed (such as very large positive or negative values or exactly zero for both values) modify the initial guess.

Note if you have not enabled macros in Excel, the IRR calculator will not run. Refer to Section “Getting Started”.

Figure 12. Life Cycle Cost Analysis Results on the "WhatIf" Tab

RESULTS					
Project Life		20	Years	Click the calculator below to update IRR	
Life Cycle Cost Analysis			Value	Value2	Update
Equity IRR	G		20.9%	0.0%	10.0%
Project IRR	G		27.8%	0.0%	10.0%
Net Present Value	Y		\$ 4,476,220		
Benefit Cost Ratio (After Tax)	G		2.00		
After-Tax Discounted Payback	Y		7.0	years	
Simple Payback			Value		
Simple Payback (Calc Method 1)	Y		3.2	years	
Simple Payback (Calc Method 2)	R		5.9	years	

### Financial Scorecard

The Financial Scorecard on the “WhatIf” tab displays a number of indicators of the financial health of the project in a specified year. This “scorecard year” is entered in the blue cell at the top of this section. In the example shown in Figure 13, the project had a gross margin of 59.7% and a debt-to-equity ratio of 0.48 in the fourth year of the project.

For a discussion of profitability ratios, liquidity measures, cash flow ratios, leverage ratios and levelized costs, refer to the section “Financial Indicators.”

### Flagging Poor, Marginal and Good Financial Indicators

In the Financial Scorecard and Life-Cycle-Cost Analysis sections on the “WhatIf” tab, colors are used to indicate poor, marginal and good performance. Poor values are shown in red, marginal values in yellow, and good values in green. The ranges of values considered good, marginal or poor are selected by the user on the “Financial Indicators” tab, as shown in Figure 14.

For financial indicators for which high values are preferred, minimum and maximum red (MIN Red and MAX Red) values and maximum yellow (MAX Yellow) values are specified. An example is the project internal rate of return (Project IRR). In the example shown in Figure 14, a Project IRR of 40% and greater (MAX Yellow) is given a green light. A yellow light will be given for Project IRRs over 20% (MAX Red) and up to 40% (MAX Yellow). Values less than 20% receive a red light.



## Section 3. Model Inputs

For financial indicators for which low values are preferred, maximum yellow (MAX Yellow) and maximum green (MAX Green) values are specified. An example is the discounted payback. In the example shown in Figure 14, a green light will be given for paybacks up to 2 years (MAX Green). A yellow light will be given for paybacks between 2 (MAX Green) and 5 (MAX Yellow.) Any value of 5 or greater will be given a red light. (If the discounted payback does not payback within 20 years, its value will be “N/A.”)

Poor, marginal and good values for levelized costs are defined similarly, as shown in Figure 15. Because low costs are preferable, MAX Yellow and MAX Green values are entered.

**Figure 13. Financial Scorecard on the “WhatIf” Tab**

FINANCIAL SCORECARD			
Scorecard Year	4		
<b>Profitability Ratios</b>		<b>Value</b>	
Gross Margin	G	59.7%	
Operating Margin	G	52.4%	
Pre - Tax Margin	G	51.7%	
After - Tax Margin	G	36.3%	
<b>Liquidity Measures</b>			
Current Ratio	G	41.3	
Acid Test Ratio	G	41.3	
<b>Cash Flow Ratios</b>			
Debt Service Coverage Ratio	G	5.5	
<b>Leverage Ratios</b>			
Debt to Equity	G	0.48	
Debt	Y	32.6%	
Equity	Y	67.4%	
Debt-Asset Ratio	G	0.04	
Interest Coverage	G	69.48	
<b>Levelised Cost (Pre-Tax)</b>			
1 Electricity Sales	G	\$60.57	\$/MWhr
2 Heat Sales	Y	\$0.00	\$/MMBtu
3 Sales 1	Y	\$0.00	\$/MMBtu
4 Sales 2	Y	\$0.00	\$/MMBtu
5 Sales 3	Y	\$0.00	\$/MMBtu
6 Sales 4	Y	\$0.00	\$/MMBtu
7 Sales 5	Y	\$0.00	\$/MMBtu
8 Sales 6	Y	\$0.00	\$/MMBtu
9 Sales 7	Y	\$0.00	\$/MMBtu

**Figure 14. Definition of Poor, Marginal and Good Values for Financial Indicators – “Financial Indicators” Tab**

<b>FINANCIAL INDICATORS &amp; RATIOS</b>						
<b>Scorecard Year=</b>	<b>4</b>					
<b>Financial Indicators (Period end values)</b>	<b>Risk Value</b>	<b>Risk Level</b>	<b>Red</b>		<b>Yellow</b>	<b>Green</b>
			<b>MIN</b>	<b>MAX</b>	<b>MAX</b>	<b>MAX</b>
Equity IRR	67.2%	G	0%	15%	50%	
Project IRR	36.81%	Y	10%	20%	40%	
Net Present Value	\$ 27,096,917	G			\$0.00	\$20,000,000
Discounted Payback (years) – After Tax	4.5	Y			5	2
Benefit-Cost Ratio (After Tax)	7.74	G	0	1	1.5	
<b>Profitability Ratios</b>						
GrossMargin	59.7%	G	0%	30%	50%	
Operating Margin	52.4%	G	0%	25%	50%	
Pre - Tax Margin	51.7%	G	0%	25%	50%	
After - Tax Margin	36.3%	G	0%	15%	30%	
<b>Liquidity Measures</b>						
Current Ratio	41.28	G	-9999	1	10	
Acid Test Ratio	41.28	G	-9999	1	10	
<b>Cash Flow</b>						
Debt Service Coverage Ratio	5.49	G	-9999	1	2	
<b>Leverage Ratios</b>						
Debt to Equity	0.48	G			1.80	1.00
Debt	32.6%	Y			50%	20%
Equity	67.4%	Y	0%	50%	80%	
Debt-Asset Ratio	0.04	G			2	1
Interest Coverage	69.48	G	0	1	1.5	
Effective Interest Cost (%)	5.07%	Y			15%	5%

**Figure 15. Financial Indicators – Levelized Selling Prices – “Financial Indicators” Tab**

<b>SALES &amp; INCOME</b>						
<b>Scorecard Year=</b>	<b>4</b>					
<b>Levelised Cost (Pre-Tax)</b>	<b>Risk Value</b>	<b>Risk Level</b>	<b>Red</b>		<b>Yellow</b>	<b>Green</b>
			<b>MIN</b>	<b>MAX</b>	<b>MAX</b>	<b>MAX</b>
1 Electricity Sales	\$ 58.85	G			100	70
2 Heat Sales	\$ -	Y			100	50
3 Sales 1	\$ -	Y			100	50
4 Sales 2	\$ -	Y			100	50
5 Sales 3	\$ -	Y			100	50
6 Sales 4	\$ -	Y			100	50
7 Sales 5	\$ -	Y			100	50
8 Sales 6	\$ -	Y			100	50
9 Sales 7	\$ -	Y			100	50

## Sensitivity Factors

Sensitivity factors can be used to vary input parameters to quickly examine the effect of different scenarios on project viability. Sensitivity factors are essentially multipliers of various inputs. Entering a sensitivity of 100% indicates values are as entered on other tabs. For a discussion of sensitivity analysis and break-even analysis refer to the section “Financial Modeling Process.”

In performing a sensitivity analysis, first a base model is established, entering the most likely values for all parameters. Once the base model is established, sensitivity factors for parameters such as interest rates, capital costs, funding plan, energy tariffs, etc. are varied one at a time. Re-run the model as many times as necessary, altering one parameter at a time.

## Section 3. Model Inputs

In the example shown in Figure 16, a sensitivity factor of 150% has been entered for the sales price of electricity. This means that the sales price that was entered on the “Sales” tab – \$50/MWh in this example (not shown) – is multiplied by 150%. The new sales price of \$75/MWh is shown to the right of the sensitivity factor. All results are recalculated using the new value. Values on the “Sales” tab remain as entered.

Sensitivity factors can also be used to compare alternate scenarios. The example shown in Figure 16 is from an analysis of an anaerobic dairy digester project for which three energy sales options were considered: electricity generation with sales to the utility grid, sale of upgraded biogas into the natural gas pipeline, or sale of biogas to a nearby private industry. In the case shown, we were looking at the option of selling electricity. Sales of upgraded gas and biogas have been “turned off” by entering zero for their sensitivity factors. Other parameters associated with these options can also be adjusted. For example, to look at natural gas sales we would need to not only zero out electricity sales but also renewable energy credits and production incentives since these are only for electricity generation. Differences in capital, major expenses, and operating expenses for each scenario can also be adjusted using sensitivity factors.

At the bottom of the Sensitivity Factors section, space is provided for entering user-defined sensitivity factors. In the example shown, sensitivity factors have been entered that are used in the funding plan (proportion of debt to equity financing and grants.)

### Escalation Forecast

At the top of the Sensitivity Factors area on the “WhatIf” tab, an escalation forecast type (likely, aggressive, or conservative) is selected. This will correspond to escalation rates entered on the “Cost Escalation” tab. In the example shown in Figure 16, a “Likely” forecast is selected.

**Figure 16. Anaerobic Digester Example – “WhatIf” Tab (examining scenario of selling electricity to the utility grid at 150% the values entered on the “Sales” tab)**

SENSITIVITY FACTORS			
<b>Escalation Forecast Type</b>	<b>Likely</b>		
<b>Environmental Credits &amp; Prod Incentives</b>		<b>1st Yr Unit Costs</b>	
Carbon Credits:	100%	\$0.00	\$ per ton
Renewable Energy Credits	100%	\$10.00	\$ per MWh
Federal RE Production Incentive	100%	\$15.00	\$ per MWh
Local RE Production Incentives	100%	\$0.00	\$ per MWh
<b>Income</b>			
1 Electricity Sales	150%	\$75.00	\$/MWhr
2 Upgraded Gas Sales to Pipeline	0%	\$0.00	\$/MMBtu
3 Gas to Private Industry	0%	\$0.00	\$/MMBtu
4 Tipping Fees: Egg Breakage	100%	\$0.05	\$ per gallon
5 Tipping Fees: Vegetable Waste	100%	\$8.00	\$ per ton
6 Tipping Fees: Other	100%	\$50.00	\$ per ton
7 Co-prod: Fiber (Bedding, Compost)	100%	\$2.00	\$ per yard
8 Co-prod: Effluent to neighboring farm	100%	\$0.05	\$ per gallons
9 Heat Sales to Co-Located Greenhouse	100%	\$5.00	\$/MMBtu
<b>Purchased Fuels</b>			
1 Biomass	0%	\$ -	\$/Ton
2 Coal (Anthracitic)	0%	\$ -	\$/Ton
3 Coal (Bituminous)	0%	\$ -	\$/Ton
4 Electricity	0%	\$ -	\$/MWh
5 Geothermal Energy	0%	\$ -	\$/MBTU
6 Municipal Waste	0%	\$ -	\$/Ton
7 Natural Gas	0%	\$ -	\$/Therm
8 Oil (Heavy)	0%	\$ -	\$/Therm
9 Oil (Light)	0%	\$ -	\$/Therm
10 Waste Heat	0%	\$ -	\$/MBTU
<b>Expenses</b>		<b>1st 5 Years</b>	
Capital Expenses	100%	\$ 7,136,226	Total 5th yr
Major Expenses	100%	\$ 21,087	Ave
O&M Expenses	100%	\$ 1,114,756	Ave
Insurance Expense	100%	\$ 33,268	Ave
Property Taxes	100%	\$ -	Ave.
<b>Tax Credits (optional)</b>		<b>1st 5 Years</b>	
Federal	100%	\$ 356,811	Total 5th yr
State	0%	\$ -	Total 5th yr
Local	0%	\$ -	Total 5th yr
<b>Operation</b>		<b>1st 5 Years</b>	
Plant Operating Factor	100%	87%	Ave.
<b>User-Defined Factors (Optional)</b>			
Federal tax credits	0%	\$ -	Total 5th yr
State tax credits	0%	\$ -	Total 5th yr
Local tax credits	0%	\$ -	Total 5th yr
LT loan to Equity	50%	\$ 1,950,000	LT loan
DOE Grant	100%	\$ 14,000,000	Total
BETC Credit (lump sum)	100%	\$ 2,100,000	Total

### **“Capital Expenditures” Tab**

*RELCOST* provides space for entering a number of initial capital expenditures in three general categories. The term initial capital expenditures refers to the cost to install a project immediately without construction interest or escalation effects. Initial capital expenditures are also referred to as “instant costs” or “overnight costs.”

Suggested categories are Engineered Equipment, Construction and Commodities, and Staff and Other Costs (see Figure 18). However, all titles and descriptions are optional on this tab and can be modified to reflect the actual project. For example, if only a total cost is known, a single lump sum can be entered into any of the category areas with all else zeroed out. What is important in calculations is the overall subtotal of these three categories, which is used in calculating below-the-line and total expenditures.

For reference, capital costs of electricity generation plants in the U.S. in June 2008 are shown in Figure 20. Useful references that contain a wealth of data on typical costs include:

- *Comparative Costs of California Central Station Electricity Generation*, Figure 8, [www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF](http://www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF)
- *Renewable Energy Cost of Generation Update*, KEMA Inc., August 2009, Publication No. CEC-500-2009-0.84, [www.energy.ca.gov/2009publications/CEC-500-2009-084/CEC-500-2009-084.PDF](http://www.energy.ca.gov/2009publications/CEC-500-2009-084/CEC-500-2009-084.PDF)
- *Building and Community Scale Renewable Technology Costs*, Kema, Inc, Oakland, CA, workshop presentation, August 10, 2009 [www.energy.ca.gov/2009\\_energypolicy/documents/2009-08-25\\_workshop/presentations/index.php](http://www.energy.ca.gov/2009_energypolicy/documents/2009-08-25_workshop/presentations/index.php)
- *Turning the Corner on Global Warming Emissions: An Analysis of Ten Strategies for California, Oregon and Washington*, Table 15, [www.oregon.gov/ENERGY/GBLWRM/docs/B-TellusTurningtheCorner.pdf](http://www.oregon.gov/ENERGY/GBLWRM/docs/B-TellusTurningtheCorner.pdf)
- *Levelized Cost of Energy*, Presentation by Lazard Ltd. to the National Association of Regulatory Utility Commissioners, June 2008, [www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20\(2\).pdf](http://www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20(2).pdf)

### **“Below the Line” Expenditures**

Contingency and contractor profit factors are applied to the sum of the sub-totals of the three general categories. In the example shown in Figure 19, the subtotal for costs entered in the three general categories is \$7,136,226. A contingency factor of 10% and contractor profit factor of 8% are applied (or 18% of \$7,136,222 equals \$1,284,521.)

### Total Expenditures

In the Total Expenditures area, costs and below-the-line expenses are totaled. The sensitivity factor from the “WhatIf” tab and cost escalation factors from the “Cost Escalation” tab are applied. In the example shown in Figure 19, a sensitivity factor of 85% was entered (85% of \$8,420,747 equals \$7,157,635.) No escalation is shown in this example because all capital expenditures occurred in the first year.

Table 6 shows typical installed costs in 2009 for several renewable energy technologies.

**Table 6. Installed Costs of Selected Community Scale (<20MW) Renewable Energy Technologies for a Sample of Projects in California\***

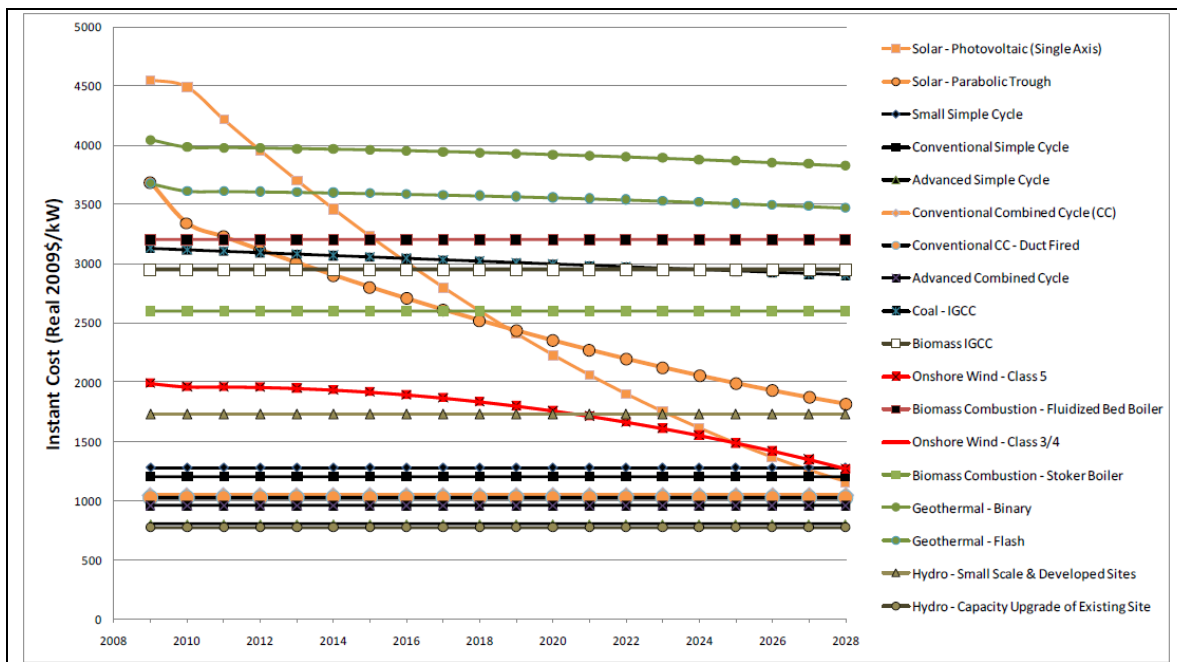
Technology	Installed Costs (\$/kW)		
	Minimum	Average	Maximum
Advanced Anaerobic Digesters (Food Industry)	\$2,033	\$4,769	\$15,250
Landfill Gas	\$1,000	\$2,000	\$2,400
Biogas - Waste Water Treatment	\$3,044	\$3,471	\$4,074
Solar Photovoltaic – Commercial Fixed Tilt	\$3,000	\$7,960	\$16,000
Solar Photovoltaic – Tracking	\$5,500	\$7,340	\$10,500
Wind	\$2,000	\$2,500	\$4,000
Hydroelectric – In Conduit	\$1,156	\$1,968	\$3,853

From *Building and Community Scale Renewable Technology Costs*, KEMA, 2009

[www.energy.ca.gov/2009\\_energy\\_policy/documents/2009-08-25\\_workshop/presentations/index.php](http://www.energy.ca.gov/2009_energy_policy/documents/2009-08-25_workshop/presentations/index.php)

## Section 3. Model Inputs

**Figure 17. Projected Trends in Initial Capital Expenditure (\$ Per kW) in 2009 Dollars**



Source: *Comparative Costs of California Central Station Electricity Generation*, Figure 8, [www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF](http://www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF)

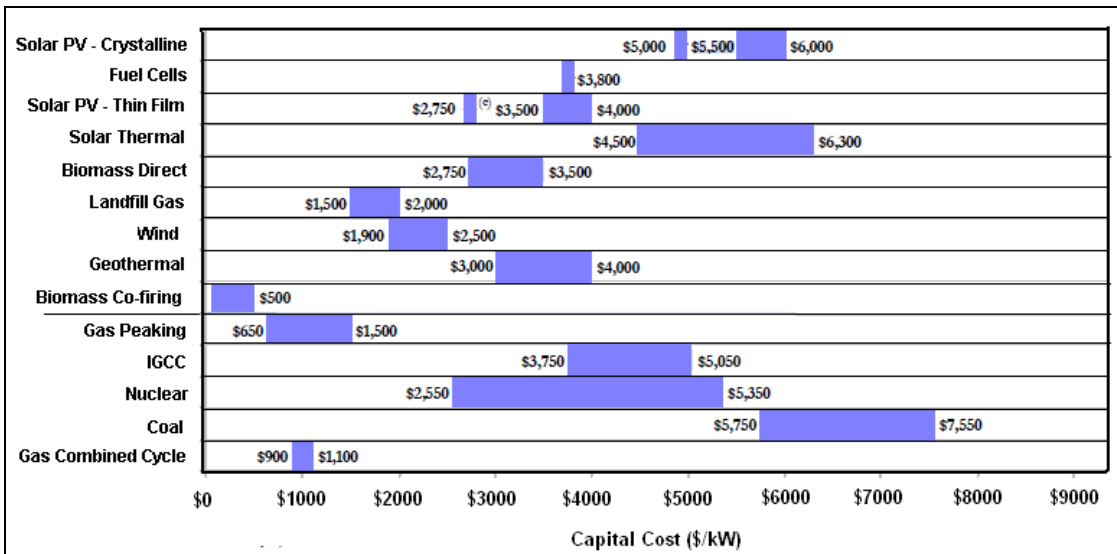
**Figure 18. Capital Expenditures**

Project Year		1	2
<b>Engineered Equipment</b>			
Boiler	\$	1,900,000	
Turbine generator	\$	1,400,000	
Wood dryer	\$	875,000	
APC	\$	250,000	
Ash handling	\$	195,000	
Chimney	\$	75,000	
Vessels	\$	10,000	
Exchangers/Condensers	\$	117,000	
Pumps	\$	115,000	
Cooling tower	\$	90,000	
Storage tanks	\$	90,000	
Fuel handling	\$	125,000	
Packaged systems	\$	112,000	
Water treatment	\$	85,000	
Electrical equip.	\$	225,000	
Instrumentation	\$	195,000	
<b>Sub-Total</b>	<b>\$</b>	<b>5,859,000</b>	<b>\$ -</b>
<b>Construction and Commodities</b>			
Site work	\$	135,000	
Concrete work	\$	625,000	

Figure 19. Capital Expenditures – “Below the Line” and Total Expenditures

Sub-Total (for the 3 categories of costs above)				
	\$	7,136,226	\$	-
<b>Below the line</b>				
Contingency factor		10.00%	10.00%	10.00%
Contractor profit factor		8.00%	8.00%	8.00%
Contingency	\$	713,623	\$	-
Contractor profit	\$	570,898	\$	-
<b>Sub-Total</b>	\$	1,284,521	\$	-
<b>Total Expenditures</b>				
Total (Non-escalated, No Sensitivity)	\$	8,420,747	\$	-
Total (Non-escalated, w/sensitivity)	\$	7,157,635	\$	-
<b>Total (Escalated + sensitivity)</b>	\$	<b>7,157,635</b>	\$	-
Accumulated	\$	7,157,635	\$	7,157,635

Figure 20. Capital Cost (\$/kW) Comparison of Conventional and Renewable Energy Projects (2008)\*



Capital cost estimates by Lazard Ltd were based on the following:

- Low end capital cost of crystalline solar PV project represents single-axis tracking crystalline and high end represents fixed installation. Single value of \$5000 per kW below the low-to-high range is based on a leading solar crystalline company's guidance of 2010 total system cost of \$5.00 per watt.
- Capital cost of thin-film solar PV project is based on the leading thin-film company's guidance of 2010 total system cost of \$2.75 per watt.
- Low end capital cost of solar thermal plant represents solar trough and high end represents solar tower.
- Capital cost of biomass co-firing represents retrofit cost of existing coal plant.
- High end capital cost of integrated gasification combined cycle (IGCC) plant incorporates 90% carbon capture and compression.

Capital cost of coal plant is based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression. Adapted from *Levelized Cost of Energy Analysis*, presentation by Lazard Ltd. to the National Association of Regulatory Utility Commissioners, June 2008, [www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20\(2\).pdf](http://www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20(2).pdf)



### ***“Depreciation” and “Depreciation\_Factors” Tabs***

Depreciation takes into account that the value of tangible assets generally declines over time. It is a basic expense of doing business and impacts cash flow and earnings. Depreciation practices are governed by tax laws of both federal and state governments. It is essential to monitor changes in tax law and depreciate assets with care, relying on experts who fully understand current tax law. The information in this User’s Manual is provided for explanatory purposes only in using *RELCOST* and should not be relied on in calculating taxes.

The way depreciation of capital expenditures is calculated in *RELCOST* is specified on the “Depreciation” tab. Depreciation is often calculated differently for tax purposes and internal purposes. Therefore, two sections are provided on the “Depreciation” tab. In the top section, depreciation for tax purposes is specified and depreciation for internal purposes is specified below this. For tax purposes, depreciation is often accelerated and is calculated using tax depreciation tables based on tax law. For shareholder and internal purposes, we are concerned with profitability from a “real” cash perspective. Depreciation for internal purposes is often calculated using either straight-line depreciation or based on debt principal payments. References to the “Capital Expenditures” tab near the top of the sheet are given for convenience in calculating the depreciation base.

### **Depreciation Factors**

Factors used in calculating depreciation for both purposes are entered on the “Depreciation\_Factors” tab, as shown in Figure 22. These factors give the percentage of an asset’s cost that can be recovered each year. Data from the U.S. Internal Revenue Service (IRS) depreciation tables have been entered as default values. Below the default values, there are blank lines to enter factors for other schedules, such as schedules for countries other than the U.S. Depreciation factors are automatically “looked up” when the user selects a depreciation schedule in the drop-down menus on the “Depreciation” tab, as shown in Figure 21. Note that “debt principal payments” is also one of the default choices on the drop-down menus of depreciation schedules.

### **Selecting a Depreciation Schedule from the Drop Down Menu**

The default factors are taken from the IRS’s Modified Accelerated Cost Recovery System (MACRS) from tables given in Appendix A of IRS Publication 946 “How to Depreciate Property,” which can be obtained online. The key used on *RELCOST*’s dropdown menus of schedules identifies four characteristics of the IRS’s MACRS schedules, as follows:

- Asset class, which defines property life in years
- Depreciation method (200% declining balance, 150% declining balance or straight line)
- Convention, which establishes when the recovery period begins (half-year, mid-quarter, or mid-month)
- Quarter that the property was placed in service (Q1, Q2, Q3 or Q4)

In the example shown in Figure 21, the depreciation schedule key 20YR~150DB~MQ~Q4 has been selected for the first year's base. This means the property has a 20 year life, is depreciated using the 150% declining balance method and mid-quarter convention, and was placed in service in the fourth quarter.

