

Financial Analysis Model for Wind Projects

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Agenda

- Goals of the financial analysis model
- Input parameters
- Results
- Demonstration of the Excel model



Goals of the Financial Analysis Model

- Evaluate wind energy projects
- Compute Levelized Cost of Energy (LCOE)
- Compute financial metrics related to P50, P84, P90



Conventions in the Model

Label

User Input requested

Formula

Output of Model



Input Parameters

Item	Data
Name of the Project	Choir wind park
Name of the Developer	Aydiner Global LLC
Location of project (lat/long)	
Name of town/village	
Name of province	Choir
Size of land (Hectares)	
Number of turbines	24
Rated Capacity of turbines (MW)	2.1
Total Size of Wind farm (MW)	50.4

Item	Data
Hub height (m)	80
Rotor diameter (m)	80
Turbine manufacturer	Suzlon
Turbine model	Suzlon S88-2.1 MW
Plant capacity factor (gross)	33.06%
Plant losses	0%
Plant capacity factor (net)	33.06%
Average Annual Energy Production (MWh)	145,961



Input Parameters

REVENUE

Tariff (\$/kWh)	\$ 0.0950
Annual increase in tariff (%)	0%
Renewable Energy Credits + Carbon Credits (\$/kWh)	0
Annual increase in value of credits (%)	0%
Production tax credit (\$/kWh)	0
Duration of PTC (yrs)	0
Annual increase of PTC (%)	0%
Investment tax credit (%)	0%
Duration of ITC (yrs)	0

TOTAL CAPITAL COST

Total installed cost (\$/kW)	\$ 1,849
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TOTAL RECURRING COST

Total Operations & Maintenance cost (\$/kWh)	\$ 0.0090
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Annual increase in O&M cost	0%
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FINANCIAL PARAMETERS

Debt (%)	62.3%
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Interest rate (%)	7.50%
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Duration of loan (years)	13
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Equity (%)	37.7%
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Expected Equity rate of return (%)	12.50%
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Input Parameters

Discount rate of NPV	10%
Inflation	3%
Tax rate	10%
Method of depreciation	Straight line
Years of depreciation	20
Expected life of wind project	20
Modified IRR finance rate	8%
Modified IRR reinvest rate	4%

Details of Model

1	Project Name	Choir wind park				
2	Years -->	0	1	2	3	4
3	Total Installed Project Cost in '000	\$ 93,169.94				
4	CAPITAL EXPENDITURES					
5	Equity Investment (Project Cost Less Debt & Grants)	\$ 35,125.07				
6	REVENUES					
7	MWh/yr		128601	128601	128601	128601
8	PPA Rate (\$/kWh)	\$ 0.0950	0.095	0.095	0.095	0.095
9	Electricity Sales Revenue per PPA		\$ 12,217	\$ 12,217	\$ 12,217	\$ 12,217
10	Green Tag Rate (\$/kWh)		0	0	0	0
11	Green Tag Sales Revenue		\$ -	\$ -	\$ -	\$ -
12	Total Annual Revenues		\$ 12,217	\$ 12,217	\$ 12,217	\$ 12,217
13						
14	EXPENSES					
15	Operations & Maintenance		\$ 1,307	\$ 1,307	\$ 1,307	\$ 1,307
18	Total Annual Operating Expenses		\$ 1,307	\$ 1,307	\$ 1,307	\$ 1,307
19						
20	EBITDA & Taxable Income					
21	EBITDA (Operating Income)		\$ 10,910	\$ 10,910	\$ 10,910	\$ 10,910
22	Depreciation		\$ 4,658	\$ 4,658	\$ 4,658	\$ 4,658
23	Debt Interest Payment		\$ 4,353	\$ 4,144	\$ 3,919	\$ 3,677

