"Financial Viability of A Wind Power Project in Madhya Pradesh"

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Abstract:-

Global warming is the biggest issue of the world. Earth's temperature increases continuously due to many factors like burning of coal, vehicle pollution and other types of pollution. Kyoto Protocol under the United Nation Framework Convention on the Climate Change main aims to fighting global warming and its main goal is stabilisation of green house gas concentration in atmosphere that would prevent dangerous anthropogenic interference with climate system. Under protocol 'Annex I Countries' commit to reduction of CO_2, Methane, Nitrous Oxide, Sulphur hexafluoride and other two gases Hydroflurocarbon & Perflurocarbon. Protocol have flexible mechanism in which CDM is important factor. Annex I Countries meet their GHG emission limitation by purchasing GHG emission reduction credits through financial exchanges projects reduce emission in Non-Annex I countries.

This research paper represents the according to the MPERC may 2010 report for Non-Conventional energy A wind power projects financially viable or not means CDM revenue how help them. For this purpose commission value taken and calculate the Project IRR. Value of sensitivity analysis without CDM revenue compare to the BPLR rate of Indian Bank.

Keywords:-

Investment Analysis, Benchmark, BPLR Rate

Introduction:-

Clean Development Mechanism (CDM) is a flexible mechanism which is defined in the article 12 of the Kyoto Protocol. In CDM additionality is important factor. "Investment Barrier" in additionality is the most relevant and big factor which is faced by the project participant. Mostly these barrier are due to high capital cost and impact on return.

The purpose of undertaking an investment analysis to determine whether or not the project activity would be financially viable without the incentive of CDM. For this purpose we are calculating the Project IRR (Internal Rate of Return). For calculating Project IRR maximum 20 years will be appropriate.

This research paper shows that according to Madhya Pradesh Electricity Regulatory Commission (MPERC) May 2010 report A wind power project is financially viable or not. For this purpose we are calculating Project IRR. We are taking any location based on the assumption that Dewas (M.P).

Methodology:-

Since the capacity of project activity is 1.5 MW which is less than maximum qualifying capacity of 15 MW for Small Scale Activity. So, it is Small Scale CDM project activity according to "Simplified modalities and procedures for small scale CDM project activity" the type and category are AMS I.D And all rules & procedures are applied on the basis of: - "AMS I.D, version 17, E.B 61"

For calculating project IRR we are using the guidelines according to the:-

1. "Guidelines on the assessment of Investment Analysis" version 05, EB 62, Annex 5."

2. "Guidelines on the demonstrated & assessment of prior consideration of CDM, version 04, Annex 13, EB 62"

For the baseline calculation using the:-

1. "Tool to calculate the emission factor an electricity system , EB 63, version 02.2.1, Annex 19"

2. "CO_2 baseline database for the Indian Power sector" User Guide version 7.0, January 2012".

Collection of Data:-

1. Establish one wind turbine generator and their capacity are 1.5 MW. So, total installed capacity is 1.5 MW.

2. According to MPERC project cost including power evacuation for 1 MW is 50.00 INR/Millions. So, for 1.5 MW project cost is 75.00 INR/Millions & total project cost is 75.00 INR/Millions.

3. Date of commissioning based on assumption that is 31 March 2012.

4. Commissions view Debt & Equity ratio are 70:30. So, based on these we are calculating 52.50 & 22.50 INR/Millions Debt & Equity respectively.

5. Interest rate are taken 12.00% according to commission view. Tenure & Moratorium are taken 10 & 1 years respectively based on assumption for term of loan.

6. Insurance charges are taken 0.10% based on assumption.

7. O & M charges are taken 1% of project cost based on commission view with 12.36% service charges i.e, based on assumption.

8. Tariff rate are applicable 4.35 INR/KWh according to commission view.

9. Income tax depreciation rate according to IT Act on project cost 80%.

10. Book depreciation rate by SLM Method on project assets 5.42% , Book depreciation up to (% of Asset value) is 100%, & Salvage value is 10% based on the assumption.

11. Income tax rate are 30.00%, Surcharge 10.0%, Cess 3.00%, Corporate tax with surcharge & cess 33.99%, Income exemption u/s 80IA of IT act for 10 consecutive years out of 15 years under the IT acts.