### Salvage Value

Salvage value is the estimated value of an asset at the end of its useful life after depreciation. Salvage value can be negative if the asset requires special treatment or disposal at the end of its life. In *RELCOST*, salvage value is entered as a percentage of its first cost. In Figure 21, a salvage value of 20% has been entered.

### Depreciation and the Pro Forma Statements

Depreciation appears on the Income Statements, Balance Sheets and Cash Flow Statement. Depreciation reduces a company's earnings while increasing its cash flow. Therefore, depreciation<sup>2</sup> is added back to cash inflows on the Cash Flow Statement and subtracted from the gross income on the Income Statement. Accumulated depreciation appears on the Balance Sheet to adjust the book value of assets.

#### Depreciation of Renewable Energy and Combined Heat & Power Technologies

A number of renewable energy and combined heat and power technologies are classified as five-year property under the MACRS. Such property currently includes:

- A variety of solar electric and solar thermal technologies
- Fuel cells and microturbines
- Geothermal electric
- Direct-use geothermal and geothermal heat pumps
- Small wind (100 kW or less)
- Combined heat and power (CHP)

For certain biomass property, the MACRS property class life is seven years. Eligible biomass property generally includes assets used in the conversion of biomass to heat or to a solid, liquid or gaseous fuel, and to equipment and structures used to receive, handle, collect and process biomass in a waterwall, combustion system, or refuse-derived fuel system to create hot water, gas, steam and electricity.

The federal *Economic Stimulus Act of 2008*, enacted in February 2008, included a 50% bonus depreciation provision for eligible renewable-energy systems.

For more information, refer to the IRS Publication 946 and to the DSIRE database at [www.dsireusa.org](http://www.dsireusa.org).

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<sup>2</sup> Amortization and depletion would also be added back to cash inflows, but these are not included in *RELCOST*. Amortization used in this sense is a method of recovering (deducting or writing off) the capital costs of intangible assets over a fixed recovery period.

Figure 21. Depreciation

Project Year	1	2	
<b>Depreciation for Internal Purposes (SH) (Expenditures with escalation and sensitivity factor)</b>			
<b>Class I</b>			
Description			
Amount	\$ 4,967,227	\$ 2,483,614	
Salvage %	0%	0%	
Depreciation Base	\$ 4,967,227	\$ 2,483,614	\$
Depreciation Schedule	07YR~SLINE~HY~ANY	20YR~150DB~MQ~Q4	20YR~150DB~MQ~Q4
<b>Class II</b>			
Description		20YR~150DB~HY~ANY	
Amount		20YR~150DB~MQ~Q1	
Salvage %		20YR~150DB~MQ~Q2	
Depreciation Base	\$	20YR~150DB~MQ~Q3	
Depreciation Schedule	10YR~200DB~HY~ANY	20YR~150DB~MQ~Q4	20YR~150DB~MQ~Q4
<b>Class III</b>			
Description			
Amount			
Salvage %			
Depreciation Base	\$ -	\$ -	\$
Depreciation Schedule	10YR~200DB~HY~ANY	10YR~200DB~HY~ANY	20YR~150DB~MQ~Q4
<b>All Classes</b>			
Salvage	\$ -	\$ -	\$
Depreciation Base	\$ 4,967,227.20	\$ 2,483,613.60	\$
Total value	\$ 4,967,227.20	\$ 2,483,613.60	\$
Calculated depreciation	\$ 377,956.32	\$ 894,349.26	\$

Figure 22. Depreciation Factors

A	B	C	D	E	F	G
<b>Inputs</b>						
<b>Outputs</b>						
	<b>Project Year</b>					
<b>Depreciation Schedule</b>	1	2	3	4	5	6
02YR~SLINE~HY~ANY	0.2000	0.4000	0.4000			
02YR~SLINE~MQ~Q1	0.3500	0.4000	0.2500			
02YR~SLINE~MQ~Q3	0.1500	0.4000	0.4000	0.0500		
02YR~SLINE~MQ~Q4	0.0500	0.4000	0.4000	0.1500		
03YR~150DB~HY~ANY	0.2500	0.3750	0.2500	0.1250		
03YR~150DB~MQ~Q1	0.4375	0.2813	0.2500	0.0312		
03YR~150DB~MQ~Q2	0.3125	0.3438	0.2500	0.0937		
03YR~150DB~MQ~Q3	0.1875	0.4063	0.2500	0.1562		
03YR~150DB~MQ~Q4	0.0625	0.4688	0.2500	0.2187		
03YR~200DB~HY~ANY	0.3333	0.4445	0.1481	0.0741		
03YR~200DB~MQ~Q1	0.5833	0.2778	0.1235	0.0154		
03YR~200DB~MQ~Q2	0.4167	0.3889	0.1414	0.0530		
03YR~200DB~MQ~Q3	0.2500	0.5000	0.1667	0.0833		
03YR~200DB~MQ~Q4	0.0833	0.6111	0.2037	0.1019		
03YR~200DB~HY~ANY	0.1667	0.3333	0.3333	0.1667		

### **Depreciation and the Section 179 Deduction**

Typically, if business property has a useful life of more than one year, the cost must be spread across several tax years as depreciation, with a portion of the cost deducted each year. However, the provisions of Internal Revenue Code Section 179 allow some property acquired for business purposes to be fully expensed in the year it is purchased. Tax-law changes over the past few years have made this option much more appealing by dramatically increasing the amount that can be written off immediately.

Refer to IRS publications ([www.irs.gov/publications/p946/ch02.html](http://www.irs.gov/publications/p946/ch02.html)) and to your tax preparer to identify eligible property that may be written off in the tax year of purchase.

In *RELCOST*, the Section 179 deduction is selected by choosing “01 YR~Section 179” on the depreciation schedule drop-down list.

### Determining Class, Convention and Method under MACRS

In calculating depreciation, it is important to correctly determine an asset's class, and the convention and method of recovering its cost in accordance with federal and state laws. Under the U.S. Internal Revenue Service's Modified Accelerated Cost Recovery System (MACRS), property is assigned an *asset class* that determines the number of years over which the cost can be recovered. Classes are defined in Appendix B "Table of Class Lives and Recovery Periods" of Publication 946. In general, MACRS provides 3, 5, 7, 10, 15 and 20 year recovery periods for property other than real estate. Most property falls into the 3, 5 or 7 year classes. The 10, 15 and 20 year classes generally include land improvements and specialized types of buildings and other property.

The *convention* defines the point in time when the recovery period begins in the year the asset is placed in service (half year, mid-quarter or mid-month.). Under MACRS, for most depreciable property, a half-year convention must be used. This means that no matter what month of the year you begin using the property, it is treated as if you began its use in the middle of the year. The mid-quarter convention must be used if you place more than 40% of your total new property for the year into service in the last quarter.

*Method* determines the rate at which the cost is recovered over its life. Under MACRS, property in the 3, 5, 7, and 10 year classes is depreciated using the 200 percent declining balance method. Assets in the 15 and 20 year classes are depreciated using the 150 percent declining balance method. Real property is always depreciated using the straight-line method. Again, the percentages that can be depreciated each year under these methods are determined by the tables in Appendix A of Publication 946. These tables are automatically looked up in *RELCOST* when you select a depreciation schedule on the drop-down menus.

Determining asset class in particular is not always straightforward since some property may seem to fit the descriptions of more than one class in Publication 946. To illustrate the importance of using a qualified tax preparer, consider a CHP system fired by biomass derived from the waste of an industrial process, which generates electricity and steam for both onsite use and sale to the local utility. Figure 23 below shows four excerpts from Publication 946 Appendix B for 2008 returns<sup>3</sup> that might apply. In the first, Asset Class 00.4 includes electric generation equipment over a certain size for onsite industrial use, which has a recovery period of 15 years under MACRS. Class 49.11 includes assets used in electricity production for sale, which can be recovered over a 20 year life. Note also the last section that identifies "certain property for which recovery period assigned." This section includes alternative energy property and biomass property, which have a much shorter recovery period of 5 years. Also notice Class 49.5 which includes assets used in "conversion of refuse or other solid waste or biomass to heat or to a solid, liquid, or gaseous fuel," which has a recovery period of 7 years.

<sup>3</sup> Note these excerpts are provided for explanatory purposes only. When preparing taxes, it is important to refer to your tax preparer and the current IRS publication directly at <http://www.irs.gov/pub/irs-pdf/p946.pdf>.

## Section 3. Model Inputs

**Figure 23. Excerpts from IRS Table of Class Lives and Recovery Periods for 2008 returns**

Table B-2. Table of Class Lives and Recovery Periods				
Asset class	Description of assets included	Recovery Periods (in years)		
		Class Life (in years)	GDS (MACRS)	ADS
DEPRECIABLE ASSETS USED IN THE FOLLOWING ACTIVITIES:				
00.4	<b>Industrial Steam and Electric Generation and/or Distribution Systems:</b> Includes assets, whether such assets are section 1245 property or 1250 property, providing such assets are depreciable, used in the production and/or distribution of electricity with rated total capacity in excess of 500 Kilowatts and/or assets used in the production and/or distribution of steam with rated total capacity in excess of 12,500 pounds per hour for use by the taxpayer in its industrial manufacturing process or plant activity and not ordinarily available for sale to others. Does not include buildings and structural components as defined in section 1.48-1(e) of the regulations. Assets used to generate and/or distribute electricity or steam of the type described above, but of lesser rated capacity, are not included, but are included in the appropriate manufacturing equipment classes elsewhere specified. Also includes electric generating and steam distribution assets, which may utilize steam produced by a waste reduction and resource recovery plant, used by the taxpayer in its industrial manufacturing process or plant activity. Steam and chemical recovery boiler systems used for the recovery and regeneration of chemicals used in manufacturing, with rated capacity in excess of that described above, with specifically related distribution and return systems are not included but are included in appropriate manufacturing equipment classes elsewhere specified. An example of an excluded steam and chemical recovery boiler system is that used in the pulp and paper manufacturing equipment classes elsewhere specified. An example of an excluded steam and chemical recovery boiler system is that used in the pulp and paper manufacturing industry.	22	15	22
49.5	<b>Waste Reduction and Resource Recovery Plants:</b> Includes assets used in the conversion of refuse or other solid waste or biomass to heat or to a solid, liquid, or gaseous fuel. Also includes all process plant equipment and structures at the site used to receive, handle, collect, and process refuse or other solid waste or biomass in a waterwall, combustion system, oil or gas pyrolysis system, or refuse derived fuel system to create hot water, gas, steam and electricity. Includes material recovery and support assets used in refuse or solid refuse or solid waste receiving, collecting, handling, sorting, shredding, classifying, and separation systems. Does not include any package boilers, or electric generators and related assets such as electricity, hot water, steam and manufactured gas production plants classified in classes 00.4, 49.13, 49.221, and 49.4. Does include, however, all other utilities such as water supply and treatment facilities, ash handling and other related land improvements of a waste reduction and resource recovery plant.	10	7	10
49.11	<b>Electric, Gas, Water and Steam, Utility Services:</b> Includes assets used in the production, transmission and distribution of electricity, gas, steam, or water for sale including related land improvements. <b>Electric Utility Hydraulic Production Plant:</b> Includes assets used in the hydraulic power production of electricity for sale, including related land improvements, such as dams, flumes, canals, and waterways.	50	20	50
	<b>Certain Property for Which Recovery Periods Assigned</b>			
	A. Personal Property With No Class Life		7	12
	Section 1245 Real Property With No Class Life		7	40
	B. Qualified Technological Equipment, as defined in section 168(i)(2).	**	5	5
	C. Property Used in Connection with Research and Experimentation referred to in section 168(e)(3)(B).	**	5	class life if no class life—12
	D. Alternative Energy Property described in sections 48(1)(3)(viii) or (iv), or section 48(1)(4) of the Code.	**	5	class life if no class life—12
	E. Biomass property described in section 48(1)(15) and is a qualifying small production facility within the meaning of section 3(17)(c) of the Federal Power Act (16 U.S.C. 796(17)(C)), as in effect on September 1, 1986.	**	5	class life if no class life—12

Extracted from [www.irs.gov/pub/irs-pdf/p946.pdf](http://www.irs.gov/pub/irs-pdf/p946.pdf) (2008 returns), for explanatory purposes only.

### ***“Funding Plan” Tab***

Funding sources handled by *RELCOST* are loans (borrowed funds), equity investments, and grants. For each, there can be 10 sources. In the example shown in Figure 24, funding comes from two loans, three investors, and one grant.

Loans, equity investments and grants appear as deposits to the cash account on the “Cash Accounts” tab. Total principal and interest payments and loan fees appear as withdrawals in “Cash Accounts”.

The schedule of interest and principal payments, fees, and amounts received that result are shown on the “Funding Schedule” tab.

### **Loans**

*RELCOST* handles three types of loans: equal payment, municipal bonds or equal principal.

With equal payment loans, the amount paid on the principal steadily increases and interest payments decline such that the payment amount remains the same. With equal principal loans, the interest varies but the principal payment stays the same throughout the loan period.

Until a municipal bond matures, only interest payments are made. At maturity, the entire principal payment must be paid. Money will need to be set aside in a reserve account so when the time comes, this payment can be made (see “Cash Accounts” tab). The interest on municipal bonds can be paid in annual payments or in a lump sum at the end of the term.

### **Equity Investments and Grants**

Equity investments and grants can be made as a lump sum or annually in a specified year. If investments are made annually, the investment period in months is entered.

*RELCOST*'s life-cycle-cost analysis assumes grants and equity investments are entered in lump sums. For accurate life-cycle-cost results (net present value, internal rate of return, benefit-to-cost ratio and discounted payback) lump sums should be entered even if the grant or investment is made over a number of years.

Figure 24. Funding Plan

Source #	1	2	3	
<b>Borrowed Funds</b>				
Institution	Bridge Loan	Bank		
Description	Working capital	Commercial Loan		
Loan Type	Equal Payment	Equal Principal		
Interest payment method (bonds only)				
Project Year	1	1	1	
Loan Begin Month	1	1	2	
Loan Fees (% amount)	0.000%	1.000%	0.000%	
Amount (\$)	\$ 500,000	\$ 1,000,000	\$ -	\$
Annual Interest Rate	0.000%	5.000%	0.000%	
Term (months)	60	60	-	
<b>Equity</b>				
Investor	Owner 1	Owner 2	Owner 3	
Description	1/2 of equity inv	1/4 of equity inv	1/4 of equity inv	
Project Year	1	1	1	
Amount (\$)	\$ 2,921,889	\$ 1,460,944	\$ 1,460,944	\$
Investment method	Lump Sum	Lump Sum	Annual Payment	
Investment Period (Annual pmt method only)			2	
<b>Grants</b>				
Investor	USDA			
Description	USDA			
Project Year	1			
Amount (\$)	\$ 1,000,000	\$ -	\$ -	\$
Grant method	Lump Sum			
Grant Period (Annual pmt method only)				

## Notes and Calculation Space

For convenience on many of the tabs, space is provided for optional notes and user-defined calculations, as shown in Figure 25.

Figure 25. Use of Notes and Calculation Space

<b>Notes and calculation space (optional)</b>				
\$ 30,000,000	Capital Cost			
\$ 3,150,000	Additional amount needed for positive cash flow in year 1			
50%	Ratio of borrowed funds to equity investment			
70%	of capital cost funded by DOE incentive			
35%	BETC incentive subtracting out DOE incentive			
\$ 10,000,000	BETC Maximum			



### Financial Incentives, Grants and Loans

Financial incentives are available at the federal, state and local levels. Environmental or philanthropic organizations may also make funding available for energy projects. Incentives can take many forms, such as tax credits, deductions, exemptions, depreciation, and production incentives, grants, low-cost loans, and marketing and technical assistance. A database of many federal, local and utility financial incentives for combined heat and power, renewable energy and energy efficiency projects is the Database of State Incentives for Renewables and Efficiency (DSIRE) at [www.dsireusa.org](http://www.dsireusa.org).

In addition to government incentives, many utilities offer incentives for renewable energy and combined heat and power systems as part of their demand side management (DSM). Incentives can include technical assistance, low-cost financing or rebates. They might also offer energy services through tariffs approved by state utility commissions. Keep in mind that many utility incentives for industrial customers may not be included in the DSIRE database since utilities often handle these on a case-by-case or custom basis. Be sure to contact your utility directly.

Vendor financing is very common for energy technologies to stimulate markets. Vendor financing is generally suitable for small projects of up to about a half million dollars. Some large vendors do provide financing for larger projects.

The U.S. Department of Agriculture's online *A Guide to Funding Resources* at [www.nal.usda.gov/ric/ricpubs/fundguide.html](http://www.nal.usda.gov/ric/ricpubs/fundguide.html) has resources and tips for obtaining funding from many public, private and non-profit sources. The Municipal Research and Services Center of Washington has also compiled many resources on locating and obtaining funding that, while intended for Washington municipalities, are useful for a broad audience: [www.mrsc.org/subjects/finance/grants/grants.aspx](http://www.mrsc.org/subjects/finance/grants/grants.aspx).

Government grants are generally awarded through competitive procurement. Solicitations for grants from all agencies within the federal government are available on the website [www.grants.gov/](http://www.grants.gov/). The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) posts solicitations for renewable energy generation, renewable energy certificates, and green power at [www.eere.energy.gov/greenpower/financial/index.shtml](http://www.eere.energy.gov/greenpower/financial/index.shtml).

### “Funding Schedule” Tab

Amounts received each year from sources specified on the “Funding Plan” tab and principal, interest and loan fee payments are shown on the “Funding Schedule” tab. Figure 26 and Figure 27 show the funding schedule that corresponds with the six funding sources in the example shown in Figure 24.

**Figure 26. Funding Schedule – Borrowed Funds**

Project Year	1	2	3	4	5
<b>Borrowed Funds</b>					
Working capital					
Amount Borrowed	\$ 500,000	\$ -	\$ -	\$ -	\$ -
Interest Payment	\$ -	\$ -	\$ -	\$ -	\$ -
Principal Payment	\$ (100,000)	\$ (100,000)	\$ (100,000)	\$ (100,000)	\$ (100,000)
Total P&I	\$ (100,000)	\$ (100,000)	\$ (100,000)	\$ (100,000)	\$ (100,000)
Loan Fees	\$ -	\$ -	\$ -	\$ -	\$ -
Commercial Loan					
Amount Borrowed	\$ 1,000,000	\$ -	\$ -	\$ -	\$ -
Interest Payment	\$ (45,417)	\$ (35,417)	\$ (25,417)	\$ (15,417)	\$ (5,417)
Principal Payment	\$ (200,000)	\$ (200,000)	\$ (200,000)	\$ (200,000)	\$ (200,000)
Total P&I	\$ (245,417)	\$ (235,417)	\$ (225,417)	\$ (215,417)	\$ (205,417)
Loan Fees	\$ 10,000	\$ -	\$ -	\$ -	\$ -

### Leasing Energy System Equipment

Leasing project equipment rather than buying provides several advantages. Lease payments create the same kind of obligation that interest payments on debt create. They are, however, more flexible in terms of adjusting to changes in technology and capacity needs. Lease payments can be bundled to include other expenses such as maintenance services, property taxes and insurance.

There are two ways of accounting for a lease: as an operating lease or a capital lease. In an operating lease, the lessor (or equipment owner) transfers only the right to use the property to the lessee. At the end of the lease period, the lessee returns the property to the lessor. In a capital lease, the lessee assumes some of the risks of ownership and enjoys some of the benefits. The lessee gets to claim depreciation each year on the asset and also deducts the interest expense component of the lease payment each year. For more information refer to the Financial Accounting Standards Board’s “Statement of Financial Accounting No. 13” at [www.fasb.org/pdf/fas13.pdf](http://www.fasb.org/pdf/fas13.pdf).

In *RELCO*, a capital lease can be entered on the “Funding Plan” tab as if it were a loan. In this way, interest payments will be deducted from taxable income. Its book value is entered on the “Depreciation” tab. If lease payments are bundled with O&M expenses, insurance, and property taxes, that portion of the payment might be entered as expenses on the “O&M” tab.

## Section 3. Model Inputs

Figure 27. Funding Schedule – All Sources, Equity and Grants

Project Year	1	2	3	4	5	
Loan Fees	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>All sources</b>						
Borrowed Amount	\$ 1,500,000	\$ -	\$ -	\$ -	\$ -	\$ -
Interest Payment	\$ (45,417)	\$ (35,417)	\$ (25,417)	\$ (15,417)	\$ (5,417)	\$ -
Principal Payment	\$ (300,000)	\$ (300,000)	\$ (300,000)	\$ (300,000)	\$ (300,000)	\$ -
Total P&I	\$ (345,417)	\$ (335,417)	\$ (325,417)	\$ (315,417)	\$ (305,417)	\$ -
Loan Fees	\$ (10,000)	\$ -	\$ -	\$ -	\$ -	\$ -
Accumulated Principal Pmts	\$ (300,000)	\$ (600,000)	\$ (900,000)	\$ (1,200,000)	\$ (1,500,000)	\$ (1,800,000)
Unpaid Principal	\$ 1,200,000	\$ 900,000	\$ 600,000	\$ 300,000	\$ -	\$ -
<b>Equity</b>						
Source #1	\$ 2,921,889	\$ -	\$ -	\$ -	\$ -	\$ -
Source #2	\$ 1,460,944	\$ -	\$ -	\$ -	\$ -	\$ -
Source #3	\$ 730,472	\$ 730,472	\$ -	\$ -	\$ -	\$ -
Source #4	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #5	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #6	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #7	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #8	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #9	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #10	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	\$ 5,113,305	\$ 730,472	\$ -	\$ -	\$ -	\$ -
Accumulated	\$ 5,113,305	\$ 5,843,777	\$ 5,843,777	\$ 5,843,777	\$ 5,843,777	\$ -
<b>Grants</b>						
USDA	\$ 1,000,000	\$ -	\$ -	\$ -	\$ -	\$ -
Source #2	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #3	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #4	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #5	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #6	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #7	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #8	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #9	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Source #10	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	\$1,000,000	\$0	\$0	\$0	\$0	\$0
Accumulated	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000

### Energy Service Company Agreements

Energy service companies (ESCOs) are an important resource to consider in financing and implementing a project. There is a broad range of business models an ESCO might offer. Depending on the contract, an ESCO may provide financing, design, commissioning, operation and maintenance, and monitoring, or some subset of these services. The system may be owned by either the ESCO or the project owner. The ESCO may assume full responsibility for non-performance or the risk may be shared. Several examples of ESCO models are summarized in Text Box 1 on page 10 of the *World Bank GEF Energy Efficiency Portfolio Review and Practitioners' Handbook*, which is available at <http://siteresources.worldbank.org/INTCC/812001-1110807496989/20480590/WBGEFEnergyEfficiencyHandbook2004.pdf>.

An energy savings performance contract or shared-savings contract is just one example of the several types of ESCO business models. In this model, the ESCO puts up all or a portion of the cost of a project and receives a share of the energy savings or sales that accrue. Much of the risk of non-performance associated with the project is shifted from the project owner to the ESCO, usually by having the ESCO guarantee that revenues will exceed payments. If revenues are less, the ESCO pays the difference. After the system cost has been paid off, ownership of the system transfers to the project owner, who retains the revenues from that point on.

A good reference on this topic is Oregon Department of Energy's "Guide to Energy Savings Performance Contracting" available at <http://www.oregon.gov/ENERGY/CONS/school/docs/ESPCGuide.pdf>.

Another good article is "The economics of energy service contracts" by Steve Sorrell published in *Energy Policy* (2007, Volume 35). This article is available online at <http://linkinghub.elsevier.com/retrieve/pii/S0301421505003411>.

How an ESCO agreement is represented in *RELCOST* may require inputs on several tabs depending on details of the agreement, such as whether the ESCO or the client finances the investment, how O&M costs are shared, who acquires ownership of the equipment, etc.

### “Purchased Fuels” Tab

The description, quantities and costs of purchased fuels are entered on the “Purchased Fuels” tab. An example from a biomass-fired combined heat and power project is shown in Figure 28. Notice that units for both quantity and costs must be entered and these must be consistent with each other for correct results.

The descriptions of fuels that are entered on this tab will appear on the “WhatIf” tab and the “O\_Purchased\_Fuels” tab.

**Figure 28. Purchased Fuels for Biomass-Fired CHP Example**

Plant Operating Factor?	True					
<b>Purchased Units</b>		<b>Project Year</b>				
<b>Description</b>	<b>Units</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	
1 Biomass	Tons	73,000	73,000	73,000	73,000	
2 Coal (Anthracitic)	Tons	0	0	0	0	
3 Coal (Bituminous)	Tons	0	0	0	0	
4 Electricity	Mwh	0	0	0	0	
5 Geothermal Energy	MBTU	0	0	0	0	
6 Municipal Waste	Tons	0	0	0	0	
7 Natural Gas	Therms	0	0	0	0	
8 Oli (Heavy)	Therms	0	0	0	0	
9 Oil (Light)	Therms	0	0	0	0	
10 Waste Heat	MBTU	0	0	0	0	
<b>Purchase Fuel Unit Cost (non-escalated)</b>						
1 Biomass	\$/Ton	\$ 43	\$ 43	\$ 43	\$ 43	\$
2 Coal (Anthracitic)	\$/Ton	\$ -	\$ -	\$ -	\$ -	\$
3 Coal (Bituminous)	\$/Ton	\$ -	\$ -	\$ -	\$ -	\$
4 Electricity	\$/Mwh	\$ -	\$ -	\$ -	\$ -	\$
5 Geothermal Energy	\$/MBTU	\$ -	\$ -	\$ -	\$ -	\$
6 Municipal Waste	\$/Ton	\$ -	\$ -	\$ -	\$ -	\$
7 Natural Gas	\$/Therm	\$ -	\$ -	\$ -	\$ -	\$
8 Oli (Heavy)	\$/Therm	\$ -	\$ -	\$ -	\$ -	\$
9 Oil (Light)	\$/Therm	\$ -	\$ -	\$ -	\$ -	\$
10 Waste Heat	\$/MBTU	\$ -	\$ -	\$ -	\$ -	\$

### Purchased Fuel Costs with Plant Operating and Sensitivity Factors

If the plant operating factor is applied (“True”), then the purchased fuel costs will be in proportion to the plant operating factor specified on the “General” tab. In the biomass example shown in Figure 28 plant operating factors were 25%, 50% and 90% in the first three years, as shown in Figure 29. A sensitivity of 120% was entered on the “WhatIf” tab, as shown in Figure 30.