Details of Model

	A	B	C	D	E	F
25	Total Annual Expenses		\$ 10,319	\$ 10,110	\$ 9,885	\$ 9,643
26	Taxable Income		\$ 1,898	\$ 2,108	\$ 2,332	\$ 2,574
27						
28	TAXES					
29	Local Owner Income Tax Benefit/(Liability)		\$ (189.83)	\$ (210.75)	\$ (233.24)	\$ (257.42)
30	Production Tax Credit		\$ -	\$ -	\$ -	\$ -
31	Investment Tax Credit (Lump Sum)		\$ -	\$ -	\$ -	\$ -
32	Total Tax Benefit/(Liability)		\$ (189.83)	\$ (210.75)	\$ (233.24)	\$ (257.42)
33	After-tax profit		\$ 1,708	\$ 1,897	\$ 2,099	\$ 2,317
34						
35	AFTER-TAX CASH FLOWS					
36	Add Back Depreciation		\$ 4,658	\$ 4,658	\$ 4,658	\$ 4,658
37	Less Debt Principal Payment		\$ 2,790	\$ 2,999	\$ 3,224	\$ 3,466
38	Net After-Tax Project Cash Flow	\$ (35,125.07)	\$ 3,577	\$ 3,556	\$ 3,534	\$ 3,509
39						
40	Local Owner Return	\$ (35,125.07)	\$ (31,548)	\$ (27,992)	\$ (24,458)	\$ (20,949)
41						
42	Accumulated Liquidity	\$ (93,170)	\$ (89,593)	\$ (86,037)	\$ (82,503)	\$ (78,994)
43						
44	FINANCIAL METRICS					
45	NPV (20 Years)		(\$3,062.83)			

Step 2 Wind farm

Step 3 Financial

Summary Results

Uncertainty Analysis

Detailed Yearly Proforma

Plant Capacity Factor



Results of the Model

Item	Output
Total average annual energy production (MWh)	145,961
Total average annual revenue	\$ 13,866
Total installed cost (in '000)	\$ 93,170
Total annual O&M cost (year 1)	\$ 1,307
Total annual principal + interest payment	\$ 7,143
Total annual depreciation (year 1)	\$ 4,658
Levelized cost of energy (20 years)	\$ 0.1196
Equity Internal rate of return (20 years)	15.20%
Equity Simple payback period (years)	8
Net Present Value (20 years)	\$15,021
Minimum Debt Service Coverage Ratio (DSCR)	1.655
Average DSCR	1.685