12. Plant load factor is 20.00% based on commission view.

13. CER (Certified Emission Reduction) price are taken 3.39 Euro taken from carbonpoint.

14. Exchange Rate Rs. /Euro 68.3403 based on Reserve Bank of India 06 April 2012 weekly reports.

15. Baseline Emission factor for northern grid 0.95280 tCO_2/MWh using the calculation of CEA database version, 07.

Analysis of Data:-

Since IRR is the financial indicator which is used by banks, financial institution and project developers for making investment decision . In this project activity post tax project IRR is selected. For calculation of IRR we are selecting the date from 31/03/2012 to 31/03/2032 for 20 year & following are calculated:-

TABLE 1:- Loan Schedule

Year Ending					
Quarter	Q-1	Q-2	Q-3	Q-4	Total
31-Mar-12				1.46	1.46
31-Mar-13	1.46	1.46	1.46	1.46	5.83
31-Mar-14	1.46	1.46	1.46	1.46	5.38

31-Mar-15	1.46	1.46	1.46	1.46	5.38
31-Mar-16	1.46	1.46	1.46	1.46	5.38
31-Mar-17	1.46	1.46	1.46	1.46	5.38
31-Mar-18	1.46	1.46	1.46	1.46	5.38
31-Mar-19	1.46	1.46	1.46	1.46	5.38
31-Mar-20	1.46	1.46	1.46	1.46	5.38
31-Mar-21	1.46	1.46	1.46	1.46	5.38
31-Mar-22	1.46	1.46	1.46		4.38

Closing Blance					
Quarter	Q-1	Q-2	Q-3	Q-4	Total
31-Mar-12				52.50	
31-Mar-13	52.50	52.50	52.50	52.50	
31-Mar-14	51.04	49.58	48.13	46.67	
31-Mar-15	45.21	43.75	42.29	40.83	
31-Mar-16	39.38	37.92	36.46	35.00	
31-Mar-17	33.54	32.08	30.63	29.17	
31-Mar-18	27.71	26.25	24.79	23.33	
31-Mar-19	21.88	20.42	18.96	17.50	
31-Mar-20	16.04	14.58	13.13	11.67	
31-Mar-21	10.21	8.75	7.29	5.83	
31-Mar-22	4.37	2.92	1.46	(0.00)	

Interest					
Quarter	Q-1	Q-2	Q-3	Q-4	Total
31-Mar-12				0.02	0.02
31-Mar-13	1.58	1.58	1.58	1.58	6.30
31-Mar-14	1.53	1.49	1.44	1.40	5.86
31-Mar-15	1.36	1.31	1.27	1.23	5.16
31-Mar-16	1.18	1.14	1.09	1.05	4.46
31-Mar-17	1.01	0.96	0.92	0.87	3.76
31-Mar-18	0.83	0.79	0.74	0.70	3.06
31-Mar-19	0.66	0.61	0.57	0.52	2.36
31-Mar-20	0.48	0.44	0.39	0.35	1.66
31-Mar-21	0.31	0.26	0.22	0.17	0.96
31-Mar-22	0.13	0.09	0.04	(0.00)	0.26

TABLE 2:- Operation & Maintenance Tariff

Year	1	2	3	4	5	6	7
O & M	-	0.84	0.89	0.94	1.00	1.05	1.11
0.96							
Year Ending	31/03/12	31/03/13	31/03/14	31/03/15	31/03/16	31/03/17	31/03/18
O & M Applicable	-	0.00	0.84	0.89	0.94	1.00	1.05

Year	8	9	10	11	12	13	14
O & M	1.18	1.24	1.32	1.39	1.47	1.55	1.64
Year Ending	31/03/19	31/03/20	31/03/21	31/03/22	31/03/23	31/03/24	31/03/25
O & M Applicable	1.11	1.18	1.24	1.32	1.39	1.47	1.55

Year	15	16	17	18	19	20	21
O & M	1.74	1.84	1.94	2.05	2.17	2.29	2.42
Year Ending	31/03/26	31/03/27	31/03/28	31/03/29	31/03/30	31/03/31	31/03/32
O & M Applicable	1.64	1.74	1.84	1.94	2.05	2.17	2.29

TABLE 3:- Profit & Loss Statement

(Values in INR/Mn)

All calculation are calculated on the Excel Sheet.