These plant operating and sensitivity factors are reflected in the purchased fuel costs shown in Figure 31. For year 1, the quantity of purchased fuel (73,000 tons) is multiplied by the cost (\$43 per ton) (Figure 28) and then by the plant operating factor of 25%, resulting in a total cost of \$784,750 in Figure 31. In the first year, escalated costs are 120% that of the non-escalated costs or \$941,700. In subsequent years, costs are escalated using the discount rate and general inflation rate entered on the “General” tab, which were 6% and 2%, respectively, in this example.

**Figure 29. Plant Operating Factors from “General” Tab for Biomass-Fired CHP Example**

Project Year	1	2	3	4
<b>PLANT OPERATING FACTOR</b>				
Dispatch Factor	100%	100%	100%	100%
Availability (capacity) Factor	25%	50%	90%	90%
Plant Operating Factor	25%	50%	90%	90%

**Figure 30. Purchased Fuels Sensitivity Factors Entered on “WhatIf” Tab for Biomass-Fired CHP Example**

26	<b>Purchased Fuels</b>			
27	1 Biomass	120%	\$ 52	\$/Ton
28	2 Coal (Anthracitic)	0%	\$ -	\$/Ton
29	3 Coal (Bituminous)	0%	\$ -	\$/Ton
30	4 Electricity	0%	\$ -	\$/MWh
31	5 Geothermal Energy	0%	\$ -	\$/MBTU
32	6 Municipal Waste	0%	\$ -	\$/Ton
33	7 Natural Gas	0%	\$ -	\$/Therm
34	8 Oli (Heavy)	0%	\$ -	\$/Therm
35	9 Oil (Light)	0%	\$ -	\$/Therm
36	10 Waste Heat	0%	\$ -	\$/MBTU

## Section 3. Model Inputs

**Figure 31. Non-Escalated Purchased Fuel Costs for Biomass-Fired CHP Example**

<b>Purchase Fuel Cost (Non-escalated • Plant operating factor)</b>						
1 Biomass	\$/Year	\$ 784,750	\$ 1,569,500	\$ 2,825,100	\$ 2,825,100	\$
2 Coal (Anthracitic)	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
3 Coal (Bituminous)	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
4 Electricity	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
5 Geothermal Energy	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
6 Municipal Waste	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
7 Natural Gas	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
8 Oil (Heavy)	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
9 Oil (Light)	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
10 Waste Heat	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
Total		\$ 784,750	\$ 1,569,500	\$ 2,825,100	\$ 2,825,100	\$
<b>Purchase Fuel Cost (Escalated • Sensitivity • Plant Operating Factor)</b>						
1 Biomass	\$/Year	\$ 941,700.0	\$ 1,973,803.2	\$ 3,723,382.4	\$ 3,902,104.7	\$
2 Coal (Anthracitic)	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
3 Coal (Bituminous)	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
4 Electricity	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
5 Geothermal Energy	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
6 Municipal Waste	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
7 Natural Gas	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
8 Oil (Heavy)	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
9 Oil (Light)	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
10 Waste Heat	\$/Year	\$ -	\$ -	\$ -	\$ -	\$
Total		\$ 941,700.0	\$ 1,973,803.2	\$ 3,723,382.4	\$ 3,902,104.7	\$

### ***“O&M” Tab***

O&M expenses are entered on the “O&M” tab in two areas: a user-defined area for either fixed or variable expenses and an area for the common fixed expenses of labor, insurance and property taxes. The plant operating factor is applied for variable expenses but not for fixed expenses.

### **User-Defined O&M Expense Categories**

Operations and maintenance (O&M) costs can be entered into four general categories with descriptions as entered by the user. Notice the cells containing the labels for these categories are blue, indicating that they are inputs and can be modified by the user. The labels entered for these four categories are echoed on the “WhatIf” tab, “O\_Operating\_Costs” tab, and “O\_IncomeStatement” (Tax and SH) tabs.

In the example shown in Figure 32, O&M costs have been split into categories of direct production O&M, selling and administrative expenses, overhead O&M, and other O&M (not shown in Figure 32.) As another example, one might choose categories of capital plant, distribution system, geothermal system, and other O&M for a geothermal district heating system.

The “Plant Operating Factor?” can be applied, or not, to the four user-defined categories by choosing True or False in response to this question. If the plant operating factor is applied (True), then O&M costs will be in proportion to the plant operating factor specified in “General”. On the “O\_Operating\_Costs” tab, the expenses entered into these user-defined categories are treated as variable costs if the plant operating factor is applied (or fixed, if not). It is assumed that operating labor, insurance and property taxes will not be affected by the plant operating factor and are fixed costs.

### **Labor, Insurance and Property Taxes**

Other categories for entering operating expenses on this tab are operating labor, insurance, and property taxes, as shown in Figure 33. For operating costs, the equivalent number of full time employees (FTE) and their salaries are entered.

The insurance cost is often estimated as a percentage – often about 0.5 or 0.6% -- of either the installed cost or the book value.



## Section 3. Model Inputs

**Figure 32. Operating Expenses for User-Defined Categories (Fixed or Variable Costs)**

	1 Direct Producti	2 Selling & Adm	3 Overhead O&	Other O&M	
Plant Operating Factor?	True	False	False	False	
	2010	2011	2012	2013	
Project Year	1	2	3	4	
<b>1 Direct Production O&amp;M</b>					
Truck Transport	\$ 142,333.00	\$ 48,091.00	\$ 48,091.00	\$ 48,091.00	\$
Equipment	\$ 67,903.00	\$ 332,276.00	\$ 332,276.00	\$ 332,276.00	\$
Total (Non-escalated)	\$ 210,236.00	\$ 380,367.00	\$ 380,367.00	\$ 380,367.00	\$
Total (With plant operating factor)	\$ 52,559.00	\$ 190,183.50	\$ 342,330.30	\$ 342,330.30	\$
Total (With sensitivity)	\$ 52,559.00	\$ 190,183.50	\$ 342,330.30	\$ 342,330.30	\$
Total (Escalated + sensitivity + op factor)	\$ 52,559.00	\$ 193,987.17	\$ 356,160.44	\$ 363,283.65	\$
<b>2 Selling &amp; Administrative Expenses</b>					
Administrative	\$ 42,000.00	\$ 42,000.00	\$ 42,000.00	\$ 42,000.00	\$
Fiber Marketing	\$ 18,725.00	\$ 18,725.00	\$ 22,500.00	\$ 22,500.00	\$
Total (Non-escalated)	\$ 60,725.00	\$ 60,725.00	\$ 64,500.00	\$ 64,500.00	\$
Total (With plant operating factor)	\$ 60,725.00	\$ 60,725.00	\$ 64,500.00	\$ 64,500.00	\$
Total (With sensitivity)	\$ 60,725.00	\$ 60,725.00	\$ 64,500.00	\$ 64,500.00	\$
Total (Escalated + sensitivity + op factor)	\$ 60,725.00	\$ 61,939.50	\$ 67,105.80	\$ 68,447.92	\$
<b>3 Overhead O&amp;M</b>					
Benefits	\$ 49,042.00	\$ 49,042.00	\$ 72,000.00	\$ 72,000.00	\$
Office Admin	\$ 3,716.00	\$ 3,715.00	\$ 14,400.00	\$ 14,400.00	\$
Professional Services	\$ -	\$ 9,289.00	\$ 9,289.00	\$ 9,289.00	\$
Travel	\$ -	\$ 2,322.00	\$ 9,000.00	\$ 9,000.00	\$
Power & Heat supplied by plant	\$ -	\$ -	\$ -	\$ -	\$
	\$ -	\$ -	\$ -	\$ -	\$
Total (Non-escalated)	\$ 52,758.00	\$ 64,368.00	\$ 104,689.00	\$ 104,689.00	\$
Total (With plant operating factor)	\$ 52,758.00	\$ 64,368.00	\$ 104,689.00	\$ 104,689.00	\$
Total (With sensitivity)	\$ 52,758.00	\$ 64,368.00	\$ 104,689.00	\$ 104,689.00	\$
Total (Escalated + sensitivity + op factor)	\$ 52,758.00	\$ 65,655.36	\$ 108,918.44	\$ 111,096.80	\$
<b>Other O&amp;M</b>					

### Section 3. Model Inputs

**Table 7. Average O&M Costs of Selected Community Scale (<20MW) Renewable Energy Technologies in a Sample of Projects in California\***

Technology	Average O&M Costs (\$/kW/yr)		
	Minimum	Average	Maximum
Advanced Anaerobic Digesters (Food Industry)	120.70	129.58	148.29
Landfill Gas	73.91	189.87	319.30
Biogas - Waste Water Treatment	100.92	126.58	189.41
Solar Photovoltaic – Fixed Tilt	25.00	30.00	35.00
Solar Photovoltaic – Tracking	60.00	68.00	92.00
Wind – Community Scale	15.00	26.00	42.00
Hydroelectric – In Conduit	12.00	59.50	105.00

From *Building and Community Scale Renewable Technology Costs*, KEMA, 2009

[www.energy.ca.gov/2009\\_energy\\_policy/documents/2009-08-25\\_workshop/presentations/index.php](http://www.energy.ca.gov/2009_energy_policy/documents/2009-08-25_workshop/presentations/index.php)

**Figure 33. Operating Expenses for Labor, Insurance and Property Taxes (Fixed Costs)**

Operating Labor				
Number of FTEs	\$ 1.5	\$ 3.0	\$ 3.0	\$ 3.0
Annual Salary (\$/Yr)	\$ 45,000	\$ 45,000	\$ 45,000	\$ 45,000
Total (Non-escalated, No Sensitivity)	\$ 67,500	\$ 135,000	\$ 135,000	\$ 135,000
Total (Non-escalated, w/sensitivity)	\$ 67,500	\$ 135,000	\$ 135,000	\$ 135,000
<b>Total (Escalated + sensitivity)</b>	\$ 67,500	\$ 139,050	\$ 143,222	\$ 147,518
Insurance				
Insurance rate (\$/\$1000)	\$ 1.33	\$ 5.14	\$ 5.14	\$ 5.14
Insured value	\$ 7,000,000	\$ 7,000,000	\$ 7,000,000	\$ 7,000,000
Total (Non-escalated, No Sensitivity)	\$ 9,289	\$ 36,000	\$ 36,000	\$ 36,000
Total (Non-escalated, w/sensitivity)	\$ 9,289	\$ 36,000	\$ 36,000	\$ 36,000
<b>Total (Escalated + sensitivity)</b>	\$ 9,289	\$ 37,260	\$ 38,564	\$ 39,914
Property Taxes				
Tax rate (\$/\$1000)	\$ -	\$ -	\$ -	\$ -
Assessed value	\$ -	\$ -	\$ -	\$ -
Total (Non-escalated, No Sensitivity)	\$ -	\$ -	\$ -	\$ -
Total (Non-escalated, w/sensitivity)	\$ -	\$ -	\$ -	\$ -
<b>Total (Escalated + sensitivity)</b>	\$ -	\$ -	\$ -	\$ -

### Operating Reserve Deposits and Withdrawals on the “O&M” Tab

The operating reserve account is a “rainy day” account to cover operating expenses, loan payments, etc. Deposits and withdrawals to the O&M operating reserve account are entered on the “O&M” tab. The interest rate of the operating reserve account is entered on the “Cash Account” tab.

In the example shown in Figure 34, a deposit of \$200,000 and a withdrawal of \$40,000 were made in the first year. An interest rate of 5% was selected for the reserve account on the “Cash Accounts” tab (not shown in Figure 34).

Operating reserve deposits and withdrawals are kept track of on the “Cash Accounts” tab, as shown in Figure 34, Figure 35 and Figure 36. Operating reserve deposits appear in the

## Section 3. Model Inputs

“Cash Accounts” tab first as a (negative) withdrawal from the current account and also as a deposit into the operating reserve account, and vice versa for withdrawals.

**Figure 34. Operating Reserve Deposits and Withdrawals on “O&M” Tab**

<b>Operating Reserve Deposits (use escalated values)</b>				
Sub-Account #1	\$ 200,000		\$ -	\$
Sub-Account #2	\$ -	\$ -	\$ -	\$
Sub-Account #3	\$ -	\$ -	\$ -	\$
Sub-Account #4	\$ -	\$ -	\$ -	\$
Sub-Account #5	\$ -	\$ -	\$ -	\$
<b>Total (Escalated)</b>	\$ 200,000	\$ -	\$ -	\$
<b>Operating Reserve Withdrawals (use escalated values)</b>				
Sub-Account #1	\$ 40,000	\$ -	\$ -	\$
Sub-Account #2	\$ -	\$ -	\$ -	\$
Sub-Account #3	\$ -	\$ -	\$ -	\$
Sub-Account #4	\$ -	\$ -	\$ -	\$
Sub-Account #5	\$ -	\$ -	\$ -	\$
<b>Total (Escalated)</b>	\$ 40,000	\$ -	\$ -	\$
Operating Reserve Account Balance (Ref.)	\$ 160,000	\$ 164,000	\$ 172,100	\$

**Figure 35. Operating Reserve Account Summary on the “Cash Accounts” Tab**

<b>Operating Reserve Account</b>				
Beginning balance	\$ -	\$ 160,000	\$ 164,000	\$
Reserve Account Deposits				
Transfer from current account	\$ 200,000	\$ -	\$ -	\$
Interest from previous year	\$ -	\$ 4,000	\$ 8,100	\$
Reserve Account Withdrawals				
Transfer to current account	\$ (40,000)	\$ -	\$ -	\$
<b>Ending Balance</b>	\$ 160,000	\$ 164,000	\$ 172,100	\$
Average balance	\$ 80,000	\$ 162,000	\$ 168,050	\$
Interest income on average balance	\$ 4,000	\$ 8,100	\$ 8,403	\$
Accumulated Interest Deposits	\$ -	\$ 4,000	\$ 12,100	\$

**Figure 36. Operating Reserve Deposit Shown as Withdrawal from the Current Account on “Cash Accounts” Tab**

<b>Current Account Withdrawals</b>		
Capital Expenditures	\$ (6,065,792)	\$
Major Expenses	\$ (50,000)	\$
Loan P&I	\$ (345,417)	\$
Loan Fees	\$ (10,000)	\$
Fuel Purchases	\$ (941,700)	\$
1 Direct Production O&M	\$ (52,559)	\$
2 Selling & Administrative Expenses	\$ (60,725)	\$
3 Overhead O&M	\$ (52,758)	\$
Other O&M	\$ (10,000)	\$
Operating Labor	\$ (67,500)	\$
Insurance	\$ (9,289)	\$
Property Taxes	\$ -	\$
Operating Reserve Deposit	\$ (200,000)	\$
Dividend payout	\$ -	\$
Income tax payment	\$ -	\$
Franchise Fees	\$ -	\$
Royalty payments	\$ -	\$
Accounts Payable (not paid)	\$ 56,352	\$
AP from previous year	\$ -	\$
<b>Sub-total</b>	<b>\$ (7,809,388)</b>	<b>\$</b>

From O&M Tab

**Figure 37. Operating Reserve Withdrawal Shown as Deposit to Current Account on “Cash Accounts” Tab**

<b>Current Account Deposits</b>		
Loans	\$ 1,500,000	\$
Equity	\$ 5,113,305	\$
Grants	\$ 1,000,000	\$
1 Electricity Sales	\$ 164,250	\$
2 Upgraded Gas Sales to Pipeline	\$ -	\$
3 Gas to Private Industry	\$ -	\$
4 Tipping Fees: Egg Breakage	\$ 8,888	\$
5 Tipping Fees: Vegetable Waste	\$ 442	\$
6 Tipping Fees: Other	\$ -	\$
7 Co-prod: Fiber (Bedding, Compost, A)	\$ -	\$
8 Co-prod: Effluent to neighboring farm	\$ -	\$
9 Heat Sales to Co-Located Greenhouse	\$ -	\$
Other Income (use escalated values)	\$ -	\$
Carbon Credits:	\$ -	\$
Renewable Energy Credits	\$ 21,900	\$
Federal RE Production Incentive	\$ 32,850	\$
Local RE Production Incentives	\$ -	\$
Transfer from Operating Reserve	\$ 40,000	\$
Interest from previous year	\$ -	\$
Accounts Receivable (not received)	\$ (8,679)	\$
AR from prior year	\$ -	\$
<b>Sub-total</b>	<b>\$ 7,872,956</b>	<b>\$</b>

From O&M Tab

### ***“MajorExpense” Tab***

Ten major expenses can be made in any year and can be periodic. In the example shown in Figure 38, a \$25,000 major expense occurs every three years starting in the second year.

**Figure 38. Major Expenses**

Expense #	1	2	3	4	5	
<b>Major Expense (Inputs)</b>						
Description	Major Overhaul					
First Project Year	2					
Period (Years)	3					
Amount (\$)	\$ 25,000					
	2010	2011	2012	2013	2014	
Project Year	1	2	3	4	5	
<b>Major Expense (Calculated Amounts)</b>						
Major Overhaul	\$0	\$25,000	\$0	\$0	\$25,000	
	\$0	\$0	\$0	\$0	\$0	
	\$0	\$0	\$0	\$0	\$0	
	\$0	\$0	\$0	\$0	\$0	
	\$0	\$0	\$0	\$0	\$0	
	\$0	\$0	\$0	\$0	\$0	
	\$0	\$0	\$0	\$0	\$0	
	\$0	\$0	\$0	\$0	\$0	
	\$0	\$0	\$0	\$0	\$0	
	\$0	\$0	\$0	\$0	\$0	
Total (Non-escalated, No Sensitivity)	\$ -	\$ 25,000	\$ -	\$ -	\$ 25,000	\$
Total (Non-escalated, w/sensitivity)	\$ -	\$ 25,000	\$ -	\$ -	\$ 25,000	\$
Total (Escalated + sensitivity)	\$ -	\$ 25,500	\$ -	\$ -	\$ 27,061	\$

## “Sales” Tab

Up to ten revenue streams from sales can be defined on the “Sales” tab. Enter the units sold per year and the unit cost, making certain these units are consistent. The labels entered for these revenue streams are echoed on the “WhatIf” tab, “O\_Operating\_Income” tab, and “O\_IncomeStatement” (Tax and SH) tabs.

If the plant operating factor is applied (True), then revenues will be in proportion to the plant operating factor specified in “General”.

Energy cost savings associated with a project can be entered on the “Sales” tab as if they were a revenue source.

In the example shown in Figure 39, sensitivity factors on the “WhatIf” tab have been set as zero for Electricity Sales and Upgraded Gas Sales to Pipeline. Hence, when the sensitivity factors are applied the total is zeroed out. The sensitivity factor for Gas Sales to Private Industry is set to 150%. Plant operating factors for this example are 25%, 50% and 90% in years 1, 2 and 3 entered on the “General” tab (not shown in Figure 39).

**Figure 39. Sales Products**

Sales:				
Plant Op. Factor?	1 Electricity Sales	2 Upgraded Gas	3 Gas to Private	4 Tipping Fees:
	True	True	True	True
Project Year	1	2	3	
<b>SALES</b>				
<b>1 Electricity Sales</b>				
Units Sold	MWh/yr	8,760	8,760	8,760
Unit Cost	\$/MWhr	\$50.00	\$50.00	\$50.00
Total (Non-escalated)	\$	438,000.00	\$ 438,000.00	\$ 438,000.00
Total (With plant operating factor)	\$	109,500	\$ 219,000	\$ 394,200
Total (With sensitivity)	\$	-	-	-
<b>Total</b>	<b>\$</b>	<b>-</b>	<b>\$ -</b>	<b>\$ -</b>
<b>2 Upgraded Gas Sales to Pipeline</b>				
Units Sold	MMbtu/Yr	91,250	91,250	91,250
Unit Cost	\$/MMBtu	\$6.00	\$6.00	\$6.00
Total (Non-escalated)	\$	\$547,500	\$547,500	\$547,500
Total (With plant operating factor)	\$	136,875	\$ 273,750	\$ 492,750
Total (With sensitivity)	\$	-	-	-
<b>Total</b>	<b>\$</b>	<b>-</b>	<b>\$ -</b>	<b>\$ -</b>
<b>3 Gas to Private Industry</b>				
Units Sold	MMbtu/Yr	91,250	91,250	91,250
Unit Cost	\$/MMBtu	\$8.50	\$8.50	\$8.50
Total (Non-escalated)	\$	\$775,625	\$775,625	\$775,625
Total (With plant operating factor)	\$	193,906	\$ 387,813	\$ 698,063
Total (With sensitivity)	\$	290,859	\$ 581,719	\$ 1,047,094
<b>Total</b>	<b>\$</b>	<b>290,859</b>	<b>\$ 602,079</b>	<b>\$ 1,121,673</b>
<b>4 Tipping Fees: Egg Breakage</b>				
Units Sold	gallons per year	711,000	711,000	711,000
Unit Cost	\$ per gallon	\$0.05	\$0.05	\$0.05
Total (Non-escalated)	\$	\$35,550	\$35,550	\$35,550
Total (With plant operating factor)	\$	8,888	\$ 17,775	\$ 31,995
Total (With sensitivity)	\$	8,888	\$ 17,775	\$ 31,995
<b>Total</b>	<b>\$</b>	<b>8,888</b>	<b>\$ 18,397</b>	<b>\$ 34,274</b>

### Other Income

In the category for “Other income” values must be entered as total *escalated* values. In the example shown in Figure 40, plant operating factors were 25%, 50% and 90% in the first three years, respectively, which are entered on the “General” tab (not shown in Figure 40). This is reflected in the bolded total.

**Figure 40. Other Income**

Other Income (use escalated values)				
	\$ 20,000	\$ 20,000	\$ 20,000	\$
	\$ 130,000	\$ 130,000	\$ 130,000	\$
	\$ -	\$ -	\$ -	\$
	\$ -	\$ -	\$ -	\$
	\$ -	\$ -	\$ -	\$
	\$ -	\$ -	\$ -	\$
Total (Escalated)	\$ 150,000	\$ 150,000	\$ 150,000	\$
<b>Total</b>	<b>\$ 37,500</b>	<b>\$ 75,000</b>	<b>\$ 135,000</b>	<b>\$</b>

### Resources for Selling the Power You Generate

A reference on generating and selling power that covers a broad range of issues is the *Distributed Generation Primer* by Science Applications International Corporation EG&G Services prepared for the U.S. Department of Energy (2002.) Topics include distributed generation technologies, site applications, permitting and regulatory issues, business agreements and purchase contracts, fuel supply, safety, interconnection, and financial issues. This reference is available at

[www.casfcc.org/2/StationaryFuelCells/PDF/Distributed%20Generation%20Primer.pdf](http://www.casfcc.org/2/StationaryFuelCells/PDF/Distributed%20Generation%20Primer.pdf).

Resources on green power marketing – including a list of green power marketers – are available on the website of the U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy at

<http://www.eere.energy.gov/greenpower/markets/marketing.shtml?page=0>

### **“Offsets, RECs” Tab**

Up to four revenue streams from carbon offsets, production-based environmental credits and production incentives can be defined on the “Offsets, RECs” tab. Production-based incentives are proportional to the units of an item sold or avoided. For example, carbon offsets are proportional to the tons of greenhouse gases avoided. Renewable energy credits (RECs) or “Green Tags” and renewable energy production incentives (REPI) are proportional to the megawatt-hours of electricity produced from renewable sources. Energy efficiency credits (EECs) or “White Tags” are proportional to megawatt-hours of electricity saved by implementing energy efficiency measures.

The “Offset, RECs” tab is essentially identical to the “Sales” tab. Enter the units sold per year and the unit cost, making certain these units are consistent. If the plant operating factor is applied (True), then revenues will be in proportion to the plant operating factor specified on the “General” tab. The labels entered for these revenue streams are echoed on the “WhatIf” tab, “O\_Operating\_Income” tab, and “O\_IncomeStatement” (Tax and SH) tabs.

In the example of the anaerobic digester shown in Figure 41, both carbon credits and RECs are claimed. Prices for the first two years are set to zero to reflect the fact that it typically takes time to register and verify these credits.

Tax credits that are not production based should be entered on the “Taxes & Fees” tab.

A reference that includes CO2 emission factors for many electricity generation resources is Table 7 of *Comparative Costs of California Central Station Electricity Generation* (California Energy Commission): [www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF](http://www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF).

### **Renewable Energy Production Incentives**

The federal government and some states and utilities in the U.S. offer renewable energy production incentives (REPIs), which are incentives based on electricity generation. The federal REPI is paid to a qualifying renewable energy project in annual payments.

For information on federal and local production incentives, refer to the DSIRE Database at [www.dsireusa.org](http://www.dsireusa.org). Affordable Energy Solution’s website provides a nice summary of renewable energy incentives with links to the DSIRE Database at <http://aesdealers.com/subpages/incentives.html>.

In *RELCOST*, revenues from REPIs are entered on the “Offset, RECs” tab in the same manner as electricity sales. REPIs are entered on the “Offset, RECs” tab because they are production-based incentives that are proportional to sales.



