

The What If Game

Sensitivity Analysis of a Wind Power Project

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Community Wind



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What is a Pro Forma Model?

- A financial statement of forecasted cash flows prepared with a set of assumptions.
- Use it to determine
 - Cash Flows
 - Net Present Value (NPV)
 - Internal Rate of Return (IRR)



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What is Sensitivity Analysis?

- Systematically changing one pro forma model assumption (at a time) to see how that change affects the forecasted results.
- The process allows the user to determine which variables are critical and which are secondary.
- Excel can do it for you!



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NYT article: "Move Over, Oil, There's Money in Texas Wind," by Clifford Frauss, 23-Feb-08

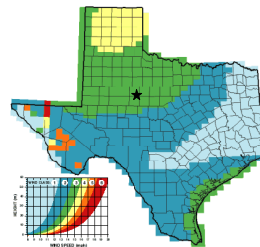


Brian Harkin for The New York Times

Louis Brooks is paid \$500 a month for each turbine he permits on his property.

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Base Case Pro Forma Assumptions



Location	West Texas
Project Size	5 x GE 1.5sl
Net Capacity Factor	30.1%
Wind Class	3
PPA Rate	\$0.035 / kWhr
REC Rate	\$0.00425 / kWhr
O&M Cost	\$60k / turbine / yr
Ongoing Project Costs	\$36k / turbine / yr
Capital Investment	\$2,000 / kW
Tax Rate	35% Fed / 0% State
Federal PTC Value	\$0.02 / kWhr
Depreciation	MACRS 5-year
Equity / Debt	100% / 0%
Escalation Rate	2.85%
Discount Rate	6.5%

http://www.seco.cpa.state.tx.us/Maps/re_maps-wind-tx.htm

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Base Case

- Additional Assumptions
 - Individual owner with project on private land (no lease payments)
 - Texas has no state-level incentives
- Results:

Net Present Value (NPV)	Internal Rate of Return (IRR)
(12,384,801)	-8.2%

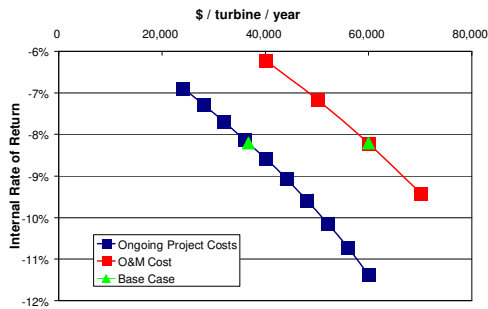
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Sensitivity Analysis Scenarios

- Expenses
 - Change Operations & Maintenance (O&M) Costs
 - Change Ongoing Project Costs
 - Change Capital Investment
- Revenue
 - Change Power Purchase Agreement (PPA) Rate
 - Change Renewable Energy Credit (REC) Rate

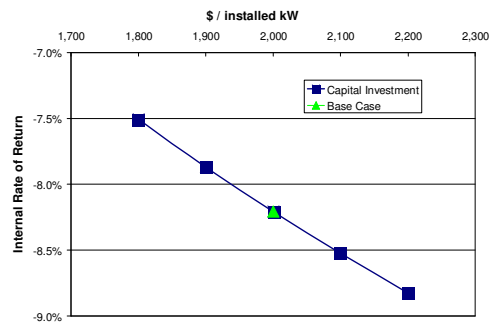
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Ongoing Project Costs and O&M Costs



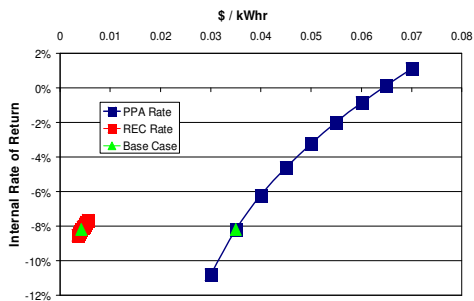
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Capital Investment