Year	1	2	3	4	5	6	7
Year Ending	31/03/12	31/03/13	31/03/14	31/03/15	31/03/16	31/03/17	31/03/18
Revenues							
Days of Operation	1	365	365	365	366	365	365
Hours of Operation	24	8760	8760	8760	8784	8760	8760
Generation (Millions of Units)	0.01	2.63	2.63	2.63	2.64	2.63	2.63
Revenues From Electricity Sales	0.03	11.43	11.43	11.43	11.46	11.43	11.43
CDM Revenues			-	-	-	-	-
Total Revenue	0.03	11.43	11.43	11.43	11.46	11.43	11.43
Expenses							
Interest on Debt	0.02	6.30	5.86	5.16	4.46	3.76	3.06
Inssurance Charges	0.00	0.08	0.08	0.08	0.08	0.08	0.08
O & M Charges	-	0.00	0.84	0.89	0.94	1.00	1.05
Book Depreciation	0.01	4.07	4.07	4.07	4.07	4.07	4.07
Total Expenses	0.03	10.44	10.85	10.19	9.54	8.90	8.26
PBT	0.00	0.99	0.59	1.24	1.92	2.53	3.18
Income tax Calculation							
PBT	0.00	0.99	0.59	1.24	1.92	2.53	3.18
Book Depreciation	0.01	4.07	4.07	4.07	4.07	4.07	4.07
Gross Income	0.01	5.05	4.65	5.30	5.98	6.60	7.24
Depreciation As Per IT Act	30.00	36.00	7.20	1.44	0.29	0.06	0.01
Profit After Depreciation	(29.99)	(30.95)	(2.55)	3.86	5.70	6.54	7.23

Cumulative Profit after Depreciation	(29.99)	(60.93)	(63.48)	(59.62)	(53.92)	(47.38)	(40.15)
80IA Applicable	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Exempted Income u/s 80IA	-	-	-	-	-	-	-
Profit after adjusting Income u/s 80IA	(29.99)	(30.95)	(2.55)	3.86	5.70	6.54	7.23
Taxable Income	(29.99)	(30.95)	(2.55)	3.86	5.70	6.54	7.23
Payable Tax	(10.19)	(10.52)	(0.87)	1.31	1.94	2.22	2.46
Profit After Tax	10.20	11.51	1.45	(0.07)	(0.02)	0.31	0.72

Year	8	9	10	11	12	13	14
Year Ending	31/03/19	31/03/20	31/03/21	31/03/22	31/03/23	31/03/24	31/03/25
Revenues							
Days of Operation	365	366	365	365	365	366	365
Hours of Operation	8760	8784	8760	8760	8760	8784	8760
Generation (Millions of Units)	2.63	2.64	2.63	2.63	2.63	2.64	2.63
Revenues From Electricity Sales	11.43	11.46	11.43	11.43	11.43	11.46	11.43
CDM Revenues	-	-	-	-	-		
Total Revenue	11.43	11.46	11.43	11.43	11.43	11.46	11.43
Expenses							
Interest on Debt	2.36	1.66	0.96	0.26			
Inssurance Charges	0.08	0.08	0.08	0.08	0.08	0.08	0.08
O & M Charges	1.11	1.18	1.24	1.32	1.39	1.47	1.55
Book Depreciation	4.07	4.07	4.07	4.07	4.07	4.07	4.07
Total Expenses	7.62	6.98	6.35	5.72	5.53	5.61	5.69
PBT	3.82	4.48	5.09	5.71	5.90	5.85	5.74
Income tax Calculation							
PBT	3.82	4.48	5.09	5.71	5.90	5.85	5.74
Book Depreciation	4.07	4.07	4.07	4.07	4.07	4.07	4.07
Gross Income	7.88	8.15	9.15	9.78	9.97	9.92	9.80
Depreciation As Per IT Act	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Profit After Depreciation	7.88	8.55	9.15	9.78	9.37	9.92	9.80
Cumulative Profit after Depreciation	(32.27)	(23.72)	(14.57)	(4.79)	5.17	15.09	24.89
80IA Applicable	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Exempted Income u/s 80IA	-	-	-	-	5.17	9.92	9.80
Profit after adjusting Income u/s 80IA	7.88	8.55	9.15	9.78	4.79	-	-
Taxable Income	7.88	8.55	9.15	9.78	4.79	-	-
Payable Tax	2.68	2.91	3.11	3.32	1.63	-	-