**Figure 41. Environmental Credits & Production Incentives**

		2010	2011	2012	2013
Project Year		1	2	3	4
<b>Carbon Offsets:</b>					
Units Offset	CO2 Tons/Yr	0	0	27,500	27,500
Unit Cost	\$ per ton	\$0.00	\$0.00	\$0.00	\$2.00
	Total (Non-escalated)	\$ -	\$ -	\$ -	\$ 55,000
	Total (With plant operating factor)	\$ -	\$ -	\$ -	\$ 49,500
	Total (With sensitivity)	\$ -	\$ -	\$ -	\$ 49,500
	<b>Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 52,530</b>
<b>Renewable Energy Credits</b>					
Units	MWh/yr	0	0	8,760	8,760
Unit Cost	\$ per MWh	\$10.00	\$0.00	\$0.00	\$10.00
	Total (Non-escalated)	\$ -	\$ -	\$ -	\$ 87,600
	Total (With plant operating factor)	\$ -	\$ -	\$ -	\$ 78,840
	Total (With sensitivity)	\$ -	\$ -	\$ -	\$ 78,840
	<b>Total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 83,666</b>
<b>Federal Production Incentive</b>					
Units	MWh/yr	8,760	8,760	8,760	8,760

### Renewable Energy Credits

Renewable energy credits (RECs) are tradable financial units, which represent one megawatt-hour (MWh) of electricity generated from an eligible renewable energy resource. RECs can be purchased by utilities or others to essentially “green” or make “carbon neutral” the electricity they generate from fossil fuels.

When electricity is generated from renewable resources, two benefits are created that can be sold separately: the electricity itself and its environmental attributes due to its energy source. Being able to sell the electricity separately from its environmental attributes gives more flexibility in marketing renewable power. For example, your local utility may have a need for your power but may not have a requirement that a certain percentage of its power be derived from renewable resources. In this case you might sell the electricity to the local utility, but sell its associated RECs to a different utility that does have an obligation to meet a certain fraction of its generation from renewable energy sources.

To have value, RECs must be certified according to rigorous standards by a qualified third party to ensure that they are correctly tracked, verified and not double-counted. For more information refer to:

- U.S. Department of Energy’s “Renewable Energy Certificates” website at [www.eere.energy.gov/greenpower/markets/certificates.shtml?page=0](http://www.eere.energy.gov/greenpower/markets/certificates.shtml?page=0)
- American Wind Energy Association’s “Green Power” website at [www.awea.org/greenpower/gp\\_how2.html](http://www.awea.org/greenpower/gp_how2.html)

### **Selling Voluntary Carbon Offsets from an Energy Project**

Some energy efficiency and renewable energy projects can be made viable by selling “carbon offsets” or “carbon credits.” A carbon offset is a tradable financial unit – similar to a stock share – representing a certain quantity of greenhouse gas emission reductions due to implementing a project. Carbon offsets from projects throughout the U.S. have been actively traded on voluntary markets for several years. The voluntary market in carbon offsets can be, but is not necessarily, created by government legislation or policy and trading is not restricted by region. In 2007 voluntary offsets sold were comprised of 31% renewable energy, 18% energy efficiency, 16% methane-abatement, and 18% forestry land projects.

Many private and non-profit organizations buy offsets from projects and sell them (or broker transactions) to over-the-counter buyers and participants in cap-and-trade systems. Contact information for offset marketers and brokers can be found at:

- U.S. Department of Energy’s list of greenhouse gas offset marketers:  
[www.eere.energy.gov/greenpower/markets/carbon.shtml?page=2](http://www.eere.energy.gov/greenpower/markets/carbon.shtml?page=2)

Trading in carbon offsets will require registering your project, quantifying carbon emission reductions, and certifying and verifying the reductions by an independent third party – all of which takes time. Typically you will be responsible for performing a feasibility study, but an offset retailer, marketer or broker will often guide you through the process and assist in an initial screening or preliminary analysis to help you determine if a more in-depth feasibility study is warranted. The details of your contract, including the point at which you begin receiving income, are negotiated between you and the buyer of the carbon offsets.

Information on market prices and trends for certified offsets can be found in New Carbon Finance’s *Voluntary Carbon Index*, published bimonthly at [www.newcarbonfinance.com](http://www.newcarbonfinance.com). The price you can obtain depends on the standard you use to certify your offsets. Standards include the Voluntary Carbon Standard, Green-e Climate, the Chicago Climate Exchange, the Californian Climate Action Registry, and the CDM Gold Standard.

For more information on selling voluntary offsets refer to *A Review of Offset Programs: Trading Systems, Funds, Protocols, Standards and Retailers* (October 2008) published by the Stockholm Environment Institute, [www.sei-us.org/climate-and-energy/SEIOffsetReview08.pdf](http://www.sei-us.org/climate-and-energy/SEIOffsetReview08.pdf).

In *RELCOST*, revenues from carbon offsets are entered on the “Offsets, RECs” tab. Carbon offsets are commonly measured in either metric tons (tCO<sub>2</sub>e) or short tons (stCO<sub>2</sub>e) of carbon dioxide-equivalent.

### Issues Impacting Carbon Offset and REC Economics and Eligibility

Issues impacting a project's eligibility and economics include:

*Additionality:* For carbon offsets and RECs to be certified, it must be demonstrated that the project faced one or more barriers that would have made it infeasible without revenues from carbon offsets or RECs. This is known as the “additionality” criteria. That is, the project must be “additional” to what would have happened anyway.

*Double Counting:* For certain projects the environmental benefits associated with greenhouse gas reductions can be sold in at least three ways. For example, electricity generated from renewable sources may be sold as “green power,” may earn renewable energy credits (RECs), or may earn carbon offsets. If you are already claiming RECs for your project or are selling green power, you usually will not also be able sell carbon offsets. Exceptions are projects that legitimately have two environmental benefits, such as dairy anaerobic digester and landfill gas projects that generate electricity. In these cases, avoided methane emission from the landfill or the dairy's manure collection pond may earn carbon offsets. At the same time, the renewable electricity generated may earn RECs or may be sold as green power.

*Ownership:* There are cases where your project may reduce greenhouse gases but someone else owns the offsets or RECs. If your project receives funding from another source, your agreement with the funder should stipulate who owns any carbon offsets or RECs that it may generate.

*Project Type:* Project type (for example, energy efficiency versus renewable energy) influences sales price, price stability, and the demand for your potential voluntary carbon offsets. Also, many retailers and marketers focus on certain types of projects.

*Market:* The rejection rate of offset projects in general is still high as the market continues to grow and mature. Uncertainty in the future of federal carbon legislation impacts the ability to secure financing of projects relying on revenue from offsets.

### “Taxes & Fees” Tab

Information on federal, state and local income taxes and fees such as franchise fees and royalties are entered on the “Taxes & Fees” tab.

### Optional Inputs

Several optional inputs relating to taxes entered on this tab are shown in Figure 42.

*Taxable Entity:* If the project is taxable, select “True”. For example, a government-owned project is tax-exempt and we would select “False” in this case.

*Tax System:* Select the tax system to be used. By default, *RELCOST* only handles the U.S. tax system and the same algorithms are used if “Other Country” is selected. In future *RELCOST* versions, additional tax systems may be available. In the meantime, the user can also modify tax calculations for other countries in the income tax work area at the bottom of this tab.

*Refundable tax credits:* Refundable tax credits can reduce the tax owed below zero and result in a refund to the taxpayer. A non-refundable tax credit cannot reduce the tax owed below zero, and hence cannot cause a taxpayer to receive a refund in excess of their payments into the tax system.

*Federal and State Carry Forward:* If carry forward of the tax credit is allowed, a tax credit or deduction that cannot be taken in the current year to reduce your tax liability can be taken in a later year or years.

*Maximum years federal tax credit carry forward:* Some tax credits must be taken within a specified number of years. In the example shown in Figure 42, tax credits must be taken within the first four years of the project.

In the current version of *RELCOST*, a maximum can be specified only for federal carry forward. If a different type of tax credit with a maximum carry forward is available, it can be entered on the federal line and labels changed as needed.

**Figure 42. Taxes & Fees – Optional Inputs**

Optional Inputs	
Taxable entity?	True
Tax system	United States
Refundable tax credits?	False
Allow federal carry forward?	True
Allow state carry forward?	False
Allow local carry forward?	False
Maximum years federal tax credit carry forward? (years)	4

### Taxes Rates, Tax Credits and Income Tax Payments

*Taxes Rates:* Percentages are entered for federal, state and local tax rates. In the example shown in Figure 43, the federal tax rate is 28% and the state tax rate is 1.5%.

*Tax Credits:* In the example shown in Figure 44, a total tax credit equal to \$303,290 can be counted against tax liabilities shown in Figure 43 in the first four years of the project. As shown, this credit was specified as being non-refundable with carry forward allowed for four years. In the first two years of the project, the net income before taxes was negative, so none of the tax credit could be claimed. In the third year the tax credit was sufficient to negate the project's entire federal tax liability. In the fourth year, the tax credit was sufficient to cover all but \$58,601. If the tax credit had been greater than \$361,891, the excess amount would have been forfeited because of the four year limit. ( $\$303,290 + \$58,601 = \$361,891$ .)

Notice how the area designated for notes and calculations was taken advantage of in calculating the amount of the tax credit. In the example, the tax credit available was 5% of capital expenditures. The user copied the capital expenditures to the calculation area where it was multiplied by 5%. This and the sensitivity factor were used in an equation in the tax credit area.

#### Pass-through of Tax Credits

Some tax credits allow a "pass-through" option by which the tax credit is transferred to a business partner. If allowed, this option is often used if the project owner itself has no tax liability to which it can apply the credit but the partner does. An example of such a tax credit is Oregon's Business Energy Tax Credit (BETC.) Under BETC, the project owner receives a lump-sum cash payment, while the partner takes the tax credit. Project owners may be a public entity or non-profit organization or a business with tax liability that chooses to use the pass-through option.

In *RELCOST* a pass-through tax credit should be entered on the "Funding Plan" in the same manner as a grant because it is paid in a lump sum. It should not be entered on the "Taxes & Fees" tab as a tax credit because it does not count against the tax liability.

## Section 3. Model Inputs

**Figure 43. Income Taxes and Fees, Tax Credits and Income Tax Payments**

Project Year	1	2	3	4
<b>Income Taxes and Fees</b>				
Federal Tax Rate	28.0%	28.0%	28.0%	28.0%
State Tax Rate	1.5%	1.5%	1.5%	1.5%
Local Tax Rate	0.0%	0.0%	0.0%	0.0%
Franchise Fee (Gross Sales - Product #1)	3.0%	3.0%	3.0%	3.0%
Franchise Fee (Gross Sales - Product #2)	0.0%	0.0%	0.0%	0.0%
Franchise Fee (Gross Sales - Product #3)	0.0%	0.0%	0.0%	0.0%
<b>Tax Credits</b>				
Federal	\$ -	\$ -	\$ -	\$ -
State				
Local				
<b>Total</b>	\$ -	\$ -	\$ -	\$ -
Total tax credit used (Ref.)	\$ -	\$ -	\$ -	\$ -
<b>Income Tax Payments</b>				
Federal Tax Payment	\$ -	\$ -	\$ 103,191	\$ 258,049
State Tax Payment	\$ -	\$ -	\$ 5,528	\$ 13,824
Local Tax Payment	\$ -	\$ -	\$ -	\$ -
<b>Total</b>	\$ -	\$ -	\$ 108,720	\$ 271,873
Net Income before taxes (Ref.)	\$ (366,815)	\$ (184,965)	\$ 368,541	\$ 921,602

**Figure 44. Tax Credit Example – \$303,290 Taken Over 4 Years Maximum**

	A	B	C	D	E
2	<b>Inputs</b>			<b>Notes and calculation space (opt</b>	
3	<b>Outputs</b>			\$ 6,065,792	Capital Investments
4					
5	<b>Optional Inputs</b>			5%	Max. percent of tax c
6	Taxable entity?	True		\$ 303,290	Total tax credit
7	Tax system	United States			
8	Refundable tax credits?	False		Tax Credit Sensitivity Factors	
9	Allow federal carry forward?	True		Federal	100%
10	Allow state carry forward?	False		State	0%
11	Allow local carry forward?	False		Local	0%
12	Maximum years federal tax credit carry forward? (years)	4			
13					
14					
15	<b>Project Year</b>	1	2	3	4
16	<b>Income Taxes and Fees</b>				
17	Federal Tax Rate	28.0%	28.0%	28.0%	28.0%
18	State Tax Rate	1.5%	1.5%	1.5%	1.5%
19	Local Tax Rate	0.0%	0.0%	0.0%	0.0%
20	Franchise Fee (Gross Sales - Product #1)	3.0%	3.0%	3.0%	3.0%
21	Franchise Fee (Gross Sales - Product #2)	0.0%	0.0%	0.0%	0.0%
22	Franchise Fee (Gross Sales - Product #3)	0.0%	0.0%	0.0%	0.0%
23	<b>Tax Credits</b>				
24	Federal	\$ 303,290	\$ -	\$ -	\$ -
25	State				
26	Local				
27	<b>Total</b>	\$ 303,290	\$ -	\$ -	\$ -
28	Total tax credit used (Ref.)	\$ -	\$ -	\$ 103,191	\$ 200,098
29	<b>Income Tax Payments</b>				
30	Federal Tax Payment	\$ -	\$ -	\$ -	\$ 58,601
31	State Tax Payment	\$ -	\$ -	\$ 5,528	\$ 13,859
32	Local Tax Payment	\$ -	\$ -	\$ -	\$ -
33	<b>Total</b>	\$ -	\$ -	\$ 5,528	\$ 72,459
34	Net Income before taxes (Ref.)	\$ (366,815)	\$ (184,965)	\$ 368,541	\$ 923,924

## Franchise Fees

Franchise fees based on a percentage of gross sales of the first three products listed on the “Sales” tab can also be specified.

In the example shown in Figure 43, a franchise fee of 3.0% was specified for gross sales of Product #1, which in this case were electricity sales. Continuing this example in Figure 45, the 3% fee was applied to gross electricity sales of \$109,500 (on the “Sales” tab not shown here) in the first year or \$3,285. A sensitivity factor for electricity sales was specified as 150% on the “WhatIf” tab in this example, so (including the sensitivity factor) the first year’s franchise fee was \$4,928. In later years, escalation is applied.

**Figure 45. Franchise Fee Payments**

<b>Franchise Fees</b>				
<b>Franchise Fees (Non-escalated, No Sensitivity)</b>				
1 Electricity Sales	\$	3,285	\$	6,570
2 Upgraded Gas Sales to Pipeline	\$	-	\$	-
3 Gas to Private Industry	\$	-	\$	-
<b>Total</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>-</b>
<b>Franchise Fees (Non-escalated, w/ Sensitivity)</b>				
1 Electricity Sales	\$	4,928	\$	9,855
2 Upgraded Gas Sales to Pipeline	\$	-	\$	-
3 Gas to Private Industry	\$	-	\$	-
<b>Total</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>-</b>
<b>Franchise Fees (Escalated + Sensitivity)</b>				
1 Electricity Sales	\$	4,928	\$	10,151
2 Upgraded Gas Sales to Pipeline	\$	-	\$	-
3 Gas to Private Industry	\$	-	\$	-
<b>Total</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>-</b>

## Royalties

Royalties are entered as lump sums for up to five recipients. If royalties escalate over time, escalated values must be entered. In Figure 46, a royalty payment of \$20,000 is due to Recipient #1. This payment is escalated at a rate of 6% each year by multiplying each year by 1.06 to determine the following year’s royalty.

**Figure 46. Royalties**

<b>Royalty Payments (Escalated)</b>				
Recipient #1	\$	20,000	\$	21,200
Recipient #2	\$	-	\$	-
Recipient #3	\$	-	\$	-
Recipient #4	\$	-	\$	-
Recipient #5	\$	-	\$	-
<b>Total</b>	<b>\$</b>	<b>20,000</b>	<b>\$</b>	<b>21,200</b>

### “Dividends” Tab

If “True” is selected for “Include Dividends?” then dividends are payable to investors.

The default calculation of dividends that is used in *RELCOST* is to pay out the lesser of a specified maximum payout or a percentage of net profits after taxes (NPAT). Values for NPAT are from “O\_IncomeStatement (Tax)”, which is the income statement for tax purposes. An example is shown in Figure 47.

There are many ways dividends to investors may be calculated. Calculations specific to your project can be developed as long as your result is entered into the “Total”.

**Figure 47. Dividends**

Include dividends?	True		
Project Year	1	2	3
<b>Dividends</b>			
Net Profit After Taxes (NPAT)	\$ (170,654)	\$ 743,868	\$ 1,963,482
Maximum payout	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000
Percent NPAT	5%	5%	5%
<b>Total</b>	\$ -	\$ 37,193	\$ 98,174



### ***“Cash Accounts” Tab***

There are two accounts: the current account and the operating reserve account. The current account is comparable to a checking account and the operating reserve account to a savings account. Both accounts can earn interest at rates specified on this tab. Deposits and withdrawals to and from the operating reserve account are made on the “O&M” tab and are echoed here.

### **Accounts Receivable and Payable Floats**

Bills may be sent out to customers but not paid on time. It’s not uncommon for customers to be 90 days past due. A 5% accounts receivable float, as shown in Figure 48, means that 5% of the accounts receivable is not received in the current year but floats to the next year. Accounts payable float is similar, but is for bills the user owes but does not pay until the following year.

**Figure 48. Interest Rates and Account Floats on “Cash Accounts” Tab**

Current account interest rate	5.000%
Operating reserve interest rate	5.000%
Accounts Receivable Float	5.00%
Accounts Payable Float	5.00%

### “Cost Escalation” Tab

Escalation rates for four types of forecasts (Likely, Aggressive, Conservative, or None) are entered on the “Cost Escalation” tab. Aggressive forecasts will have higher escalation rates (and conservative forecasts, lower rates) compared to likely forecasts.

In *RELCOSt*, the type of forecast used is selected on the “WhatIf” tab just above the sensitivity factors (see example in Figure 49 in which a “likely” forecast is selected). The forecast selected appears on the “Cost Escalation” tab”, as shown in Figure 50. The general inflation rate is entered on the “General” tab. In the example shown in Figure 50, a 2% rate of general inflation has been specified.

Technically, the escalation rate of a cost or revenue stream is defined as the rate at which its price increases minus the general inflation rate. For convenience in *RELCOSt*, however, the user can specify whether or not to add general inflation to the escalation factors entered. If the general inflation rate is included in annual escalation factors, then the inflation rate and the escalation rate are added in the upper green table of escalation factors. Below this green section are blue input areas for likely, aggressive and conservative escalation factors. Note in this example how the 2% interest rate has been added to the “likely” forecast (Figure 52) to obtain the total escalation factors shown in Figure 51.

For the case of no escalation, neither escalation nor inflation is applied.

**Figure 49. Selection of Forecast Type on “WhatIf” Tab**

SENSITIVITY FACTORS			
Escalation Forecast Type	Likely		
Environmental Credits & Prod Incentives		1st Yr Unit Costs	
Carbon Credits:	500%	\$0.00	\$ per ton
Renewable Energy Credits	100%	\$10.00	\$ per MWh
Federal RE Production Incentive	100%	\$15.00	\$ per MWh
Local RE Production Incentives	100%	\$0.00	\$ per MWh
Income			
1 Electricity Sales	200%	\$150.00	\$/MWh/yr

**Figure 50. Cost Escalation – Include General Inflation**

Selected Forecast	Likely	(From What If tab)
Include general inflation?	True	2.00% (Factor)

**Figure 51. Annual Escalation Factors as Sum of the 2% Rate of General Inflation (Figure 50) and Escalation Values for the “Likely” Forecast (Shown in Figure 52)**

Annual Escalation Factors	Project Year				
Description	1	2	3	4	5
<b>SALES</b>					
1 Electricity Sales	3.000%	3.000%	3.000%	3.000%	3.000%
2 Upgraded Gas Sales to Pipeline	3.000%	3.000%	3.000%	3.000%	3.000%
3 Gas to Private Industry	3.500%	3.500%	3.500%	3.500%	3.500%
4 Tipping Fees: Egg Breakage	3.500%	3.500%	3.500%	3.500%	3.500%
5 Tipping Fees: Vegetable Waste	3.500%	3.500%	3.500%	3.500%	3.500%
6 Tipping Fees: Other	3.500%	3.500%	3.500%	3.500%	3.500%
7 Co-prod: Fiber (Bedding, Compost,	3.500%	3.500%	3.500%	3.500%	3.500%
8 Co-prod: Effluent to neighboring farm	3.500%	3.500%	3.500%	3.500%	3.500%
9 Heat Sales to Co-Located Greenhouse	3.500%	3.500%	3.500%	3.500%	3.500%
<b>ENVIRONMENTAL CREDITS &amp; PRODUCTION INCENTIVES</b>					
Carbon Credits:	3.000%	3.000%	3.000%	3.000%	3.000%
Renewable Energy Credits	3.000%	3.000%	3.000%	3.000%	3.000%
Federal RE Production Incentive	3.000%	3.000%	3.000%	3.000%	3.000%
Local RE Production Incentives	3.000%	3.000%	3.000%	3.000%	3.000%
<b>O&amp;M</b>					

**Figure 52. Escalation Factors for a “Likely” Forecast**

<b>Forecast: Likely</b>					
Escalation Factors	Project Year				
Description	1	2	3	4	5
<b>SALES</b>					
1 Electricity Sales	1.00%	1.00%	1.00%	1.00%	1.00%
2 Upgraded Gas Sales to Pipeline	1.00%	1.00%	1.00%	1.00%	1.00%
3 Gas to Private Industry	1.50%	1.50%	1.50%	1.50%	1.50%
4 Tipping Fees: Egg Breakage	1.50%	1.50%	1.50%	1.50%	1.50%
5 Tipping Fees: Vegetable Waste	1.50%	1.50%	1.50%	1.50%	1.50%
6 Tipping Fees: Other	1.50%	1.50%	1.50%	1.50%	1.50%
7 Co-prod: Fiber (Bedding, Compost,	1.50%	1.50%	1.50%	1.50%	1.50%
8 Co-prod: Effluent to neighboring farm	1.50%	1.50%	1.50%	1.50%	1.50%
9 Heat Sales to Co-Located Greenhouse	1.50%	1.50%	1.50%	1.50%	1.50%
<b>ENVIRONMENTAL &amp; SOCIETY CREDITS</b>					
Carbon Credits:	1.00%	1.00%	1.00%	1.00%	1.00%
Renewable Energy Credits	1.00%	1.00%	1.00%	1.00%	1.00%
Federal RE Production Incentive	1.00%	1.00%	1.00%	1.00%	1.00%
Local RE Production Incentives	1.00%	1.00%	1.00%	1.00%	1.00%
<b>O&amp;M</b>					

### **“Cost Allocation” Tab**

When multiple products are generated, cost allocation factors entered for each revenue stream are used in calculating levelized costs. In the example shown in Figure 53, a plant sells both electricity and steam and attributes 60% of its total costs to electricity generation and 40% to steam generation. Levelized costs of electricity and steam (in units of \$/MWh and \$/MMBtu, respectively) are reported on the “What If” tab.

## Section 3. Model Inputs

For a CHP plant that provides both steam and electricity as outputs, one way of allocating costs is the efficiency method. The efficiency method allocates costs of CHP plants between electric and thermal outputs on the basis of the energy input that would be used to produce the steam and electricity products separately. To use this method, you must know the total steam production  $E_s$  and electricity production  $E_e$  of the plant in consistent units (such as MMBtu) and the steam efficiency  $\eta_s$  and electricity efficiency  $\eta_e$  of the facility. Calculate the percent  $S$  allocated to steam production by

$$S = \frac{\frac{E_s}{\eta_s}}{\frac{E_s}{\eta_s} + \frac{E_e}{\eta_e}}$$

and the percent  $P$  allocated to electricity production by

$$P = 1 - S$$

To determine the energy output  $E_s$  attributable to steam, use published steam tables that provide the enthalpy of steam at different temperature and pressure conditions. Then determine the net heat production by subtracting from this the enthalpy of the return condensate. If actual efficiencies of the CHP plant are not known, default values of 80 percent for steam efficiency  $\eta_s$  and 35 percent for electricity efficiency  $\eta_e$  are often used.

**Figure 53. Cost Allocation Factors**

ALLOCATION OF COSTS OF SALES			
PROJECT YEAR	1	2	3
1 Electricity Sales	60%	60%	60%
2 Heat Sales	40%	40%	40%
3 Sales 1			
4 Sales 2			
5 Sales 3			
6 Sales 4			
7 Sales 5			
8 Sales 6			
9 Sales 7			
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

## 4. Pro Forma Statements

Pro forma financial statements are commonly used by investors for valuation, risk evaluation, and investment purposes. They provide insight into how a project will generate income and a firm's ability to repay debt, as well as cash flow and cash available to provide equity investors a return. Pro forma statements included in *RELCOST* are the Income Statement, Cash Flow Statement, Balance Sheet, and Use of Funds Statement.

Pro forma financial statements are prepared on the basis of some assumed events and transactions that have not yet occurred. Pro forma statements are similar to historical financial statements in appearance and use, except that they focus on the future instead of the past and are based upon assumptions rather than fact.

In *RELCOST*, there are two versions of Income Statements and Balance Sheets, one for tax purposes (Tax) and one for shareholder (SH) or internal purposes. Companies usually maintain two sets of books, one for taxes and one for shareholders. The difference between them is how depreciation is calculated, as specified on the "Depreciation" tab.

All tabs with names beginning with "O\_" are forms that are intended to be printed out for record keeping. For printing out forms on two pages, printing at 65% of normal size in landscape view is suggested.

### ***Income Statement***

The income statement, also called a profit and loss statement, reports flows of revenues and expenses incurred to produce and finance operations. The income statement is not based on when cash is actually received or spent, but when the obligation to pay is incurred or a contract is settled. Thus, an income statement does not provide an explanation of the cash flows.

An income statement for a particular year shows whether a business made a profit. Like other pro forma statements, comparing income statements across years provides greater insight into the performance of the business than looking at a single year. For example, a business may be profitable in one year, but that profit may have declined from previous years.

In *RELCOST*, the Income Statement itself comprises the top section of the "O\_IncomeStatement" tab (Tax and SH versions), as shown in Figure 54. Detail on what is included in sales income, cost of sales and operating expenses are given the sections below the income statement.