Demonstration

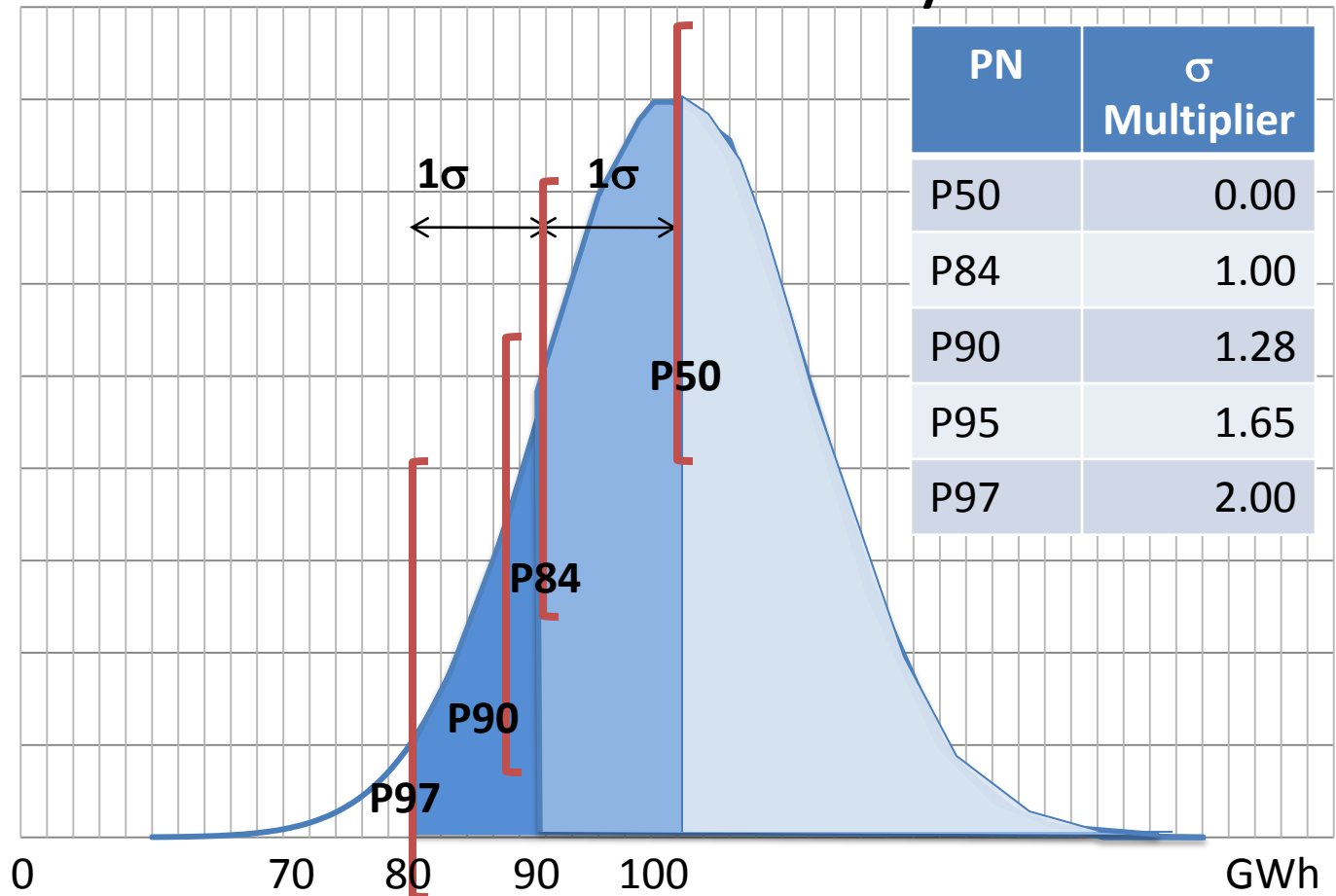
- IRR
- LCOE
- DSCR
- Payback period



Uncertainty Analysis for Wind Projects

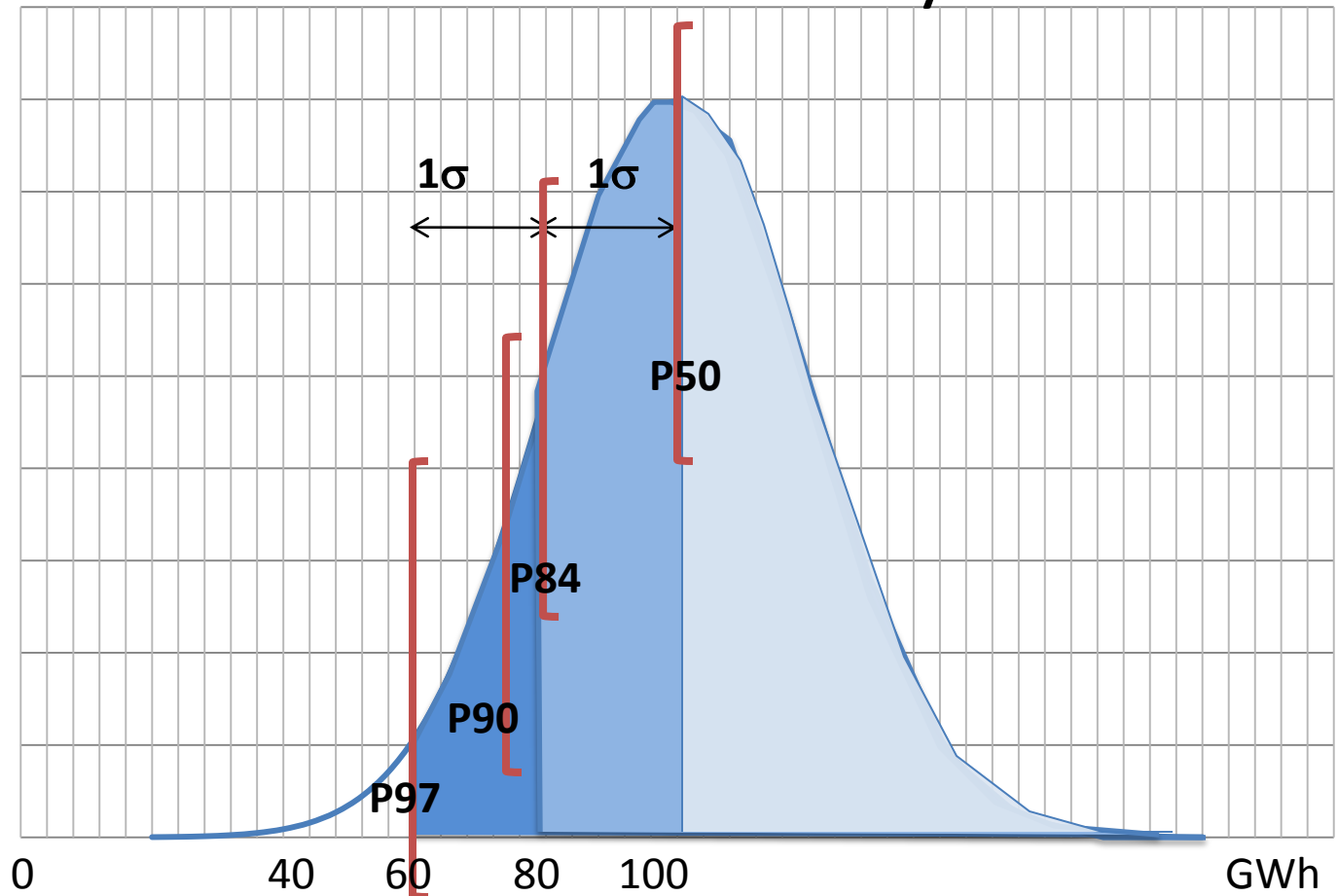
Component of Uncertainty	Sensitivity Factor	Amount of Uncertainty (%)	Net Uncertainty of AEP Because of Component (%)
Wind speed measurement	1.5	5	7.5
Wind speed spatial extrapolation	1.5	3	4.5
Wind speed long-term correction	1.5	3	4.5
Wind shear, height extrapolation	1.5	2	3
Air density	1	0.3	0.3
Power curve	1	0.6	0.6
Wake losses in wind farm	1	1.7	1.7
Unaccounted for Loss	1	1	1
Total uncertainty of AEP assuming components are uncorrelated is square root of sum of squares			10.5%