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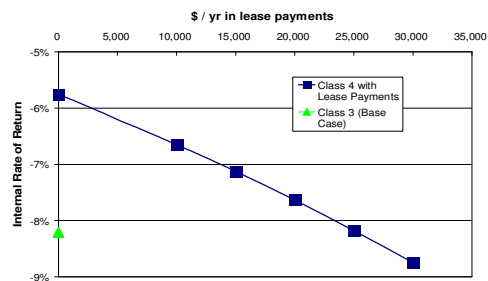
PPA Rate and REC Rate



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Change Location Assumption

Move to a Class 4 wind site. Add lease payments.
New Capacity Factor = 35%



Change Ownership Assumption

Find Outside Investor to utilize the PTC and MACRS Depreciation

	Net Present Value (NPV)	Internal Rate of Return (IRR)
Now	(4,769,198)	-0.2%
Base Case	(12,384,801)	-8.2%

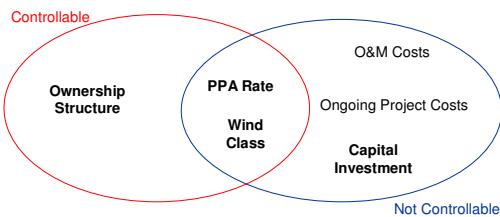
What If We...

- Move to a Class 4 site
- Add PTC & MACRS Depreciation
- Increase PPA Rate to \$0.055/kWhr

	Net Present Value (NPV)	Internal Rate of Return (IRR)
Now	993,583	7.6%
Base Case	(12,384,801)	-8.2%

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Can you Control the Important Variables?



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Thank You

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Details and Sources for Assumptions

PPA Rate	DOE Annual Report on U.S. Wind Power Installation, Cost, and Performance Trends: 2006: http://www.nrel.gov/docs/fy07osti/41435.pdf ERCOT 2006 State of the Market Report: http://www.puc.state.tx.us/wmo/documents/annual_reports/2006annualreport.pdf
REC Rate	Evolution Markets, Q3-Q4 2007 Data: http://new.evomarkets.com/index.php?page=Renewable_Energy
O&M Expense	\$40k-\$70k / turbine / yr for a 1-2 MW turbine: Wind Energy 201 Class, a 2007 AWEA Pre-Conference Seminar

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Details and Sources for Assumptions

Ongoing Project Costs:	
Admin/Legal/Financial/PM Fees	\$6k - \$10k / turbine / yr: Windustry Community Wind Toolbox
Insurance	\$8 - \$15k / turbine / yr: Windustry Community Wind Toolbox
Property Tax	Property Tax Exemption for Value-Adding Projects in TX: http://www.dsireusa.org/library/includes/map2.cfm?CurrentPageID=1&State=TX&RE=1&EE=1
Lease Payments	\$500 / month / turbine, from NYT article: "Move Over, Oil, There's Money in Texas Wind," by Clifford Frauss, 23-Feb-08 (paid to Louis Brooks in Sweetwater). \$2.5k-\$3k/installed MW: Windustry Community Wind Toolbox
Warranty Expense	\$15k-\$30k / turbine / yr for 5 years: Windustry Community Wind Toolbox
Decomm./Repower Fund	\$25k / turbine: Windustry Community Wind Toolbox

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Details and Sources for Assumptions

Capital Investment / Overall Project Cost includes:	\$2 million / installed MW per conversation with fellow presenters
Feasibility Study/Wind Resource Assessment	
Project Design & Development	\$1.8 - \$1.9 million / installed MW
Turbine & Tower	2007 per Wind Energy 201
Interconnection	Class, a 2007 AWEA Pre-Conference Seminar
Commissioning	
Installation/Construction	

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Details and Sources for Assumptions

Federal Tax Rate	Average Effective Tax Rate
State Tax Rate	No Texas state income tax: http://www.taxadmin.org/FTA/rate/ind_inc.html
PTC Value	Energy Policy Act of 2005, IRS Form 8835
Depreciation	MACRS 5-year: IRS Publication 946, IRS Form 4562
Escalation Rate	2.85% = 2007 Average Inflation Rate: http://www.inflationdata.com/Inflation/Inflation_Rate/CurrentInflation.asp
Discount Rate	Current articles, conversations with industry experts.
Net Capacity Factor Calculations	GE 1.5sl turbine power curve from INL: http://www.inl.gov/wind/software/powercurves/pc_ge_wind.xls Power calculator from Danish Wind Industry Association: http://www.windpower.org/en/tour/wres/pow/index.htm