The results indicated by bold titles are gross income or profit, earnings before income, taxes, depreciation and amortization (EBITDA), operating income (also referred to as

## Section 4. Pro Forma Statements

earnings before interest and taxes or EBIT), net profit before taxes, net profit after taxes, and retained earnings. These are calculated as follows:

$$\text{Gross Income} = \text{Sales Income} - \text{Cost of Sales}$$

$$\text{EBITDA} = \text{Gross Income} - \text{Operating Expenses}$$

$$\text{EBIT} = \text{EBITDA} - \text{Depreciation}$$

$$\text{Net Profit Before Taxes} = \text{EBIT} - \text{Interest Expenses} - \text{Finance Charges}$$

$$\text{Net Profit After Taxes} = \text{Net Profit Before Taxes} - \text{Taxes}$$

$$\text{Retained Earnings} = \text{Net Profit After Taxes} - \text{Dividends Paid}$$

The final result – retained earnings – equals the funds available for project use and may be used to fund growth, expansion, or unplanned expenditures.

Two plots from the income statement are shown on the “WhatIf” tab. Figure 56 shows an example of the plot of net profit after taxes. Figure 57 shows an example of a bar graph of profit, EBITDA, net profit before taxes and net profit after taxes in the “scorecard” year.

*Sales Income (Detail):* Sales income includes revenues from all income sources entered on the “Sales” tab, the “Offset, RECs” tab and interest income earned on the current and reserve accounts. Note that cost savings entered on the “Sales” tab in the same manner as sales income will show up on the Income Statement.

*Cost of Sales (Detail):* Cost of sales includes royalties and fees entered on the “Taxes & Fees” tab, operating and maintenance expenses entered on the “O&M” tab, major expenses entered on the “Major Expenses” tab, and the cost of purchased fuels entered on the “Purchased Fuels” tab.

*Operating Expenses (Detail):* Operating expenses include operating reserve account deposits and withdrawals, operating labor, insurance and property taxes, all as entered on the “O&M” tab.

## Section 4. Pro Forma Statements

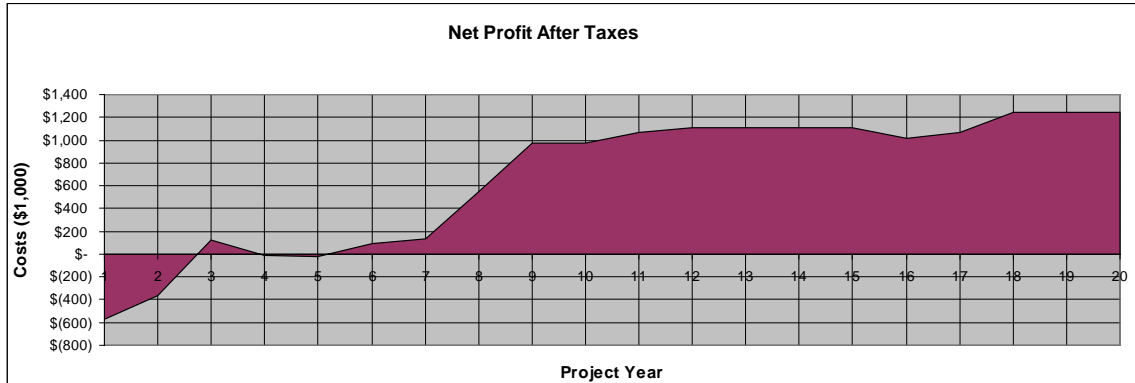
**Figure 54. Income Statement on the “O\_IncomeStatement” Tab**

Project Description	ABC Community Digester Community Digester Project of 10 Dairies			
Project Year	1	2	3	4
<b>Income Statement (Tax Calculation)</b>				
(+) Sales, Income	\$ 261,180	\$ 647,231	\$ 1,201,683	\$ 1,408,381
(-) Cost of Sales	\$ (182,612)	\$ (345,185)	\$ (567,196)	\$ (631,601)
<b>Gross Income (Profit)</b>	\$ 78,568	\$ 302,046	\$ 634,486	\$ 776,780
(-) Operating Expense	\$ (76,789)	\$ (174,420)	\$ (177,908)	\$ (181,467)
<b>EBITDA</b>	\$ 1,779	\$ 127,626	\$ 456,578	\$ 595,314
(-) Depreciation (Tax)	\$ (318,167)	\$ (545,270)	\$ (389,415)	\$ (278,090)
<b>Operating Income (EBIT)</b>	\$ (316,389)	\$ (417,645)	\$ 67,163	\$ 317,224
(-) Interest Expense	\$ (45,417)	\$ (35,417)	\$ (25,417)	\$ (15,417)
(-) Finance Charges	\$ (10,000)	\$ -	\$ -	\$ -
<b>Net Profit Before Taxes</b>	\$ (371,805)	\$ (453,061)	\$ 41,746	\$ 301,807
(-) Income Taxes	\$ -	\$ -	\$ (626)	\$ (4,527)
<b>Net Profit After Taxes</b>	\$ (371,805)	\$ (453,061)	\$ 41,120	\$ 297,280
(-) Dividends	\$ -	\$ -	\$ -	\$ -
<b>Retained Earnings</b>	\$ (371,805)	\$ (453,061)	\$ 41,120	\$ 297,280

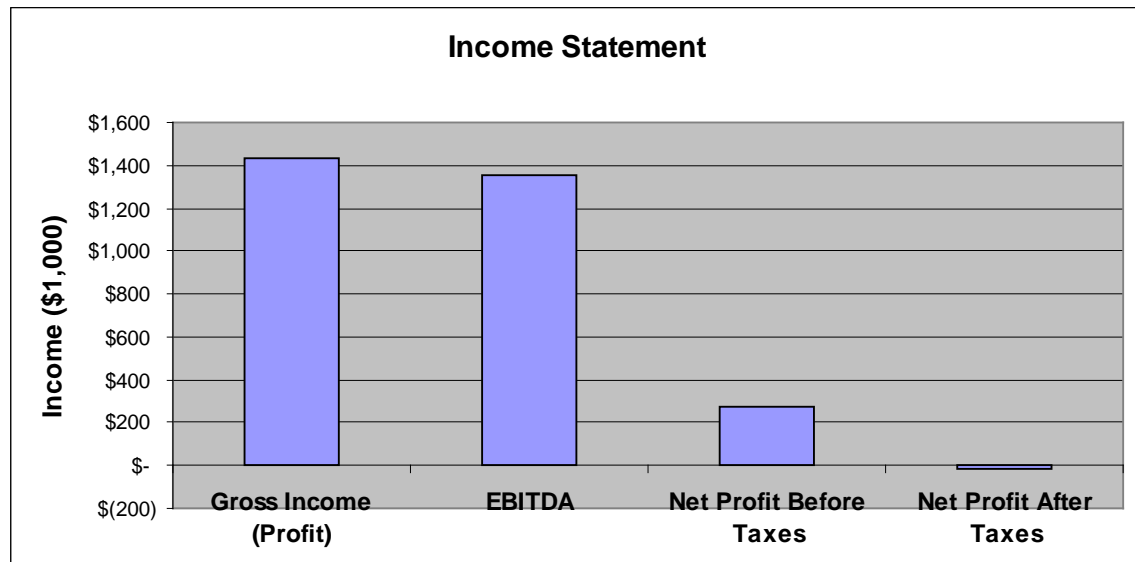
**Figure 55. Detail of Sales, Cost of Sales and Operating Expenses on the “O\_IncomeStatement” Tab**

<b>Sales, Income (Detail)</b>				
Electricity Sales	\$ 14,506,560	\$ 14,941,757	\$ 15,390,010	\$ 15,851,710
Heat	\$ -	\$ -	\$ -	\$ -
Sales 3	\$ -	\$ -	\$ -	\$ -
Sales 4	\$ -	\$ -	\$ -	\$ -
Sales 5	\$ -	\$ -	\$ -	\$ -
Sales 6	\$ -	\$ -	\$ -	\$ -
Sales 7	\$ -	\$ -	\$ -	\$ -
Sales 8	\$ -	\$ -	\$ -	\$ -
Sales 9	\$ -	\$ -	\$ -	\$ -
Other Income (use escalated values)	\$ -	\$ -	\$ -	\$ -
Carbon Offsets:	\$ -	\$ -	\$ -	\$ -
Renewable Energy Credits	\$ -	\$ -	\$ -	\$ -
Federal Production Incentive	\$ -	\$ -	\$ -	\$ -
Local Production Incentives	\$ -	\$ -	\$ -	\$ -
Interest Income	\$ -	\$ -	\$ -	\$ -
<b>Sub-total</b>	<b>\$ 14,506,560</b>	<b>\$ 14,941,757</b>	<b>\$ 15,390,010</b>	<b>\$ 15,851,710</b>
<b>Cost of Sales (Detail)</b>				
Franchise Fees	\$ -	\$ -	\$ -	\$ -
Royalties	\$ -	\$ -	\$ -	\$ -
Fixed O&M Costs	\$ 5,216,000	\$ -	\$ -	\$ -
Variable O&M Costs	\$ -	\$ -	\$ -	\$ -
Property Taxes and Insurance	\$ -	\$ -	\$ -	\$ -
Category 4	\$ -	\$ -	\$ -	\$ -
Major Expenses	\$ -	\$ -	\$ -	\$ -
Purchased Fuels	\$ 8,666,210	\$ -	\$ -	\$ -
<b>Sub-total</b>	<b>\$ 13,882,210</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
<b>Operating Expense (Detail)</b>				
Operating Labor	\$ -	\$ -	\$ -	\$ -
Insurance	\$ -	\$ -	\$ -	\$ -
Property Taxes	\$ -	\$ -	\$ -	\$ -
<b>Sub-total</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>

**Figure 56. Example Plot of Net Profit After Taxes Over 20 Years (“WhatIf” Tab)**



**Figure 57. Example Plot of Data from the Income Statement in the Scorecard Year (“WhatIf” Tab)**



### Cash Flow Statement

The purpose of the cash flow statement is to show the reasons for changes in the cash held by a business over an accounting period. It provides a more detailed presentation of entries found on other statements and reports funds on hand at the beginning of the period, funds received, funds spent and funds remaining at the end of the period. The Financial Accounting Standards Board standards require firms to prepare and report a statement of cash flow. Lenders often place highest priority on the cash flow statement because it demonstrates a company’s ability to meet its obligations and finance operations.



## Section 4. Pro Forma Statements

Positive cash flow is desirable, but even healthy businesses can have a negative net cash flow in, for example, a year of high capital expenditures. A repeated negative net cash flow over a number of years is usually an indication of trouble, however. Negative cash *balances* indicate the project is underfunded, has too little revenue or expenses are too high. While the cash flow statement does not measure net income, cash flows that are very inconsistent with net profit can indicate operating or managerial problems.

In *RELCOST*, the cash flow statement on the “O\_CashFlow” tab shows cash inflows and outflows due to operations and financing activities, as shown in Figure 58. Taxation paid and capital expenditures are also shown. Results shown in bold are the net cash flow, discounted net cash flows, and finally the cash balance. As a check, the cash balance on the cash flow statement should equal the sum of the current account and operating reserve account ending balances.

The results shown in bold at the bottom of the statement are the net cash flow, discounted net cash flow and cash balance. These are calculated as follows:

$$\begin{aligned}\text{Net Cash Flow} &= \text{Tax Flow from Operations} - \text{Taxation Paid} \\ &\quad - \text{Capital Expenditures} \\ &\quad - \text{Cash Flow from Financing Activities}\end{aligned}$$

$$\text{Discounted Net Cash Flow} = \text{Present Value of the Net Cash Flow}$$

$$\text{Cash Balance} = \text{Sum of Net Cash Flows from current and previous years}$$

Plots of discounted cash flows and cash balances over a 20-year period, as shown in Figure 59, are on the “WhatIf” tab.

*Operations:* Operations cash flows include EBIT from the “Income Statement” to which depreciation is added back, and accounts receivable and accounts payable from the “Cash Accounts” tab.<sup>4</sup> The sum of these cash flows equals the cash flow from operations shown in bold.

*Financing Activities:* Cash flows from financing activities include interest expenses and finance charges and loans received, loans paid, equity injections and grants received, all from the “Funding Schedule” tab, and dividends paid from “Dividends” tab. The sum of these cash flows equals the cash flow from financing activities shown in bold.

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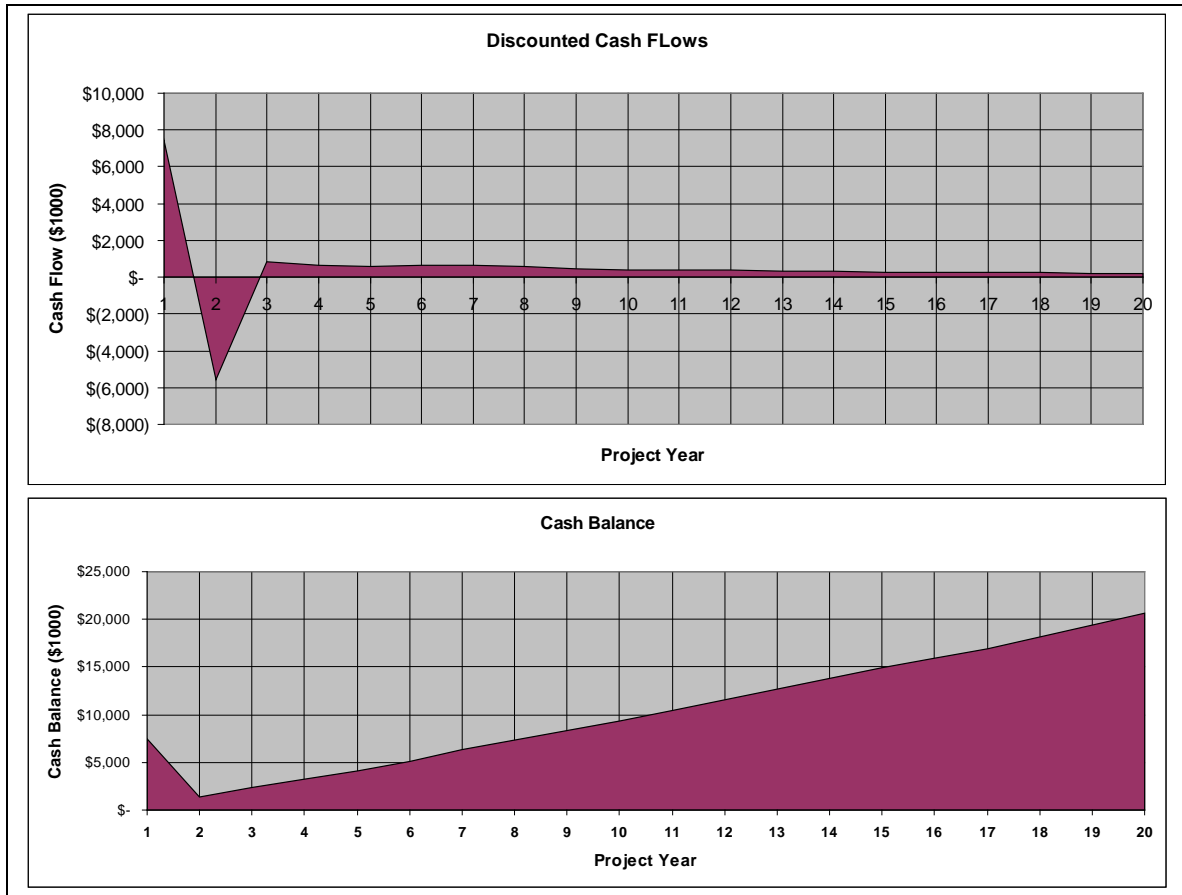
<sup>4</sup> Note there is also a line for changes in stock which is unused in this version of *RELCOST*. Future versions are planned to have stock purchases and sales and earnings from sales.

## Section 4. Pro Forma Statements

Figure 58. Cash Flow Statement From “O\_CashFlow” Tab

Project Description	Biomass CHP Project			
	0			
Project Year	1	2	3	4
<b>Cash Flow Statement</b>				
<b>Operations</b>				
Operating Profit (EBIT)	\$ (5,030,420)	\$ 5,710,387	\$ 9,535,240	\$ 12,113,300
Add Back Depreciation (Tax)	\$ 5,654,770	\$ 9,231,370	\$ 5,854,770	\$ 3,738,410
Change in Stocks (unused)	\$ -	\$ -	\$ -	\$ -
Change in Debtors (Accounts Receivable)	\$ -	\$ -	\$ -	\$ -
Change in Creditors (Accounts Payable)	\$ -	\$ -	\$ -	\$ -
<b>(+) Cash Flow from Operations</b>	<b>\$ 624,350</b>	<b>\$ 14,941,757</b>	<b>\$ 15,390,010</b>	<b>\$ 15,851,710</b>
<b>(-) Taxation Paid</b>	<b>\$ -</b>	<b>\$ (1,699,550)</b>	<b>\$ (2,850,235)</b>	<b>\$ (3,627,013)</b>
<b>(-) Capital Expenditure</b>	<b>\$ -55,000,000</b>	<b>\$ 0</b>	<b>\$ 0</b>	<b>\$ 0</b>
<b>Financing Activities</b>				
Interest Expense	\$ (31,180)	\$ (45,220)	\$ (34,457)	\$ (23,255)
Finance Charges	\$ (14,000)	\$ -	\$ -	\$ -
Loans Received	\$ 1,400,000	\$ -	\$ -	\$ -
Loans Repaid	\$ (149,302)	\$ (264,178)	\$ (274,941)	\$ (286,143)
Equity Injections	\$ 36,430,000	\$ -	\$ -	\$ -
Loan Fees	\$ -	\$ -	\$ -	\$ -
Grant Injections	\$ 17,170,000	\$ -	\$ -	\$ -
Dividends Paid	\$ -	\$ -	\$ -	\$ -
<b>(-) Cash Flow from Financing Activities</b>	<b>\$ 54,805,518</b>	<b>\$ (309,398)</b>	<b>\$ (309,398)</b>	<b>\$ (309,398)</b>
<b>(=) Net Cash Flow</b>	<b>\$ 429,868</b>	<b>\$ 12,932,809</b>	<b>\$ 12,230,377</b>	<b>\$ 11,915,299</b>
<b>Net Cash Flow (Discounted)</b>	<b>\$ 429,868</b>	<b>\$ 11,547,151</b>	<b>\$ 9,749,982</b>	<b>\$ 8,481,074</b>
Present value factor	1.000	0.893	0.797	0.712
<b>Cash Balance</b>	<b>\$ 429,868</b>	<b>\$ 13,362,677</b>	<b>\$ 25,593,054</b>	<b>\$ 37,508,353</b>
Cash Account (Ref.)	\$ 429,868	\$ 13,362,677	\$ 25,593,054	\$ 37,508,353
Check (=0)	\$ 0	\$ -	\$ -	\$ -

**Figure 59. Example Plots of Discounted Cash Flows and Cash Balance (“WhatIf” Tab)**



### Balance Sheet

A balance sheet provides a snapshot of the book values of the assets and liabilities of a business at a specific date. It is essentially a statement of assets, liabilities and equity. In *RELCOST*, the balance sheet is comprised of three sections: Assets, Liabilities, and Shareholder Funds & Grants. As a check, assets, liabilities and shareholder funds and grants must balance; that is,

$$\text{Assets} = \text{Liabilities} + \text{Shareholder Funds \& Grants}$$

A balance sheet does not represent the market value of a business. Property shown on the balance sheet may be worth more or less than its book value, for example. Equipment is shown at cost less depreciation. There may also be hidden assets, such as a valuable brand name, reputation, or copyrights. There may also be hidden liabilities, such as a pending legal action.

## Section 4. Pro Forma Statements

Positive assets shown on a balance sheet is good. Negative assets indicate trouble unless it is being supported by some other party, such as a parent company. Negative current assets, as opposed to long-term assets, indicate the business may have difficulty meeting its short-term liabilities.

*Assets:* Current assets are the cash balance from the “O\_CashFlow” tab and accounts receivable from the “Cash Accounts” tab. In future versions of *RELCOST*, stocks will be included as a current asset. Long-term assets are capital expenditures minus depreciation.

*Liabilities:* Current liabilities are accounts payable from the “Cash Accounts” tab and bank overdrafts from the “O\_CashFlow” tab. Bank overdrafts correspond to negative cash balances on the cash flow statement. Long-term liabilities are notes payable from the “Funding Schedule” tab.

*Shareholder Funds & Grants:* Shareholder Funds & Grants consists of equity investments and grants from the “Funding Schedule” tab and retained earnings from the “O\_IncomeStatement” tab.

**Figure 60. Balance Sheet on the “O\_BalanceSheet” Tab**

	A	B	C	D	E	
1	<b>Project</b>	Paper Mill				
2	<b>Scenario</b>	Gas turbine, BP steam turbine & duct burner				
3						
4	<b>Project Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	
5	<b>Balance Sheet (Shareholder Calculation)</b>					
6	<b>Assets</b>					
7	<b>Current</b>					
8	Cash	\$ 245,907	\$ 1,956,860	\$ 3,620,379	\$ 5,395,764	\$
9	Accounts receivable	\$ 64,792	\$ 242,580	\$ 252,284	\$ 262,375	\$
10	Stocks (unused)	\$ -	\$ -	\$ -	\$ -	\$
11	<b>Sub-Total</b>	<b>\$ 310,699</b>	<b>\$ 2,199,441</b>	<b>\$ 3,872,662</b>	<b>\$ 5,658,139</b>	<b>\$</b>
12	<b>Long Term</b>					
13	Capital Expenditures (at cost)	\$ 30,000,000	\$ 30,000,000	\$ 30,000,000	\$ 30,000,000	\$
14	Accumulated Depreciation (Funding Schedule)	\$ (301,841)	\$ (3,735,150)	\$ (4,298,225)	\$ (4,884,240)	\$
15	<b>Sub-total</b>	<b>\$ 29,698,159</b>	<b>\$ 26,264,850</b>	<b>\$ 25,701,775</b>	<b>\$ 25,115,760</b>	<b>\$</b>
16	<b>Total Assets</b>	<b>\$ 30,008,859</b>	<b>\$ 28,464,290</b>	<b>\$ 29,574,437</b>	<b>\$ 30,773,899</b>	<b>\$</b>
17	<b>Liabilities</b>					
18	<b>Current</b>					
19	Accounts Payable	\$ 31,700	\$ 130,947	\$ 138,322	\$ 145,312	\$
20	Bank Overdraft	\$ -	\$ -	\$ -	\$ -	\$
21	<b>Sub-total</b>	<b>\$ 31,700</b>	<b>\$ 130,947</b>	<b>\$ 138,322</b>	<b>\$ 145,312</b>	<b>\$</b>
22	<b>Long Term</b>					
23	<b>Notes Payable</b>	<b>\$ 5,773,159</b>	<b>\$ 2,339,850</b>	<b>\$ 1,776,775</b>	<b>\$ 1,190,760</b>	<b>\$</b>
24	<b>Total Liabilities</b>	<b>\$ 5,804,859</b>	<b>\$ 2,470,796</b>	<b>\$ 1,915,097</b>	<b>\$ 1,336,072</b>	<b>\$</b>
25	<b>Shareholder's Funds &amp; Grants</b>					
26	Equity	\$ 2,925,000	\$ 2,925,000	\$ 2,925,000	\$ 2,925,000	\$
27	Grants	\$ 21,000,000	\$ 24,150,000	\$ 24,150,000	\$ 24,150,000	\$
28	Retained Earnings	\$ 278,999	\$ (1,081,506)	\$ 584,340	\$ 2,362,826	\$
29	<b>Total</b>	<b>\$ 24,203,999</b>	<b>\$ 25,993,494</b>	<b>\$ 27,659,340</b>	<b>\$ 29,437,826</b>	<b>\$</b>
30	<b>Check = 0</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$</b>

## Section 4. Pro Forma Statements

### Use of Funds

The Use of Funds Statement provides a summary of sources of funds and how they are used, as shown in Figure 61. As a check, sources and uses must balance; that is

$$\text{Sources} = \text{Uses}$$

**Figure 61. Use of Funds Statement on the “O\_UseOfFunds” Tab**

	A	B	C	D	E	
1	<b>Project</b>	Paper Mill				
2	<b>Scenario</b>	Gas turbine, BP steam turbine & duct burner				
3						
4						
5	<b>Project Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	
6	<b>Sources and Uses of Funds Statement</b>					
7	<b>Sources of Funds</b>					
8	Sales Income	\$ 1,295,835	\$ 4,851,606	\$ 5,045,670	\$ 5,247,497	\$
9	Environmental Credits & Production Incentives	\$ -	\$ -	\$ -	\$ -	\$
10	Other Income	\$ -	\$ -	\$ -	\$ -	\$
11	Equity Injections	\$ 2,925,000	\$ -	\$ -	\$ -	\$
12	Grant Injections	\$ 21,000,000	\$ 3,150,000	\$ -	\$ -	\$
13	Debt Drawdowns	\$ 6,075,000	\$ -	\$ -	\$ -	\$
14	Interest Earned	\$ -	\$ 3,689	\$ 33,042	\$ 83,659	\$
15	Increase in Creditors	\$ 31,700	\$ 99,247	\$ 7,375	\$ 6,990	\$
16	Decrease in Debtors	\$ -	\$ -	\$ -	\$ -	\$
17	Decrease in Stocks	\$ -	\$ -	\$ -	\$ -	\$
18	Decrease in Bank Account	\$ -	\$ -	\$ -	\$ -	\$
19	<b>Total Sources</b>	<b>\$ 31,327,535</b>	<b>\$ 8,104,542</b>	<b>\$ 5,086,087</b>	<b>\$ 5,338,146</b>	<b>\$</b>
20	<b>Uses of Funds</b>					
21	Operating Costs	\$ 532,329	\$ 2,023,759	\$ 2,085,509	\$ 2,149,730	\$
22	Capital Expenditure	\$ 30,000,000	\$ -	\$ -	\$ -	\$
23	Debt Repayments	\$ 301,841	\$ 3,433,310	\$ 563,075	\$ 586,015	\$
24	Interest Expenses	\$ 20,250	\$ 163,554	\$ 83,345	\$ 60,405	\$
25	Finance Charges	\$ 60,750	\$ -	\$ -	\$ -	\$
26	Decrease in Creditors	\$ -	\$ -	\$ -	\$ -	\$
27	Increase in Debtors	\$ 64,792	\$ 177,789	\$ 9,703	\$ 10,091	\$
28	Increase in Stocks	\$ -	\$ -	\$ -	\$ -	\$
29	Taxation Paid	\$ 101,666	\$ 595,177	\$ 680,937	\$ 756,520	\$
30	Dividends Paid	\$ -	\$ -	\$ -	\$ -	\$
31	Increase in Bank Account	\$ 245,907	\$ 1,710,953	\$ 1,663,518	\$ 1,775,385	\$
32	<b>Total Uses</b>	<b>\$ 31,327,535</b>	<b>\$ 8,104,542</b>	<b>\$ 5,086,087</b>	<b>\$ 5,338,146</b>	<b>\$</b>
33	Check = 0	\$ -	\$ -	\$ -	\$ -	\$

## 5. Summaries of Expenses, Income & Purchased Fuels

Summaries of purchased fuels, operating costs and operating income are summarized on the tabs “O\_Purchased\_Fuels”, “O\_Operating\_Costs”, and “O\_Operating\_Income.”