Illustration of P50, P84, P90 with 10% uncertainty



P84 is an Annual Energy Production number with the following property: There is a 84% likelihood (probability) that energy production will be at least 90GWh. 90% likelihood that AEP will be at least 87.2GWh. Assuming: Average AEP=100GWh, uncertainty is 10%

Illustration of P50, P84, P90 with 20% uncertainty

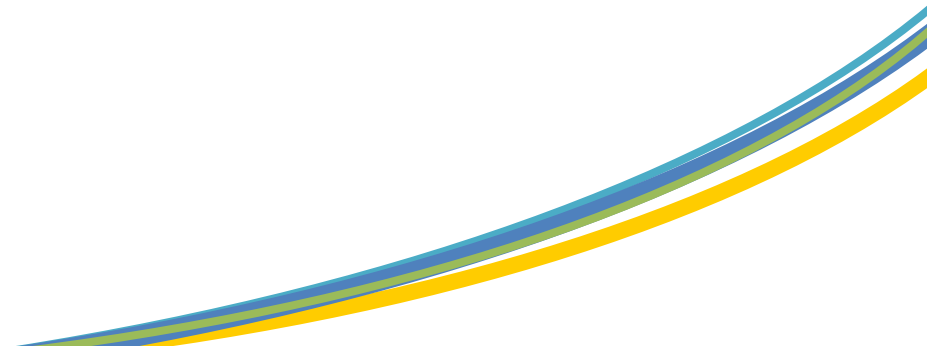


P84 is an Annual Energy Production number with the following property:
There is a 84% likelihood (probability) that energy production will be at least 80GWh. 90% likelihood that AEP will be at least 74.4GWh.
Assuming: Average AEP=100GWh, uncertainty is 20%

Uncertainty Analysis

Item	P50	P84	P90	P95
Total average annual energy production (MWh)	145,961	116,769	108,595	97,940
Total average annual revenue	\$ 13,866	\$ 11,093	\$ 10,317	\$ 9,304
Total annual depreciation (year 1)	\$ 4,658	\$ 4,658	\$ 4,658	\$ 4,658
Levelized cost of energy (20 years)	\$ 0.0802	\$ 0.1003	\$ 0.1078	\$ 0.1196
Equity Internal rate of return (20 years)	15.20%	8.51%	6.61%	4.11%
Equity Simple payback period (years)	8	14	15	17
Net Present Value (20 years)	\$15,021	(\$4,296)	(\$9,705)	(\$16,756)
Minimum Debt Service Coverage Ratio (DSCR)	1.655	1.305	1.207	1.080
Average DSCR	1.685	1.336	1.238	1.110

Demonstration of Uncertainty Model



Methodology for Cost Data

- Correct methodology:
 - Create a breakdown of costs
 - Accurately account for all costs (install and annual)
 - Compute the P50 Levelized Cost of Energy (LCOE) using realistic parameters like return expected by equity investors
 - Compute P84 and P90 LCOE
- Update cost data on regular basis
- Update other financial parameters
- Update annual costs