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Details and Sources for Assumptions

CREBs	http://www.crebs.org/ ; http://www.matneyfrantz.com/crebs/ ; Conversations with industry experts
USDA Section 9006 Grant	25% of cost, or \$500k max. http://www.rurdev.usda.gov/rbs/farbill/what_is.html . Open to farmers, ranchers, and rural small businesses.
USDA Rural Electrification Loan	http://usda.gov/rus/electric/loans.htm , http://www.usda.gov/rus/electric/rates.shtml

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Details and Sources for Assumptions

Free Online Pro Forma Models:	
National Renewable Energy Laboratory (NREL)	http://analysis.nrel.gov/windfinance/login.asp
RETScreen International	http://www.retscreen.net/ang/d_o_view.php
Windustry Community Wind Toolbox Calculator	http://www.windustry.org/your-wind-project/community-wind/community-wind-toolbox/chapter-3-project-planning-and-management/wi

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Sensitivity Analysis in Excel

Step 1: Make Data Table & Highlight It
First row must contain the formula(s) of the answer(s) for which you are solving. First column is for the changing variable.

CREB	NPV	IRR
0		
1,000,000		
2,000,000		
3,000,000		
4,000,000		
5,000,000		
6,000,000		
7,000,000		
8,000,000		
9,000,000		
10,000,000		
11,000,000		
12,000,000		
13,000,000		
14,000,000		

In this example, the variable is the amount of CREB funding.

Range of numbers you want to see the results for

IRR formula

NPV formula

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Sensitivity Analysis in Excel

Step 2: Go to Data pull down menu and Table function*

Microsoft Excel - Sensitivity Analysis Model 1_20_08

File Edit View Insert Format Tools Data Window Help

Base Case: Community Wind

Table

Inputs

Power Generation

Number of Turbines

Turbine Size

Project Size

Net Capacity Factor

Annual Hours

Total Annual Power Production

Taxes

Income Tax Rate

Federal PTC Value

Cost per kW

Total Cost

14,280,000 \$

Rates

Escalation Rate

Discount Rate

MACRS Depreciation

Can the project use MACRS? [no]

*In Excel Vista, go to Data menu, pick What If Analysis in the Data Tools category, and then pick the Data Table option.

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Sensitivity Analysis in Excel

Step 3: Enter cell reference from pro forma model of variable in first column to be changed

CREB	NPV	IRR
0	(11,634,801)	-7.87%
1,000,000		
2,000,000		
3,000,000		
4,000,000		
5,000,000		
6,000,000		
7,000,000		
8,000,000		
9,000,000		
10,000,000		
11,000,000		
12,000,000		
13,000,000		
14,000,000		

Table

Row input cell:

Column input cell:

OK Cancel

D25 is the cell where the CREB variable of this example is in the pro forma model (you can see it on the previous slide)

Use "Column input cell" because our changing variable is in the first column of our data table

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Sensitivity Analysis in Excel

Step 4: Excel will fill in the table

CREB	NPV	IRR
0	(11,634,801)	-7.87%
1,000,000	(11,245,287)	-8.44%
2,000,000	(10,855,772)	-9.09%
3,000,000	(10,466,257)	-9.83%
4,000,000	(10,076,742)	-10.67%
5,000,000	(9,687,228)	-11.63%
6,000,000	(9,297,713)	-12.71%
7,000,000	(8,908,198)	-13.91%
8,000,000	(8,518,683)	-15.22%
9,000,000	(8,129,169)	-16.60%
10,000,000	(7,739,654)	-18.03%
11,000,000	(7,350,139)	-19.45%
12,000,000	(6,960,624)	-20.85%
13,000,000	(6,571,110)	-22.18%
14,000,000	(6,181,595)	-23.45%

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