Notice the bottom sections of these forms show values that do not include escalation and sensitivity factors. When printing, you may want to exclude these sections for clarity.

For printing out forms on two pages, printing at 65% of normal size in landscape view is suggested.

In *RELCOST*, all tabs with names beginning with “O\_” are forms that are intended to be printed out for record keeping. The content of each of these output forms is summarized in Table 2.

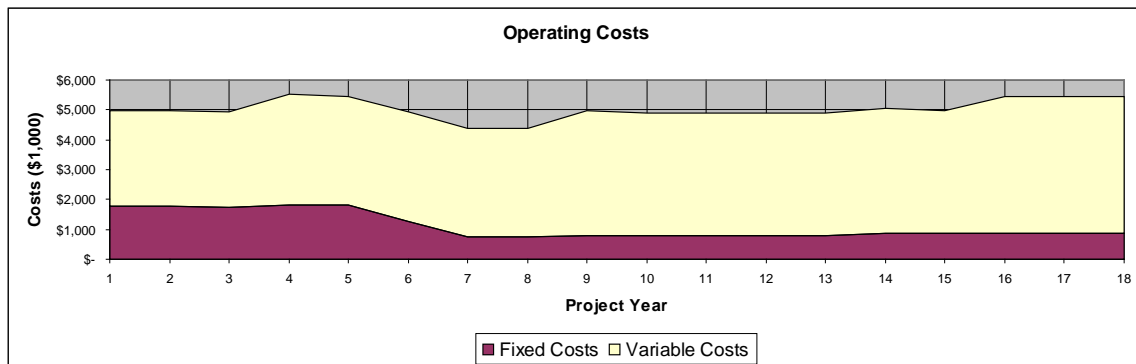
### ***Summary of Fixed and Variable Operating Costs***

Fixed and variable operating costs are summarized on the “O\_Operating\_Costs” tab, as shown in Figure 64. Variable costs are expenses that change in proportion to the project’s activity, i.e., the plant operating factor. Fixed costs are those that are not dependent on the level of activity. Fixed costs tend to be time-related, such as salaries, rents, insurance, and property taxes, which are typically paid monthly.

For the four user-defined O&M categories on the “O&M” tab, if the plant operating factor is applied (“True”), costs are included in variable costs. If not (“False”), costs are included in fixed costs. The categories on the “O&M” tab that are not user-defined (operating labor, insurance and property tax) are all included in fixed costs.

A plot of fixed and variable costs is located on the “WhatIf” tab, as shown in Figure 62.

**Figure 62. Example Plot of Fixed and Variable Costs (“WhatIf” Tab)**



## **Section 5. Summaries of Expenses, Income & Purchased Fuels**

### ***Summary of Operating Income***

The “O\_Operating\_Income” tab shows sales and revenues from all income sources entered on the “Sales” tab, the “Offset, RECs” tab, and interest income earned on the current and reserve accounts, as shown in Figure 65.

Sales revenues can include direct income (e.g. power sales), sales of co-products (e.g. brine mineral from a geothermal project), income from fees (e.g. tipping fees at a waste-to-energy plant) and incentives (e.g. renewable energy credits and production incentives).

Cost savings from, for example, energy efficiency improvements made in conjunction with the project installed at an existing plant might be entered on the “Sales” tab in the same manner as sales income. These would, however, show up as operating income.

### ***Summary of Purchased Fuels***

Quantities and costs of purchased fuels are summarized on the “O\_Purchased\_Fuels” tab, shown in Figure 63.

## Section 5. Summaries of Expenses, Income & Purchased Fuels

**Figure 63. "O\_Purchased\_Fuels" Tab**

	A	B	C	D	E	F	
1	<b>Project</b>	Paper Mill					
2	<b>Scenario</b>	Gas turbine, BF	steam turbine & duct burner				
3							
4	<b>Project Year</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	
5	<b>Purchased Units (includes sensitivity multipliers and plant operating factor)</b>						
6	1 Biomass	Tons	0.0	0.0	0.0	0.0	
7	2 Coal (Anthracitic)	Tons	0.0	0.0	0.0	0.0	
8	3 Coal (Bituminous)	Tons	0.0	0.0	0.0	0.0	
9	4 Electricity	Mw/h	0.0	0.0	0.0	0.0	
10	5 Geothermal Energy	MBTU	0.0	0.0	0.0	0.0	
11	6 Municipal Waste	Tons	0.0	0.0	0.0	0.0	
12	7 Natural Gas	Therms	2,464,017.8	8,870,463.9	8,870,463.9	8,870,463.9	
13	8 Oli (Heavy)	Therms	0.0	0.0	0.0	0.0	
14	9 Oil (Light)	Therms	0.0	0.0	0.0	0.0	
15	10 Waste Heat	MBTU	0.0	0.0	0.0	0.0	
16	<b>Purchased Cost (Escalated, includes sensitivity multipliers)</b>						
17	1 Biomass		\$ -	\$ -	\$ -	\$ -	\$
18	2 Coal (Anthracitic)		\$ -	\$ -	\$ -	\$ -	\$
19	3 Coal (Bituminous)		\$ -	\$ -	\$ -	\$ -	\$
20	4 Electricity		\$ -	\$ -	\$ -	\$ -	\$
21	5 Geothermal Energy		\$ -	\$ -	\$ -	\$ -	\$
22	6 Municipal Waste		\$ -	\$ -	\$ -	\$ -	\$
23	7 Natural Gas		\$ 412,329	\$ 1,543,759	\$ 1,605,509	\$ 1,669,730	\$
24	8 Oli (Heavy)		\$ -	\$ -	\$ -	\$ -	\$
25	9 Oil (Light)		\$ -	\$ -	\$ -	\$ -	\$
26	10 Waste Heat		\$ -	\$ -	\$ -	\$ -	\$
27	<b>Total</b>		<b>\$ 412,329</b>	<b>\$ 1,543,759</b>	<b>\$ 1,605,509</b>	<b>\$ 1,669,730</b>	<b>\$</b>
28	<b>Purchased Cost (Non-Escalated, w/o sensitivity multipliers)</b>						
29	1 Biomass		\$ -	\$ -	\$ -	\$ -	\$
30	2 Coal (Anthracitic)		\$ -	\$ -	\$ -	\$ -	\$
31	3 Coal (Bituminous)		\$ -	\$ -	\$ -	\$ -	\$
32	4 Electricity		\$ -	\$ -	\$ -	\$ -	\$
33	5 Geothermal Energy		\$ -	\$ -	\$ -	\$ -	\$
34	6 Municipal Waste		\$ -	\$ -	\$ -	\$ -	\$
35	7 Natural Gas		\$ 412,329	\$ 1,484,384	\$ 1,484,384	\$ 1,484,384	\$
36	8 Oli (Heavy)		\$ -	\$ -	\$ -	\$ -	\$
37	9 Oil (Light)		\$ -	\$ -	\$ -	\$ -	\$
38	10 Waste Heat		\$ -	\$ -	\$ -	\$ -	\$
39	<b>Total</b>		<b>\$ 412,329</b>	<b>\$ 1,484,384</b>	<b>\$ 1,484,384</b>	<b>\$ 1,484,384</b>	<b>\$</b>
40							



## Section 5. Summaries of Expenses, Income & Purchased Fuels

**Figure 64. “O\_Operating\_Costs” Tab**

	A	B	C	D	E			
Project		Biomass CHP Project						
Description		0						
Project Year		1	2	3	4			
Operation Costs (Escalated, includes sensitivity multipliers)								
Variable Costs	\$	8,666,210	\$	-	\$			
Fixed Costs	\$	5,261,180	\$	45,220	\$	34,457	\$	23,25
Total	\$	13,927,390	\$	45,220	\$	34,457	\$	23,25
Variable Costs (Escalated, includes sensitivity multipliers)								
Purchased Fuels	\$	8,666,210	\$	-	\$	-	\$	
Major Expenses	\$	-	\$	-	\$	-	\$	
Franchise Fees	\$	-	\$	-	\$	-	\$	
Royalty payments	\$	-	\$	-	\$	-	\$	
-	\$	-	\$	-	\$	-	\$	
-	\$	-	\$	-	\$	-	\$	
-	\$	-	\$	-	\$	-	\$	
Category 4	\$	-	\$	-	\$	-	\$	
Sub-Total	\$	8,666,210	\$	-	\$	-	\$	
Fixed Costs (Escalated, includes sensitivity multipliers)								
Operating Labor	\$	-	\$	-	\$	-	\$	
Property taxes	\$	-	\$	-	\$	-	\$	
Insurance	\$	-	\$	-	\$	-	\$	
Depreciation (SH)	\$	-	\$	-	\$	-	\$	
Debt Interest	\$	31,180	\$	45,220	\$	34,457	\$	23,25
Loan Fees	\$	14,000	\$	-	\$	-	\$	
Fixed O&M Costs	\$	5,216,000	\$	-	\$	-	\$	
Variable O&M Costs	\$	-	\$	-	\$	-	\$	
Property Taxes and Insur	\$	-	\$	-	\$	-	\$	
-	\$	-	\$	-	\$	-	\$	
Sub-Total	\$	5,261,180	\$	45,220	\$	34,457	\$	23,25

## Section 5. Summaries of Expenses, Income & Purchased Fuels

**Figure 65. “O\_Operating\_Income” Tab**

	A	B	C	D	E	F
1	<b>Project</b>	Paper Mill				
2	<b>Scenario</b>	Gas turbine, BP	steam turbine & duct burner			
3						
4		<b>Project Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
5	<b>Sales, Income Units (includes sensitivity multipliers and plant operating factors)</b>					
6	1 Electricity Sales	MWh/yr	79,744	79,744	79,744	79,744
7	2 Heat Sales	MMBtu/Yr	0	0	0	0
8	3 Sales 1	MMBtu/Yr	0	0	0	0
9	4 Sales 2	MMBtu/Yr	0	0	0	0
10	5 Sales 3	MMBtu/Yr	0	0	0	0
11	6 Sales 4	MMBtu/Yr	0	0	0	0
12	7 Sales 5	MMBtu/Yr	0	0	0	0
13	8 Sales 6	MMBtu/Yr	0	0	0	0
14	9 Sales 7	MMBtu/Yr	0	0	0	0
15	Other Income (use escal		0	0	0	0
16	Carbon Credits:	CO2 Tons/Yr	0	0	0	0
17	Renewable Energy Credits	MWh/yr	19,936	71,769	71,769	71,769
18	Federal RE Production In	MWh/yr	19,936	71,769	71,769	71,769
19	Local RE Production Inc	MWh/yr	0	0	0	0
20	<b>Income, Sales (Escalated, includes sensitivity multipliers)</b>					
21	1 Electricity Sales		\$ 1,295,835	\$ 4,851,606	\$ 5,045,670	\$ 5,247,497
22	2 Heat Sales		\$ -	\$ -	\$ -	\$ -
23	3 Sales 1		\$ -	\$ -	\$ -	\$ -
24	4 Sales 2		\$ -	\$ -	\$ -	\$ -
25	5 Sales 3		\$ -	\$ -	\$ -	\$ -
26	6 Sales 4		\$ -	\$ -	\$ -	\$ -
27	7 Sales 5		\$ -	\$ -	\$ -	\$ -
28	8 Sales 6		\$ -	\$ -	\$ -	\$ -
29	9 Sales 7		\$ -	\$ -	\$ -	\$ -
30	Other Income (use escalated values)		\$ -	\$ -	\$ -	\$ -
31	Carbon Credits:		\$ -	\$ -	\$ -	\$ -
32	Renewable Energy Credits		\$ -	\$ -	\$ -	\$ -
33	Federal RE Production Incentive		\$ -	\$ -	\$ -	\$ -
34	Local RE Production Incentives		\$ -	\$ -	\$ -	\$ -
35	Interest Income		\$ -	\$ 3,689	\$ 33,042	\$ 83,659
36	<b>Total Income</b>		<b>\$ 1,295,835</b>	<b>\$ 4,855,295</b>	<b>\$ 5,078,712</b>	<b>\$ 5,331,156</b>

## 6. Life-Cycle Cost Analysis

Life-cycle cost analysis is a method for assessing the total cost of facility ownership that takes into account all costs of acquiring, owning, and disposing of the project. Life-cycle cost analysis results in several indicators of a project's worth that may be of interest to utilities, governments, investment bankers and developers. The most common are the net present value, the internal rate of return, the benefit-cost ratio, and the discounted and simple payback period. In *RELCOST*, results of the life-cycle cost analysis are shown on the "WhatIf" tab.

Calculation of these indicators involves determining the project's benefits and costs. In *RELCOST*, benefits are defined as the net profit after taxes<sup>5</sup> minus depreciation. Shareholder depreciation from the "O\_IncomeStatement (SH)" tab is used.

$$\text{Benefits} = \text{NPAT} - \text{Depreciation}$$

Costs include capital expenditures minus any grants received.

$$\text{Costs} = \text{CapEx} - \text{Grants}$$

### Net Present Value

The net present value (NPV) is an investment's benefits minus costs summed over the life of the project. Only projects with positive NPVs should be considered.

The NPV method is a valuable indicator because it recognizes the time value of money. Because of this, however, its result is only as reliable as the discount rate that is chosen. If you rely on the NPV, be sure that the discount rate accurately reflects the cost of capital and the risk of the project.

In *RELCOST*, the difference between benefits *B* and costs *C* for each year is calculated as:

$$B - C = (\text{NPAT} - \text{Depreciation}) - (\text{Capital Expenditures} - \text{Grants})$$

The values used in this equation are adjusted for price escalation and inflation (if the user selects to include inflation in escalation multipliers on the "Cost Escalation" tab). The

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<sup>5</sup> Some analysts may prefer using retained earnings instead of NPAT. To make this change, values for NPAT in cells AH33:BA33 (yellow highlighted) on "\_Calcs\_Life\_Cycle\_Cost" can be replaced with Retained Earnings from the Income Statement. Since dividend policies can vary so greatly across projects and companies, the NPAT may be preferable in comparing metrics that are used for cross-project comparisons.

## Section 6. Life-Cycle Cost Analysis

difference  $B-C$  for each year is then discounted to the present value. Thus, NPV equals the sum of the present values of  $B-C$  over the life of the project.<sup>6</sup>

$$NPV = \text{Sum} [ (B-C) * (1+\text{Discount Rate})^{(\text{Year}-1)} ]$$

### **Internal Rate of Return**

The internal rate of return (IRR) is examined to determine if it exceeds a minimally acceptable return, often called the hurdle rate. A company's hurdle rate is normally the discount rate used in considering investment alternatives. The Project IRR represents the return on capital expenditures minus grants. The Equity IRR is the return on equity investments.

Because the IRR is a percentage – rather than an absolute value like the NPV – it can be used to compare projects of different sizes. The IRR calculation is often preferred in situations where a project produces negative cash flow (outflows) in the beginning, followed by positive cash flow (inflows) in later years. Small, high-growth companies and private businesses are more likely to use the IRR, while larger, public companies are more likely to use the NPV.

In *RELCOST*, the Project IRR is calculated on the “\_Calcs\_Life\_Cycle\_Cost” tab by solving for the discount rate at which the NPV is zero.<sup>7</sup> IRR results are not automatically updated when changes are made to the spreadsheet. To update results, click on the calculator table on the “WhatIf” tab, as shown previously in Figure 12.

### **Benefit-to-Cost Ratio (BC Ratio)**

The BC ratio is the sum of the present value of the benefits from an investment over the life of the project divided by the sum of the present value of the costs of the investment. Benefits and costs are determined as described above for the net present value. Only projects with a BC ratio greater than 1 should be considered.

In *RELCOST*, the BC ratio is calculated as

$$BC \text{ ratio} = \frac{\text{Sum} [ B * (1+\text{Discount Rate})^{(\text{Year}-1)} ]}{\text{Sum} [ C * (1+\text{Discount Rate})^{(\text{Year}-1)} ]}$$

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<sup>6</sup> Note Excel's function NPV is defined slightly differently and gives a different result. The method used in *RELCOST* is considered standard. For a discussion of this difference, refer to <http://one-nomads-blog.blogspot.com/2006/07/excels-npv-and-irr-function.html>.

<sup>7</sup> Excel's IRR function is not used because its result does not check with the NPV.

### ***Discounted Payback Period***

The payback period is the time required for cumulative cash inflows to recover the cash outflows of a project. *Simple payback* – one of the most popular criteria for evaluating capital projects – is the period required for an energy investment to pay for itself through first-year energy cost savings. The problem with the simple payback is that it ignores the time value of money. It is not uncommon for industry to require simple paybacks of two years or less. Projects that are subject to less risk, such as utility projects, generally have longer minimum paybacks.

Discounted payback is similar in concept to simple payback, but it is calculated using discounted cash flows. The discounted payback is also the time at which the BC ratio equals one and the NPV equals zero, as shown in Figure 66. In other words, the discounted payback is the time required for the project's benefits to equal its initial costs.

In *RELCOSt*, the discounted payback is determined using costs and benefits as defined previously for the NPV, IRR and BC ratio. That is, costs are capital expenditures minus grants and benefits are net profits after taxes (NPAT.)

### ***Simple Payback Period***

A simple payback is calculated in *RELCOSt* in two ways. The first method is provided for comparison with many energy analyses that calculate simple payback as the ratio of total expenditures to first year cash flow of operations, assuming full operation in the first year. It is calculated as:

$$\text{Simple Payback} = (\text{Capital Expenditures} - \text{Grants}) / \text{Average Cash Flow}$$

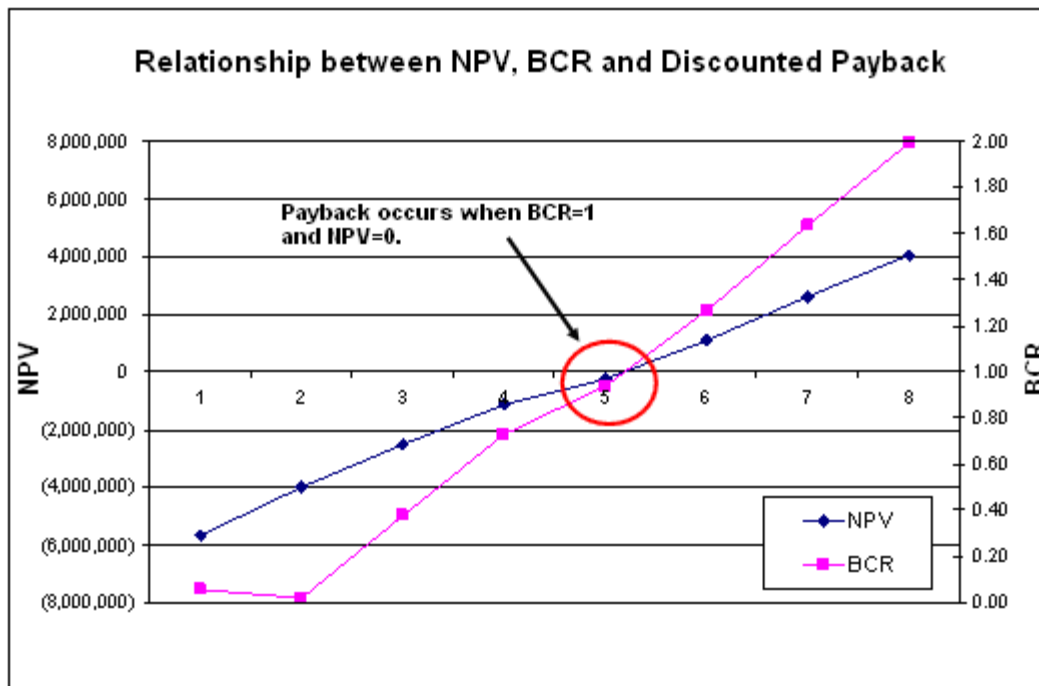
In *RELCOSt*, the cash flow is averaged over the life of the project to compensate for possible part year operation in beginning years. Non-discounted values are used.

In the second method, the simple payback is calculated in the same manner as discounted payback except cash flows are not discounted.

**Table 8. Typical Decision Factors Based on Life-Cycle-Cost Analysis**

<b>Result</b>	<b>Typical Minimum Criteria for Consideration</b>
Net present value	NPV>0
Benefit-to-cost ratio (BCR)	BCR>1
Project internal rate of return	IRR > Hurdle Rate (normally the Discount Rate)
Discounted payback	Varies widely. PB<2 to 5 years for private industry is common. Longer minimum paybacks are typical for utilities and government projects with lower risk.

Figure 66. Example Showing Relationship of NPV, BCR and Discounted Payback



## 7. Financial Ratios

Indicators of financial performance in each year include profitability margins, liquidity measures, cash flow ratios, and leverage ratios. In *RELCOST*, values of these financial ratios are shown on the “WhatIf” tab.

### ***Profitability Margins***

Margins are earnings expressed as ratio or percentage of sales. Profitability margins give investors insight into management efficiency. Using a percentage rather than an absolute number allows investors to compare the profitability of different companies of various sizes. In general, profit margins can vary significantly between industries and so comparisons of margins should be made only with similar companies.

Profitability margins for various industries can be found in many published sources, such as *The Almanac of Business and Industrial Financial Ratios*, *Dun and Bradstreet Key Business Ratios*, *Value Line Service*, and *Standard and Poor’s Corporation Financial Sheets*.

### **Gross Margin**

The gross profit margin shows how efficiently a firm uses material and labor. Acceptable gross margins are often determined by comparison with gross margins of similar companies. Acceptable gross margin levels vary widely, depending on the industry. For example, the airline industry has a gross margin of about 5%, while the software industry has a gross margin of about 90%.

In *RELCOST*, the gross margin for each year is calculated from the income statement as the revenue from sales minus the cost of sales all divided by sales:<sup>8</sup>

$$\text{Gross Profit Margin} = (\text{Sales} - \text{Cost of Sales}) / \text{Sales}$$

As detailed on the “O\_IncomeStatement” tab, cost of sales includes purchased fuels, royalties and franchise fees, variable O&M costs, and major expenses.

### **Operating Margin**

The operating margin shows how successful a firm has been in generating income from the operation of the project. High operating profits can mean the company has effective control of costs, or that sales are increasing faster than operating costs. Because the

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<sup>8</sup> Gross Margin: On “Calcs\_Financial\_Indicators”, cell B94=IF('O\_IncomeStatement (SH)'!B6>0,'O\_IncomeStatement (SH)'!B8/'O\_IncomeStatement (SH)'!B6,"N/A")

## Section 7. Financial Ratios

operating profit-margin accounts for not only costs of materials and labor, but also administration and selling costs, it should be less than the gross margin.

In *RELCOST*, the operating margin for a year is calculated from the income statement by dividing the earnings before interest and tax (EBIT) by the revenue from sales:<sup>9</sup>

$$\text{Operating Profit Margin} = \text{EBIT} / \text{Sales}$$

The EBIT is calculated as sales revenue minus cost of sales, operating expenses and depreciation. As detailed on the “O\_IncomeStatement” tab, operating expenses include operating reserve account deposits and withdrawals, labor, insurance and property taxes.

### Pre-Tax and After-Tax Margins

The pre-tax and after-tax margins are used to evaluate the relationship between operating income and revenues. The after-tax profit margin is the percentage of money a company actually earns per dollar of sales. This ratio is interpreted in the same way as other profit margins, but the after-tax profit margin is more stringent because it takes taxes into account. The pre-tax margin takes into consideration all costs except taxes. In *RELCOST*, the pre-tax and after-tax margins for each year are calculated from the income statement as<sup>10,11</sup>

$$\text{Pre-tax Margin} = \text{Net Profit Before Taxes} / \text{Sales}$$

$$\text{After-tax Margin} = \text{Net Profit After Taxes} / \text{Sales}$$

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<sup>9</sup> Operating Margin: On “Calcs\_Financial\_Indicators”, cell B95=IF('O\_IncomeStatement (SH)!'B6>0,'O\_IncomeStatement (SH)!'B12/'O\_IncomeStatement (SH)!'B6,"N/A")

<sup>10</sup> After-Tax Margin: On “Calcs\_Financial\_Indicators”, cell B97=IF('O\_IncomeStatement (SH)!'B6>0,'O\_IncomeStatement (SH)!'B17/'O\_IncomeStatement (SH)!'B6,"N/A")

<sup>11</sup> Pre-tax Margin: On “Calcs\_Financial\_Indicators”, cell B96=IF('O\_IncomeStatement (SH)!'B6>0,'O\_IncomeStatement (SH)!'B15/'O\_IncomeStatement (SH)!'B6,"N/A")



### ***Liquidity Measures***

Liquidity ratios indicate how quickly an asset can be converted into cash without incurring a substantial loss. Two well known liquidity ratios are the current ratio and the acid-test ratio (aka quick ratio).

#### **Current Ratio**

The current ratio is the relationship between current assets and current liabilities. The current ratio roughly indicates the margin of safety available to a firm to meet short-term liabilities. In *RELCOST*, the current ratio for each year is calculated from the balance sheet as:<sup>12</sup>

$$\text{Current Ratio} = \text{Current Assets} / \text{Current Liabilities}$$

where current assets include cash, accounts receivable and, in future versions, stocks. Current liabilities include accounts payable and bank overdrafts. Refer to the “O\_BalanceSheet (SH)” tab for an itemization of current assets and liabilities.

The minimum acceptable current ratio varies depending on the industry and the type of company. For example, a current ratio of 2.0 times or better may be good for a manufacturing firm, while a ratio of 1.5 may be acceptable for a utility because of its highly predictable cash inflow and small current liabilities.

#### **Acid-Test Ratio**

The acid-test ratio indicates whether a firm could meet its creditor obligations if sales were to drop catastrophically. In *RELCOST*, the acid-test ratio is similar to the current ratio except the acid-test ratio does not include stocks.<sup>13</sup>

$$\text{Acid-Test Ratio} = \text{Ratio} = (\text{Current Assets} - \text{Stocks}) / \text{Current Liabilities}$$

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<sup>12</sup> Current Ratio: On “Calcs\_Financial\_Indicators”, cell B82=IF('O\_BalanceSheet (SH)'!B11<=0,"N/A",IF('O\_BalanceSheet (SH)'!B21<=0,"N/A",'O\_BalanceSheet (SH)'!B11/'O\_BalanceSheet (SH)'!B21))

<sup>13</sup> Acid-Test Ratio: On “Calcs\_Financial\_Indicators”, cell B83=IF('O\_BalanceSheet (SH)'!B11<=0,"N/A",IF('O\_BalanceSheet (SH)'!B21<=0,"N/A",('O\_BalanceSheet (SH)'!B11 - 'O\_BalanceSheet (SH)'!B10)/'O\_BalanceSheet (SH)'!B21))

### **Cash Flow Ratios**

Cash flow ratios can be useful in determining the adequacy of cash and cash equivalents.

#### **Debt-Service Coverage Ratio**

The debt-service coverage ratio indicates the amount of cash flow available to meet annual interest and principal payments on debt. A ratio less than 1 would mean a negative cash flow. A ratio of less than 1, say 0.95, would mean that there is only enough net operating income to cover 95% of annual debt payments.

In *RELCOST*, the debt-service coverage ratio for each year is calculated from the cash flow sheet and funding schedule as:<sup>14</sup>

$$\text{Debt-Service Coverage Ratio} = \frac{\text{Cash Flow from Operations minus Taxes}}{\text{(Total Principal and Interest Paid + Loan Fees)}}$$

In *RELCOST*, a value of "N/A" will be displayed if the "Total P&I + Loan Fees" value from the Funding Schedule sheet is equal to zero (indicating no debt service).

#### **Other Cash Flow Ratios**

Other cash flow ratios not currently included in *RELCOST*, but which could be incorporated, are

$$\begin{aligned}\text{Cash Flow Solvency} &= \text{Cash Flow from Operations} / \text{Total Liabilities} \\ \text{Cash Flow Margin} &= \text{Cash Flow from Operations} / \text{Sales} \\ \text{Cash Flow Return on Assets} &= \text{Cash Flow from Operations} / \text{Total Assets}\end{aligned}$$

These and others are discussed in “The Power of Cash Flow Ratios” (Urbanic) at [www.newaccountantusa.com/ThePowerofCashFlowRatios.pdf](http://www.newaccountantusa.com/ThePowerofCashFlowRatios.pdf).

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<sup>14</sup> **Debt-Service Coverage Ratio:** On “Calcs\_Financial\_Indicators”, cell B85=IF(-('Funding Schedule'!B70+'Funding Schedule'!B71)>1,(O\_CashFlow!B12+O\_CashFlow!B13)/-('Funding Schedule'!B70+'Funding Schedule'!B71),"N/A")

### **Leverage Ratios**

Financial leverage relates to the practice of using debt to finance investments. An unlevered firm does its financing by issuing common stock and has no debt on its books. A levered firm finances part of its operation with debt.

When debt is issued, the firm commits itself to pay interest and repay principal sometime in the future. Leveraging can be advantageous because this interest is a tax-deductible expense and so more of the operating income flows through to investors. However, the more debt a firm has in its capital structure, the greater the financial risk.

### **Debt-to-Equity Ratio**

The debt-to-equity ratio is calculated as the sum of long-term debt and the value of leases divided by equity. Electric utilities, which have steady inflows of receipts can safely afford to have high D/E ratios, whereas cyclical companies usually have lower ones.

In *RELCOST*, the debt-to-equity ratio for each year is calculated from the balance sheet as:<sup>15</sup>

$$\text{Debt-to-Equity Ratio} = \text{Total Liabilities} / \text{Equity Investments}$$

### **Debt Ratio**

The debt ratio is the ratio of total liabilities to total assets. The greater the debt ratio, the greater the financial leverage. A high ratio tends to magnify earnings and a low ratio could mean inefficient use of debt.

In *RELCOST*, the debt ratio is calculated from the debt-to-equity ratio as:<sup>16</sup>

$$\text{Debt Ratio} = \text{Debt-to-Equity Ratio} / (\text{Debt-to-Equity Ratio} + 1)$$

### **Equity Ratio**

The equity ratio is the proportion of the total assets that are financed by stockholders rather than creditors. A low equity ratio will produce good results for stockholders as long as the company earns a rate of return on equity that is greater than the interest rate paid to creditors. The equity ratio is more commonly used in Europe, while the debt-to-equity ratio is more common in the U.S.

In *RELCOST*, the equity ratio is calculated from the debt-to-equity ratio as:<sup>17</sup>

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<sup>15</sup> Debt-to-Equity Ratio: On "Calcs\_Financial\_Indicators", cell B87=IF('O\_BalanceSheet (SH)'!B26>0,'O\_BalanceSheet (SH)'!B24/'O\_BalanceSheet (SH)'!B26,"N/A")

<sup>16</sup> Debt Ratio: On "Calcs\_Financial\_Indicators", cell B88=B87/(B87+1)

<sup>17</sup> Equity Ratio=On "Calcs\_Financial\_Indicators", cell B89=1/(B87+1)

$$\text{Equity Ratio} = 1 / (\text{Debt-to-Equity Ratio} + 1)$$

### Debt-Asset Ratio

The debt-asset ratio indicates what proportion of the company's assets is being financed through debt. A ratio less than 1 means a majority of assets are financed through equity, greater than 1 means they are financed more by debt. A high ratio indicates a "highly debt leveraged firm."

In *RELCOST*, the debt-asset ratio is calculated from the balance sheet as:<sup>18</sup>

$$\text{Debt-Asset Ratio} = \text{Total liabilities} / \text{Total Assets}$$

Total liabilities include accounts payable, bank overdrafts and notes payable. Total assets include cash, accounts receivable, stocks, and capital expenditures (at cost) minus depreciation.

### Interest Coverage Ratio

The interest coverage ratio is used to determine how easily a company can pay interest on outstanding debt. The lower the ratio, the more the company is burdened by debt expense. When a company's interest coverage ratio is 1.5 or lower, its ability to meet interest expenses may be questionable. An interest coverage ratio below 1 indicates the company is not generating sufficient revenues to satisfy interest expenses.

In *RELCOST*, the interest coverage ratio for each year is calculated from the income statement as:<sup>19</sup>

$$\text{Interest Coverage Ratio} = \text{EBIT} / \text{Interest Expenses}$$

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<sup>18</sup> Debt-Asset Ratio: On "Calcs\_Financial\_Indicators", cell B89=IF('O\_BalanceSheet (SH)'!B16>1,'O\_BalanceSheet (SH)'!B24/'O\_BalanceSheet (SH)'!B16,"N/A")

<sup>19</sup> Interest Coverage Ratio: On "Calcs\_Financial\_Indicators", cell B92=IF('O\_IncomeStatement (SH)'!B13<-1,'O\_IncomeStatement (SH)'!B12/'O\_IncomeStatement (SH)'!B13,"N/A")

**Table 9. Decision Factors Based on Selected Financial Ratios**

Ratio	Decision Factors
Profitability Margins	Vary widely depending on industry. Refer to references such as <i>The Almanac of Business and Industrial Financial Ratios</i> .
Current Ratio	Firms with Current Ratios of around 1 or less should have inventories that can immediately be converted to cash. Ratio of 1.5 or less may be acceptable for projects with highly predictable cash inflow and small current liabilities, such as utilities. Ratio of 2 or more may be required for businesses with less predictable cash inflows or greater current liabilities.
Debt-Service Coverage Ratio	Ratio<1 indicates negative cash flow and insufficient cash to cover operating income.
Debt Ratio	The larger the debt ratio, the greater the financial leverage and risk. Low debt ratios can indicate inefficient use of debt.
Debt-Asset Ratio	Ratio<1 indicates a majority of assets are financed through equity. High ratio indicates high leveraging.
Interest Coverage Ratio	Ratio<1 indicates the company cannot cover its interest expenses. Ratio <1.5 indicates ability to meet interest expenses may be questionable.

**Table 10. Financial Ratios in the U.S. Energy Industry in 2005**

Ratio	Electricity-Specialized Firms			Electricity and Gas Firms		
	Mean	Min	Max	Mean	Min	Max
Current Ratio	1.28	0.15	4.96	1.40	0.30	9.39
Long TermDebt to Equity	1.28	0.41	4.99	1.31	0.45	6.02
Interest Coverage	3.71	2.30	8.25	3.93	2.27	13.57
Gross Margin (%)	28.75	11.27	88.10	22.00	0.60	35.61
EBITDA of revenue (%)	21.27	6.73	71.19	17.57	7.13	26.58
Net Profit Margin (%)	8.85	1.00	29.53	5.94	-20.94	14.71
Return on Equity	11.44	1.00	32.02	10.57	-24.95	46.56

From "Productivity, Efficiency, and Economic Growth in the Asia-Pacific Region," Jeong-Dong Lee, Almas Heshmati, Springer, 2008

## 8. Levelized Costs

Levelized cost of energy (LCE) is the annualized total cost of investment, fuel, operations, and indirect income (incentives, credits, etc.) divided by annual quantity of energy produced. In other words, it is the constant annual cost that is equivalent on a present value basis to the actual annual costs. An example illustrating levelized costs is shown in Figure 1 of the CEC's *Comparative Costs of California Central Station Electricity Generation* available at [www.energy.ca.gov/2007publications/CEC-200-2007-011/CEC-200-2007-011-SD.PDF](http://www.energy.ca.gov/2007publications/CEC-200-2007-011/CEC-200-2007-011-SD.PDF).

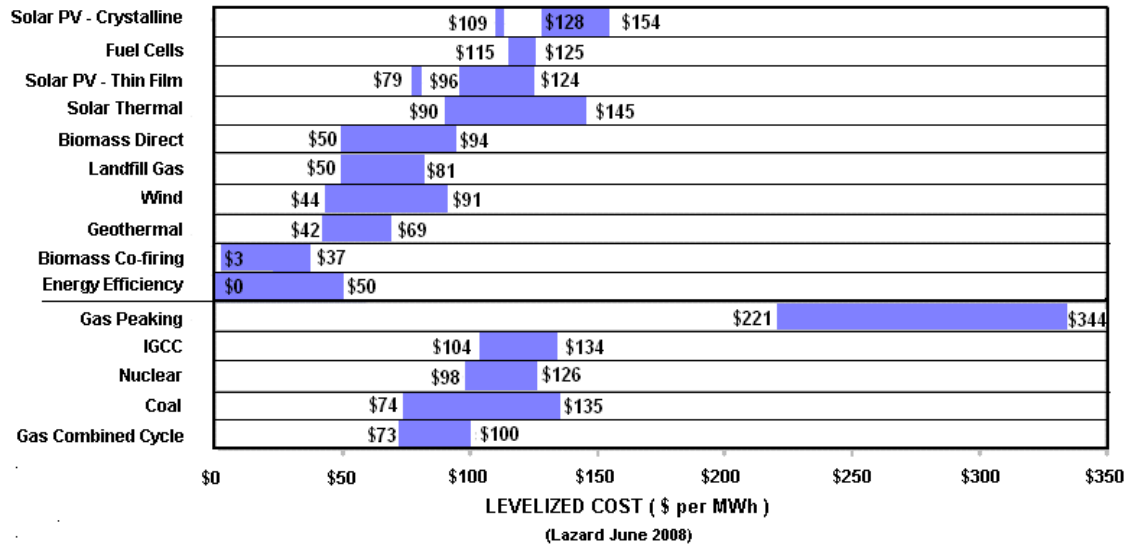
Levelized costs are often used by energy policy analysts and project evaluators to develop first-order assessments of a project's attractiveness and to compare alternate technologies. For electricity, LCE is typically expressed in units of \$/MWh. For natural gas, the units of LCE are typically \$/therm or \$/MMBtu in the U.S. Levelized costs of other revenue sources, such as fiber sales for the case of an anaerobic digester, can be treated similarly, as a cost per units produced. For reference, levelized costs of electricity generated from various energy sources and energy efficiency in the U.S. in June 2008 are shown in Figure 67.

In *RELCOST*, levelized costs are calculated for the scorecard year as:

$$\text{Levelized Cost} = \frac{\text{Present Value of Cumulative Total Costs} \times \text{Cost Allocation Factor} \times \text{Annualized Payment Factor}}{\text{Cumulative Units Produced}}$$

Cost allocation factors for each revenue stream are defined on the "Cost Allocation" tab.

**Figure 67. Levelized Costs (\$/MWh) of Electricity Generated from Conventional and Renewable Energy Sources and Energy Efficiency Measures (2008)\***



Levelized cost estimates by Lazard Ltd. reflect production tax credit, investment tax credit, and accelerated asset depreciation, as applicable, and assume 2008 dollars, 60% debt at 7% interest rate, 40% equity at 12% cost, 20-year economic life, 40% tax rate, and 5-20 year tax life. Coal price of \$2.50 per MMBtu and natural gas price of \$8.00 per MMBtu are assumed.

- Low end levelized cost for crystalline solar PV represents single-axis tracking crystalline and high end represents fixed installation. The single value of \$109 below the low-to-high range represents a leading solar crystalline company's targeted implied levelized cost of energy in 2010, assuming a total system cost of \$5.00 per watt.
- For thin film solar PV, the single value of \$79 below the low-to-high range represents the leading thin-film company's targeted implied levelized cost of energy in 2010, assuming a total system cost of \$2.75 per watt.
- For solar thermal plants, the low end levelized cost represents a solar tower and high end cost represents a solar trough system.
- Levelized costs for biomass co-firing represent retrofit cost of existing coal plant.
- Levelized costs for energy efficiency are per National Action Plan for Energy Efficiency. Actual cost for various initiatives varies widely.
- High end levelized costs of integrated gasification combined cycle (IGCC) incorporates 90% carbon capture and compression.
- Levelized costs for nuclear power do not reflect potential economic impact of federal loan guarantees or other subsidies.
- Levelized costs of coal plants are based on advanced supercritical pulverized coal. High end levelized cost incorporates 90% carbon capture and compression.

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\*Adapted from *Levelized Cost of Energy Analysis* presentation by Lazard Ltd. to the National Association of Regulatory Utility Commissioners, June 2008,  
[www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20\(2\).pdf](http://www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20(2).pdf)

## 9. Financial Modeling Process

### ***Evaluation Method***

*RELCOST* provides three general methods to evaluate the viability of a project: use of pro forma statements, use of financial ratios, and life-cycle-cost analysis. Which evaluation method is used depends on the analysis goals. For example, if responding to a request for proposal or establishing support for a business case, an examination of pro forma statements is often required. If comparing alternate scenarios or projects, life-cycle-cost analysis is appropriate. If evaluating project performance and efficiency over time or project liquidity or the ability to repay debt, as just a few examples, financial ratios are very useful.

Multiple methods are almost always used to provide different perspectives on risk assessment. Other more complex methods exist, such as Monte-Carlo simulations for multi-variant risk assessment.

### ***Model Input Detail versus Accuracy***

Early model inputs can be high-level and may lack many details and project-specific factors. High level inputs are often adequate for:

- Preliminary feasibility studies
- Initial screening of alternatives
- Break-even sales pricing
- Estimating factors based on industry standards or rules-of-thumb, such as typical costs per kW

Model inputs required to support contract or funding decisions should be project-specific and more detailed. Such studies require substantially more input time. Detailed project-specific inputs are required for:

- Developing a specific funding plan based on negotiated arrangements with financial institutions and investors
- Negotiating a sales price according to a Power Sales Agreement
- Identifying line item details for costs, income, expenses based upon specific technologies, site-specific conditions, etc.



### ***Sensitivity Analysis***

No project goes exactly according to plan. Sensitivity analysis, also referred to as “What If” analysis, is an interactive process that tells you what effect changes in factors such as revenues, incentives and sources of funding will have on project viability. In its simplest form it involves selecting scenarios such as a “best-case” scenario, a “worst-case” scenario and the “most-likely-case” scenario. By indentifying the relative importance of risky variables, the decision-maker can adjust projects to reduce the risks and consider responses should the outcomes occur.

Sensitivity analysis begins with a base-case situation, which is developed by using the most likely values for each input. Then a specific variable is varied, both increasing and decreasing it from the most likely value, while holding other variables constant. The corresponding change in some measure of performance, such as the IRR, NPV or levelized costs, is recorded for each change in input.

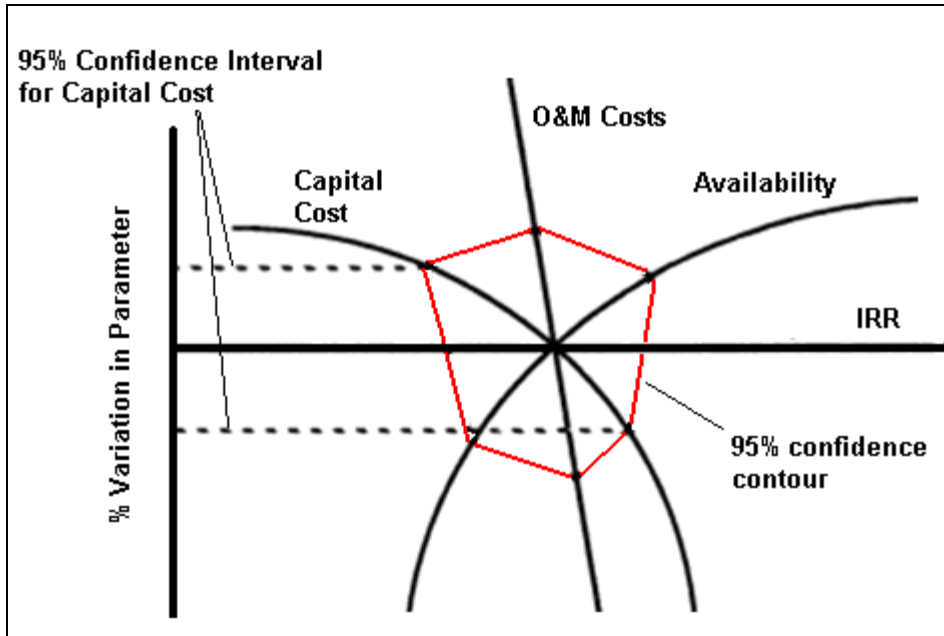
A “spider diagram” is a useful way to present the results of sensitivity studies. A spider diagram has the selected measure of viability along its horizontal axis and the percent variation in parameters on its vertical axis. Spider diagrams are constructed as follows:

1. Identify parameters that are subject to risk, such as sales price or operating expenses.
2. Select a particular measure of performance, such as the IRR.
3. Calculate the IRR (or other selected measure) using expected values for all parameters. Plot this on the horizontal axis.
4. Select one risky parameter at a time and re-calculate the IRR, varying this parameter in increments. Plot the results on the diagram for each parameter.

The flatter a line on the spider diagram, the more sensitive project performance is to changes in that parameter.

Because spider diagrams can get confusing when many parameters are subject to risk, it is often useful to construct several diagrams. For example, capital aspects of the project can be plotted on one spider diagram while operating parameters can be plotted on another. It is also useful to include a measure of the likelihood (e.g. 95% confidence) that a parameter will remain within a certain percentage of its expected value. A “confidence contour” can then be constructed as in Figure 68.

**Figure 68. Spider Diagram**



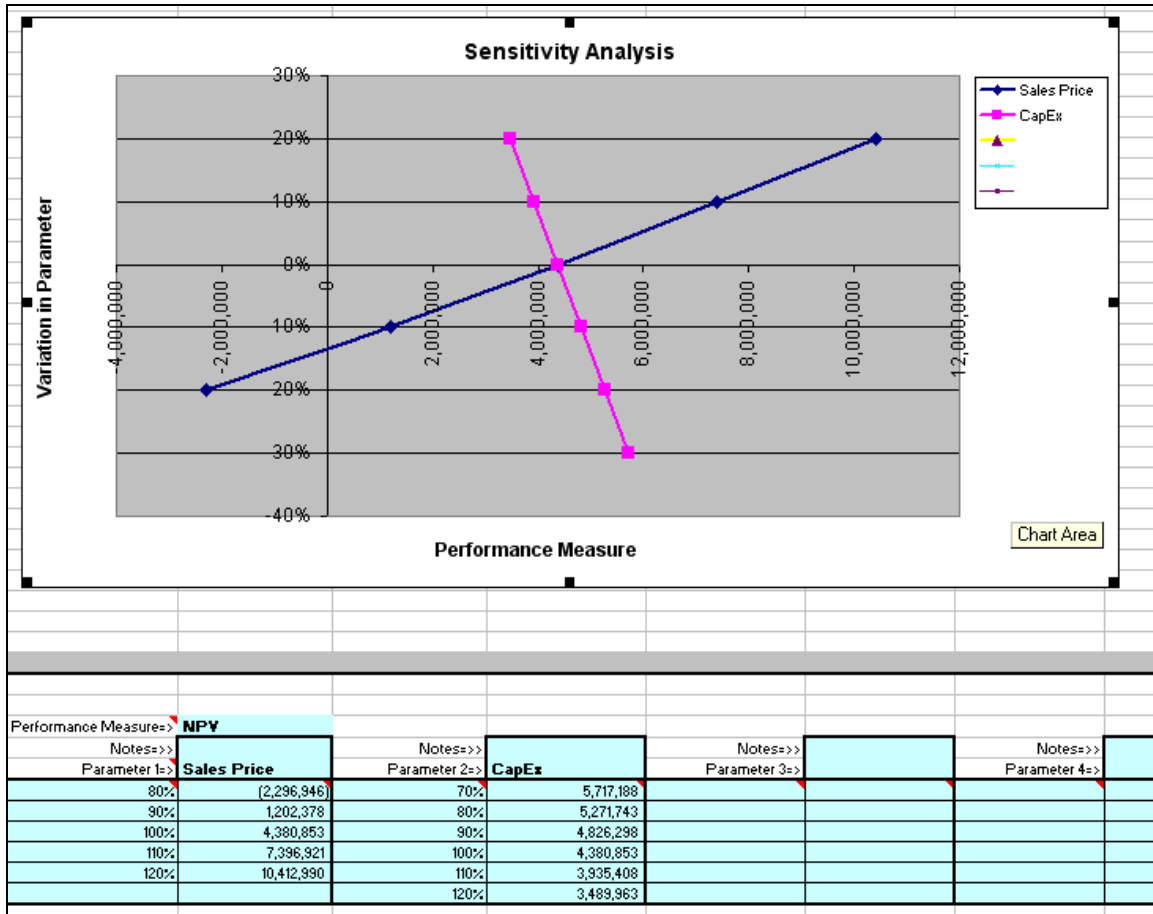
### Spider Diagram Worksheet

A worksheet for preparing a spider diagram is provided on the “Spider\_Diagram,” as shown in Figure 69. Note the diagram is not created automatically and is not updated if changes are made to inputs.

To create the diagram, use the sensitivity factors on the “WhatIf” tab. Select parameters to vary, such as Sales Price, Capital Expenditures or Operating Expenses. Also, select a performance measure, such as NPV or Equity IRR. First, set all sensitivity factors to 100%. Then for each parameter, vary its sensitivity factor leaving all others at 100%. Enter the sensitivity factor and the resulting performance measure in the worksheet table.

In the example shown in Figure 69, sales price was varied by 80%, 90%, 100%, 110% and 120% of the expected value. Each sensitivity factor was entered one at a time and the corresponding NPV was recorded. In this example, the NPV ranged from negative \$2,296,946 to positive \$10,412,999 for these sensitivity factors. Capital Expenditure was used as the second parameter with sensitivity factors of 70% to 120% (remembering to set that for the sales price back to 100%). This corresponded to NPVs ranging from \$5,717,188 to \$3,489,963. Notice the NPVs for both parameters at 100% were equal. Also, notice how increasing capital expenditures gives a negative slope that is greater than the slope for sales price.

**Figure 69. Worksheet for Creating a Spider Diagram on the “Spider\_Diagram” Tab**



## Break-Even Analysis

Break-even analysis is similar to sensitivity analysis, except the analysis question is framed a bit differently. In sensitivity analysis, the question is framed as “How much will a change in one variable affect project performance?” In break-even analysis, the question is framed as “How much can a parameter, such as sales or revenue, decrease below forecasts before the project begins to lose money?” At the break-even point, total revenue received equals the total costs associated with the sales. This is equivalent to a zero gross margin. In *RELCOST*, break-even analysis can be performed by varying the sensitivity factors of risky variables until the gross margin in the year in question equals zero.

## 10. Online Resources

Online References on Financial Terms:

- Investopedia: [www.investopedia.com/terms/d/debtratio.asp](http://www.investopedia.com/terms/d/debtratio.asp)
- Business Dictionary: [www.businessdictionary.com](http://www.businessdictionary.com)
- Financial Dictionary: [www.financialdict.org/](http://www.financialdict.org/)

DSIRE Database of U.S. renewable energy and energy efficiency financial incentives  
[www.dsireusa.org/](http://www.dsireusa.org/)

U.S. Internal Revenue Service, Publication 946, “How to Depreciate Property”  
[www.irs.ustreas.gov/pub/irs-pdf/p946.pdf](http://www.irs.ustreas.gov/pub/irs-pdf/p946.pdf)

U.S. Department of Energy, Energy Efficiency and Renewable Energy Office, “Project Financial Evaluation” [www.eere.energy.gov/ba/pba/pdfs/financial.pdf](http://www.eere.energy.gov/ba/pba/pdfs/financial.pdf)

U.S. Federal Reserve Board, “The Discount Rate”  
[www.federalreserve.gov/monetarypolicy/discountrate.htm](http://www.federalreserve.gov/monetarypolicy/discountrate.htm)

Shrestha, Ram M. “Financial Analysis of Renewable Energy Projects,” Lecture 7 of an online course on Bio-Energy for Achieving the United Nation’s Millennium Development Goals, Asian Institute of Technology, School of Environment, Resources and Development, Thailand, June 2007  
[www.energyforumasia.org/e-learning/materials/20070041-Shrestha-07-1in1.pdf](http://www.energyforumasia.org/e-learning/materials/20070041-Shrestha-07-1in1.pdf)

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Basic Books, *The Ultimate Small Business Guide: A Resource for Startups and Growing Business*, Perseus Books Group, 2004

California Energy Commission, *Comparative Costs of California Central Station Electricity Generation*, August 2009, [www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF](http://www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SD.PDF)

Groppelli, A.A., and Ehsan Nikbackht, *Finance*, 5<sup>th</sup> edition, Barron's Educational Series, 2006

Intermediate Technology Development Group, *Financial Guidelines for Micro – Hydro Projects*, Nepal, 1997.

KEMA, Inc., “Building and Community Scale Renewable Technology Costs,” Oakland, CA, August 2009, [www.energy.ca.gov/2009\\_energypolicy/documents/2009-08-25\\_workshop/presentations/index.php](http://www.energy.ca.gov/2009_energypolicy/documents/2009-08-25_workshop/presentations/index.php)

Khatib, Hisham, *Economic Evaluation of Projects in the Electricity Supply Industry*, IEE Power and Energy Series 44, London, 2002

Lang, Hans J., and Donald N. Merino, *The Selection Process for Capital Projects*, New York: J. Wiley & Sons, 1993, ISBN 978-0-471-63425-6

Park, Chan S., *Contemporary Engineering Economics*, 4th edition, Prentice-Hall, N.J., 2007

United Nations Development Programme, United Nations Department of Economic and Social Affairs, World Energy Council, *World Energy Assessment: Energy and the Challenge of Sustainability*, 2000, [www.energyandenvironment.undp.org/undp/index.cfm?module=Library&page=Document&DocumentID=5037](http://www.energyandenvironment.undp.org/undp/index.cfm?module=Library&page=Document&DocumentID=5037)

## 12. Glossary

**Accounts Payable:** Unpaid bills. Accounts that are owed to suppliers (trade creditors) as distinguished from accrued interest, rent, salaries, taxes, and other such accounts. Accounts payable are shown under current (short-term) liabilities in the balance sheet. Lenders and investors examine the relationship of these accounts to the firm's purchases in order to judge the soundness of its day to day financial management.  
([www.businessdictionary.com](http://www.businessdictionary.com))

**Accounts Payable Float:** The fraction of the accounts payable not paid in the current year expected to be paid in the following year.

**Accounts Receivable:** Sales made but not paid-for by customers (trade debtors). Accounts receivables are shown as current (short-term) assets in a balance sheet and are, in fact, unsecured promises by customers to pay in the future.  
([www.businessdictionary.com](http://www.businessdictionary.com))

These sums are a key factor in determining a firm's liquidity and may be discounted. A provision is usually made in the accounts of a firm to offset uncollectible accounts receivable (bad debts) as losses.

**Accounts Receivable Float:** The fraction of the accounts receivable not received in the current year expected to be received in the following year.

**Acid Test Ratio:** This ratio is similar to the current ratio except it does not include inventory and prepaids as assets that can be liquidated. The components of current ratio (current assets and current liabilities) can be used to derive working capital (difference between current assets and current liabilities). Working capital is frequently used to derive the working capital ratio, which is working capital as a ratio of sales.  
<http://www.investopedia.com>

A value of "N/A" can be displayed if there are no current Liabilities (see the Glossary entry on "Balance Sheet").

**After-Tax Margin:** Calculated by dividing the Net Profit After Taxes by revenues (see the Glossary entry on "Income Statement").  
<http://www.investopedia.com>

After-Tax Profit Margin is a measurement of what proportion of a company's revenue is left over after paying taxes. A positive value indicates a Net profit that can be used to pay dividends and/or for Retained Earnings. A negative value indicates that the company has not made a profit and will not be subject to income taxes.

**Annual Equivalent Worth:** The product of the net present worth and the capital recovery factor.

## Section 12. Glossary

**Availability (Capacity) Factor:** Availability indicates how much of the time a plant is available to generate power during the times when it can be sold. Resource degradation can be factored into availability. (See also “Dispatch Factor)

**Balance Sheet:** Condensed statement that shows the financial position of an entity on a specified date (usually the last day of an accounting period). Among other items of information, it states (1) what assets the entity owns, (2) how it paid for them, (3) what it owes (its liabilities), and (4) what is the amount left after satisfying the liabilities. Balance sheet data is based on a fundamental accounting equation (assets = liabilities + owners' equity), and is classified under sub-headings such as current assets, fixed assets, current liabilities, Long-term Liabilities. With income statement and cash flow statement, it comprises the set of documents indispensable in running a business. An audited balance sheet is often demanded by investors, lenders, suppliers, and taxation authorities; and is required by law under the corporate legislation (such as the Companies Act). To be considered valid, a balance sheet must give a 'true and fair view' of the entity's state of affairs, and must follow the provisions of GAAP in its preparation. Called also statement of condition, statement of financial condition, or statement of financial position. ([www.businessdictionary.com](http://www.businessdictionary.com))

**Benefit-Cost Ratio:** Ratio of the total present value of benefits during the service life of the project to the total present value of the costs at the minimum attractive rate of return.

**Capital Costs:** The capital cost includes the total costs of construction. Capital costs often include land purchase, land development, permitting, interconnection, environmental control equipment and component costs.

**Carryforward:** See Loss Carryforward.

**Cash Flow Ratios:** A variety of ratios of cash flow from operations to liabilities, revenues, debts and assets are used in evaluating financial viability. Which are used depends upon a project's critical needs of cash. For example, if cash is critical to servicing debt, then the Debt Service Coverage Ratio, which is the amount of cash flow available to meet annual interest and principal payments on debt, is important. A Debt Service Coverage Ratio indicates that a project has plenty of cash flow to settle obligations. A low ratio could be an indication of financial distress in the future.

Other variations of cash flow ratios include the cash flow margin, which is the ratio of cash flow from operations to revenue, and the cash flow return on investment, which is the ratio of cash flow to average total assets. A high cash flow margin or cash flow return on assets indicates that a project generates large amounts of cash flow relative to revenues or assets.

[http://www.exinfm.com/board/cash\\_flow\\_ratios.htm](http://www.exinfm.com/board/cash_flow_ratios.htm)

<http://www.journalofaccountancy.com/Issues/1998/Oct/mills.htm>

<http://financial-education.com/2007/01/30/cash-flow-ratios/>

## Section 12. Glossary

**Contingency Factor:** An amount added to a cost estimate to account for unexpected changes.

**Cost of Capital:** The expected return that the provider of capital expects to earn on their investment. (See also "Hurdle Rate")

**Current Account:** Two accounts handled in *RELCOST*: the current account and the operating reserve account. The current account is comparable to a checking account and the operating reserve account to a savings account. An account which allows the accountholder to write checks against the funds in the account.

**Current Ratio:** Also known as "liquidity ratio", "cash asset ratio" and "cash ratio". Calculated by dividing Current Assets by Current Liabilities.  
<http://www.investopedia.com>

The ratio is mainly used to give an idea of the ability to pay back its short-term liabilities (debt and payables) with its short-term assets (cash, inventory, receivables). The higher the current ratio, the more capable the project is of paying its obligations. A ratio under 1 suggests that the project would be unable to pay off its obligations if they came due at that point. While this shows the project is not in good financial health, it does not necessarily mean that it will go bankrupt - as there are many ways to access financing - but it is definitely not a good sign.

A value of "N/A" can be displayed if there are no current Liabilities (see Balance Sheet).

**Curtailment:** Load curtailment (or demand response) programs offered by utilities provide commercial and industrial building owners with reduced electrical rates in exchange for an agreement to curtail energy use at the request of the utility. Typically, these requests come during periods of high load such as hot summer afternoons. Building owners or managers who have the ability to reduce loads by turning off equipment or using alternative sources of energy can realize significant savings under these programs.

**Debt Asset Ratio:** Equals Total Assets divided by Total Liabilities. Indicates what proportion of the company's assets is being financed through debt.  
<http://www.investopedia.com>

This ratio is very similar to the debt-equity ratio. A ratio under 1 means a majority of assets are financed through equity, above 1 means they are financed more by debt. Furthermore you can interpret a high ratio as a "highly debt leveraged firm".

**Debt Service Coverage Ratio:** The amount of cash flow available to meet annual interest and principal payments on debt, including sinking fund payments.  
<http://www.investopedia.com>



## Section 12. Glossary

A ratio less than 1 would mean a negative cash flow. A ratio of less than 1, say .95, would mean that there is only enough net operating income to cover 95% of annual debt payments.

A value of "N/A" will be displayed if the "Total P&I + Loan Fees" value from the Funding Schedule sheet is equal to zero (indicating no debt service).

**Debt to Equity Ratio:** A measure of a company's financial leverage calculated by dividing its total liabilities by stockholders' equity. It indicates what proportion of equity and debt the company is using to finance its assets. Note: sometimes only interest-bearing, long-term debt is used instead of total liabilities in the calculation.

<http://www.investopedia.com>

A high debt/equity ratio generally means that a company has been aggressive in financing its growth with debt. This can result in volatile earnings as a result of the additional interest expense.

If a lot of debt is used to finance increased operations (high debt to equity), the company could potentially generate more earnings than it would have without this outside financing. If this were to increase earnings by a greater amount than the debt cost (interest), then the shareholders benefit as more earnings are being spread among the same amount of shareholders. However, the cost of this debt financing may outweigh the return that the company generates on the debt through investment and business activities and become too much for the company to handle. This can lead to bankruptcy, which would leave shareholders with nothing.

The debt/equity ratio also depends on the industry in which the company operates. For example, capital-intensive industries such as auto manufacturing tend to have a debt/equity ratio above 2, while personal computer companies have a debt/equity of under 0.5.

A negative value can occur when Shareholder Funds (see Balance Sheet) are not positive indicating that equity has been used to offset negative Net Profits After Tax (see Income Statement).

**Demand Ratchet:** In utility billing, demand ratchet is a means of applying a minimum billing to a customer who may have inconsistent or seasonal energy requirements. When a facility has seasonal energy use, the utility may have to maintain extra staff or equipment year round to make that energy available when the facility needs it. To account for this cost, a minimum monthly billing is calculated based on a given percentage of their peak use, for example 60% of their January billing. The facility is then billed at least this much for every month of the year, even if they use little or no energy during that month. This ensures that the utility is properly compensated for the year-round expenses it incurs to serve this customer.

[www.energyvortex.com/energydictionary/demand\\_ratchet.html](http://www.energyvortex.com/energydictionary/demand_ratchet.html)

## Section 12. Glossary

**Depreciation:** Gradual conversion of the cost of a tangible capital asset or fixed asset (excluding land because it has unlimited life) into an operational expense (called depreciation expense) over the asset's estimated useful life.

([www.businessdictionary.com](http://www.businessdictionary.com))

**Discount Rate:** Multiplier that converts anticipated returns from an investment project to their current market value (present value). It is always less than 1, and depends on the cost of capital (current compound interest rate) and the time interval between the investment date and the date when returns start to flow. ([www.businessdictionary.com](http://www.businessdictionary.com))

**Discounted Cash Flow Indicators:** (Calculated using the Discount Rate input on the General Tab)

**Discounted Cash Flows (DCF):** Value of the anticipated revenue stream from an investment as of today or on any given date. Because money can grow by itself (when placed in an interest earning account), a dollar received today is less valuable than a dollar received in the future. This quality (the "time value of money") makes choosing among investment opportunities a convoluted process. Therefore, DCF techniques are applied to "bring-back" or discount the anticipated returns to a common ground—their present value. Two basic DCF methods are the net present value (NPV) method and the internal rate of return (IRR) method, both of which take into account the time-value of money, and are similar to the methods used in computing interest-income on bank deposits. ([www.businessdictionary.com](http://www.businessdictionary.com))

**Dispatch Factor:** The dispatch factor indicates how much of the power that can be generated occurs at times when there is a market for it. See also Availability (Capacity) Factor.

**Effective Interest Cost (%):** An investment's annual rate of interest when compounding occurs more often than once a year.

[www.investopedia.com](http://www.investopedia.com)

Consider a stated annual rate of 10%. Compounded yearly, this rate will turn \$1000 into \$1100. However, if compounding occurs monthly, \$1000 would grow to \$1104.70 by the end of the year, rendering an effective annual interest rate of 10.47%. Basically the effective annual rate is the annual rate of interest that accounts for the effect of compounding.

A value of "N/A" is presented when all Notes Payable have been satisfied.

**Equity Ratio:** A ratio that indicates what proportion of debt a company has relative to its assets. The measure is an indicator of the level of leverage of the company along with the potential risks the company faces in terms of its debt-load.

<http://www.investopedia.com> and <http://www.money-zine.com/Definitions/Investing-Dictionary/>

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A debt ratio of greater than 1 indicates that a company has more debt than assets; meanwhile, a debt ratio of less than 1 indicates that a company has more assets than debt. Used in conjunction with other measures of financial health, the debt ratio can help investors determine a company's level of risk. A low equity ratio will produce good results for stakeholders as long as the company earns a rate of [return on assets](#) that is greater than the interest rate paid to creditors.

A value of zero indicates that all Long Term Notes Payable (see Balance Sheet) have been satisfied (e.g., loans have been paid off).

**Escalation Rate:** Percentage at which an annual change in the price levels of the goods and services occurs or is expected to occur. (<http://www.businessdictionary.com>)

**Fixed Cost:** Fixed costs are those that are not dependent on the level of activity. Fixed costs tend to be time-related, such as salaries, rents, insurance, and property taxes, which are typically paid monthly. For comparison, variable costs are expenses that change in proportion to the project's activity; i.e., the plant operating factor.

**Franchise:** (1) Privilege granted to make or market a good or service under a patented process or trademarked name. (2) Business operating under such privilege. ([www.businessdictionary.com](http://www.businessdictionary.com))

**Gross Income:** Amount by which sales revenue exceeds production costs (cost of sales). Though operating income (gross income less depreciation and taxes) gives a more accurate picture of a firm's profitability, gross income provides a top-line view of a firm's production or (in case of a trading firm) sales related cost structure. It is a measure of how well (or badly) a firm is utilizing its capital, capacity, and other resources, and shows its competitive strengths and weaknesses in comparison with other firms in the same industry. A high gross income means stability in times of economic downturn because the firm can afford to cut prices; a low gross income may mean low creditworthiness or inability to fight off competition. A falling gross income shows cost of production is rising faster than the selling price, or that inventory is shrinking due to stealing or spoilage. It is allocated to employees as wages, to lenders as interest, to investors as dividends, to government as taxes, and to the firm as reinvestment. When expressed as a percentage of cost of sales, it is called gross margin. Called also gross profit or value added. ([www.businessdictionary.com](http://www.businessdictionary.com))

**Gross Margin:** Calculated by dividing the Cost of Sales by the Income, Sales (see Income Statement). [www.investopedia.com](http://www.investopedia.com)

A company's cost of sales, or cost of goods sold, represents the expense related to labor, raw materials and manufacturing overhead involved in its production process. This expense is deducted from the company's net sales/revenue, which results in a company's first level of profit, or gross profit. The gross profit margin is used to analyze how

## Section 12. Glossary

efficiently a company is using its raw materials, labor and manufacturing-related fixed assets to generate profits. A higher margin percentage is a favorable profit indicator.

Industry characteristics of raw material costs, particularly as these relate to the stability or lack thereof, have a major effect on a company's gross margin. Generally, management cannot exercise complete control over such costs. Companies without a production process (e.g., retailers and service businesses) don't have a cost of sales exactly. In these instances, the expense is recorded as a "cost of merchandise" and a "cost of services", respectively. With this type of company, the gross profit margin does not carry the same weight as a producer-type company.

**Hurdle Rate:** The hurdle rate is the rate of return that must be met for a company to undertake a particular project. The hurdle rate is usually determined by evaluating existing opportunities in operations expansion, rate of return for investments, and other factors deemed relevant by management. A risk premium can also be attached to the hurdle rate if management feels that specific opportunities inherently contain more risk than others that could be pursued with the same resources. Most companies use a 12% hurdle rate, which is based on the fact that the S&P 500 typically yields returns somewhere between 8% and 11% (annualized). Companies operating in industries with more volatile markets might use a slightly higher rate in order to offset risk and attract investors. "Hurdle rate" is frequently used synonymously with "cutoff rate", "benchmark" and "cost of capital".

[http://en.wikipedia.org/wiki/Hurdle\\_rate](http://en.wikipedia.org/wiki/Hurdle_rate)

**Income Statement:** The income statement, also called a profit and loss statement, reports flows of revenues and expenses incurred to produce and finance operations. An income statement for a particular year shows whether a business made a profit. The income statement is not based on when cash is actually received or spent, but when the obligation to pay is incurred or a contract is settled.

**Inflation:** The overall general upward price movement of goods and services in an economy, usually as measured by the Consumer Price Index and the Producer Price Index. ([www.businessdictionary.com](http://www.businessdictionary.com))

**Instant Cost:** Initial capital expenditures are also referred to as "instant costs" or "overnight costs".

**Interest Coverage Ratio:** A ratio used to determine how easily a company can pay interest on outstanding debt. The interest coverage ratio is calculated by dividing a company's earnings before interest and taxes (EBIT) of one period by the company's interest expenses of the same period:

[www.investopedia.com](http://www.investopedia.com)

The lower the ratio, the more the company is burdened by debt expense. When a company's interest coverage ratio is 1.5 or lower, its ability to meet interest expenses may

be questionable. An interest coverage ratio below 1 indicates the company is not generating sufficient revenues to satisfy interest expenses.

**Internal Rate of Return:** The discount rate at which the after-tax net present value of a project is zero. The calculated IRR is examined to determine if it exceeds a minimally acceptable return, often called the hurdle rate. The advantage of IRR is that, unlike NPV, its percentage results allow projects of vastly different sizes to be easily compared.

<http://www1.eere.energy.gov/ba/pba/pdfs/financial.pdf>

Only those projects with an IRR greater than the internal cost of capital or hurdle rate should be pursued. Whenever the net present value of a project is a linearly declining function of the discount rate, this IRR rule is equivalent to accepting project investments with positive net present value.

<http://www.energysolutionscenter.org/DistGen/AppGuide/DGuideFrameSet.htm>

**Levelized Selling Price:** Present value of revenues divided by total power sold. Present values are calculated using the Discount Rate input on the General tab.

<http://www.investopedia.com>

**Levelized Values:** Expenses and revenues in real dollars; i.e., adjusted to remove the impact of inflation.

**Leverage Ratios** (e.g. debt to equity, debt, equity, debt asset, interest coverage):

A leverage ratio is any ratio used to calculate the financial leverage of a company to get an idea of the company's methods of financing or to measure its ability to meet financial obligations. There are several different ratios, but the main factors looked at include debt, equity, assets and interest expenses.

The most well known financial leverage ratio is the debt-to-equity ratio. For example, if a company has \$10M in debt and \$20M in equity, it has a debt-to-equity ratio of 0.5 (\$10M/\$20M).

Another example is the operating ratio, which is used to measure a company's mix of fixed and variable operating costs. This ratio gives an idea of how changes in output will affect operating income. Companies with high fixed costs, after reaching the breakeven point, see a greater increase in operating revenue when output is increased compared to companies with high variable costs. The reason for this is that the costs have already been incurred, so every sale after the breakeven transfers to the operating income. On the other hand, a high variable cost company sees little increase in operating income with additional output, because costs continue to be imputed into the outputs.

<http://www.investopedia.com>

**Life:** Project life is used in the life cycle cost analysis to calculate the net present value. The class life is the life used in calculating depreciation. Book life is the period over which shareholders expect to recover their initial investment.

**Liquidity:** A measure of how quickly a company's assets can be converted to cash. Liquidity ratios can give investors an idea of how capable a company will be at raising cash to purchase additional assets or to repay creditors quickly, either in an emergency situation, or in the course of normal business.

<http://www.investopedia.com>

**Loss Carryforward:** An accounting technique that applies the current year's net operating losses to future years' profits in order to reduce tax liability. Generally accepted accounting principles (GAAP) specify that loss carryforwards can be used in any one of the seven years following the loss.

<http://www.investopedia.com>

**Margin:** Difference between the cost price and selling price of a product.

(<http://www.businessdictionary.com>)

**Minimum Acceptable Rate of Return (MARR):** The minimum return on a project a manager is willing to accept before starting a project, given its risk and the opportunity cost of foregoing other project.

[http://en.wikipedia.org/wiki/Minimum\\_acceptable\\_rate\\_of\\_return](http://en.wikipedia.org/wiki/Minimum_acceptable_rate_of_return)

The MARR is often decomposed into the sum of the following components (range of typical values shown):

- Traditional inflation-free rate of interest for risk-free loans: 3-5%
- Expected rate of inflation: 5%
- The anticipated change in the rate of inflation, if any, over the life of the investment: usually taken at 0%
- The risk of defaulting on a loan: 0-5%
- The risk profile of a particular venture: 0-50% and higher

**Net Present Value (NPV) or Worth:** The sum of all years' discounted after-tax cash flows. Projects whose returns show positive NPVs are attractive.

<http://www.energyforumasia.org/e-learning/materials/20070041-Shrestha-07-1in1.pdf>

**Net Profit:** Total revenue in an accounting period less all expenses during the same period. If income taxes are not deducted, it is called operating profit (or loss, as the case may be). Also called earnings, net earnings, or net income.

(<http://www.businessdictionary.com>)

**Operating Cost:** Cost per unit of a product or service or the annual cost incurred on a continuous process. Operating costs do not include capital outlays or the costs incurred in design and implementation phases of a new process.

(<http://www.businessdictionary.com>)

**Operating Reserve Account:** Two accounts handled in *RELCOST*: the current account and the operating reserve account. The current account is comparable to a checking account and the operating reserve account to a savings account.

**Operating Income:** Income resulting from a firm's primary business operations, excluding extraordinary income and expenses. Also called earnings before interest and taxes (EBIT), it gives a more accurate picture of a firm's profitability than gross income. Also called operating margin. Formula: Sales revenue - (Cost of sales + Operating expenses). (<http://www.businessdictionary.com>)

**Operating Margin:** A ratio used to measure a company's pricing strategy and operating efficiency, calculated by dividing the Operating Income (EBIT) by the Sales, Income (see Income Statement). Also known as "operating profit margin" or "net profit margin". <http://www.investopedia.com>

Operating margin is a measurement of what proportion of a company's revenue is left over after paying for variable costs of production such as wages, raw materials, etc. A healthy operating margin is required for a company to be able to pay for its fixed costs, such as interest on debt.

Operating margin gives analysts an idea of how much a company makes (before interest and taxes) on each dollar of sales. When looking at operating margin to determine the quality of a company, it is best to look at the change in operating margin over time and to compare the company's yearly or quarterly figures to those of its competitors. If a company's margin is increasing, it is earning more per dollar of sales. The higher the margin, the better.

For example, if a company has an operating margin of 12%, this means that it makes \$0.12 (before interest and taxes) for every dollar of sales. Often, nonrecurring cash flows, such as cash paid out in a lawsuit settlement, are excluded from the operating margin calculation because they don't represent a company's true operating performance.

**Operating Reserve Account:** Funds set aside for operating expenses.

**Plant Operating Factor:** The product of the dispatch factor and plant availability.

**Pre-Tax Margin:** Calculated by dividing the Net Profit Before Taxes by the Sales, Income (see Income Statement). <http://www.investopedia.com>

Pre-Tax Profit Margin is a measurement of what proportion of a company's revenue is left over before paying taxes. A negative value indicates that the company has not made a profit and will not be subject to income taxes.

**Profit Factor:** Cost of goods sold, cost of sales, price, or any other such factor that affects the amount of profit realized from a product. (<http://www.businessdictionary.com>)

**Profitability Ratios** (gross margin, operating margin, pre-tax margin, after-tax margin, benefit cost ratio): Profitability is a key piece of information that should be analyzed



## Section 12. Glossary

when you're considering investing in a company. This is because high revenues alone don't necessarily translate into dividends for investors (or increased stock prices, for that matter) unless a company is able to clear all of its expenses and costs.

<http://www.investopedia.com>

Profitability ratios are used to give us an idea of how likely it is that a company will turn a profit, as well as how that profit relates to other important information about the company.

**Retained Earnings:** Profits generated by a firm that are not distributed to stockholders (shareholders) as dividends but are either reinvested in the business or kept as a reserve for specific objectives (such as to pay off a debt or purchase a capital asset). Balance sheet figure shown under the heading retained earnings is the sum of all profits retained since the firm's inception. Retained earnings are reduced by losses, and are also called accumulated earnings, accumulated profit, accumulated income, accumulated surplus, earned surplus, Undistributed Earning, or undivided profits. See also retention ratio.

(<http://www.businessdictionary.com>)

**Royalty:** Compensation, consideration, or fee paid for a license or privilege to use an intellectual property (brand, copyright, patent, process) or a natural resource (fishing, hunting, mining), computed usually as a percentage of revenue or profit realized from the use. (<http://www.businessdictionary.com>)

**Tax Loss Carryforward:** See “Loss Carryforward”

**Variable Costs:** See “Fixed Cost”