Profit After Tax	1.14	1.58	1.98	2.39	4.27	5.85	5.74

Year	15	16	17	18	19	20	21
Year Ending	31/03/26	31/03/27	31/03/28	31/03/29	31/03/30	31/03/31	31/03/32
Revenues							
Days Of Operation	365	365	366	365	365	365	365
Hours of Operation	8760	8760	8784	8760	8760	8760	8760
Generation (Millions of Units)	2.63	2.63	2.64	2.63	2.63	2.63	2.63
Revenues From Electricity Sales	11.43	11.43	11.46	11.43	11.43	11.43	11.43
CDM Revenues							
Total Revenue	11.43	11.43	11.46	11.43	11.43	11.43	11.43
Expenses							
Interest on Debt							
Inssurance Charges	0.08	0.08	0.08	0.08	0.08	0.08	0.07
O & M Charges	1.64	1.74	1.84	1.94	2.05	2.17	2.29
Book Depreciation	4.07	4.07	4.07	4.07	4.07	1.82	-
Total Expenses	5.78	5.88	5.98	6.08	6.19	4.06	2.37
PBT	5.65	5.55	5.49	5.35	5.24	7.37	9.06
Income tax Calculation							
PBT	5.65	5.55	5.49	5.35	5.24	7.37	9.06
Book Depreciation	4.07	4.07	4.07	4.07	4.07	1.82	-
Gross Income	9.71	9.62	9.55	9.42	9.30	9.19	9.06
Depreciation As Per IT Act	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Profit After Depreciation	9.71	9.62	9.55	9.42	9.30	9.19	9.06
Cumulative Profit after Depreciation	34.61	44.23	53.78	63.19	72.50	81.69	90.75
80IA Applicable	1.00	-	-	-	-	-	-
Exempted Income u/s 80IA	9.71	-	-	-	-	-	-
Profit after adjusting Income u/s 80IA	-	9.62	9.55	9.42	9.30	9.19	9.06
Taxable Income	-	9.62	9.55	9.42	9.30	9.19	9.06
Payable Tax	-	3.27	3.25	3.20	3.16	3.12	3.08
Profit After Tax	5.65	2.29	2.24	2.15	2.08	4.25	5.98

TABLE 4:- Cash Flow Statement

Year	31/03/12	31/03/13	31/03/14	31/03/15	31/03/16	31/03/17	31/03/18
Cash Inflow							
Term Loan	52.50						

Equity	22.50						
Profit After Tax	10.20	11.51	1.45	(0.07)	(0.02)	0.31	0.72
Book depreciation	0.01	4.07	4.07	4.07	4.07	4.07	4.07
Salvage value							
Total Cash Inflow	85.21	15.57	5.52	3.39	4.05	4.38	4.78
Cash Outflow							
Capital Expenses	75.00						
Loan Repayment	1.46	5.83	5.83	5.83	5.83	5.83	5.83
Total Cash outflow	76.46	5.83	5.83	5.83	5.83	5.83	5.83
Net Cash Flow	8.75	9.74	(0.32)	(1.84)	(1.79)	(1.46)	(1.05)

Year	31/03/19	31/03/20	31/03/21	31/03/22	31/03/23	31/03/24	31/03/25
Cash Inflow							
Term Loan							
Equity							
Profit After Tax	1.14	1.58	1.98	2.39	4.27	5.85	5.74
Book depreciation	4.07	4.07	4.07	4.07	4.07	4.07	4.07
Salvage value							
Total Cash Inflow	5.20	5.64	6.04	6.46	8.34	9.92	9.80
Cash Outflow							
Capital Expenses							
Loan Repayment	5.83	5.83	4.38	-	-	-	-
Total Cash outflow	5.83	5.83	4.38				
Net Cash Flow	(0.63)	(0.19)	1.67	6.46	8.34	9.92	9.80

Year	31/03/26	31/03/27	31/03/28	31/03/29	31/03/30	31/03/31	31/03/32
Cash Inflow							
Term Loan							
Equity							
Profit After Tax	5.65	2.29	2.24	2.15	2.08	4.25	5.98
Book depreciation	4.07	4.07	4.07	4.07	4.07	1.82	-
Salvage value							7.50
Total Cash Inflow	9.71	6.35	6.31	6.22	6.14	6.06	13.48
Cash Outflow							
Capital Expenses							
Loan Repayment							
Total Cash outflow							
Net Cash Flow	9.71	6.35	6.31	6.22	6.14	6.06	13.48

TABLE 5:- Project IRR

Year		1	2	3	4	5	6	7
Year Ending		31/03/12	31/03/13	31/03/14	31/03/15	31/03/16	31/03/17	31/03/18
Net Cash flow		8.75	9.74	(0.32)	(1.84)	(1.79)	(1.46)	(1.05)
Project Cost	-75.00							
Loan Repayment		1.46	5.83	5.83	5.83	5.83	5.83	5.83

Interest Payment		0.02	6.30	5.86	5.16	4.46	3.76	3.06
Net Project Cash flow	(75.00)	10.22	21.87	11.38	9.15	8.51	8.14	7.85

Year	8	9	10	11	12	13	14
Year Ending	31/03/19	31/03/20	31/03/21	31/03/22	31/03/23	31/03/24	31/03/25
Net Cash flow	(0.63)	(0.19)	1.67	6.46	8.34	9.92	9.84
Project Cost							
Loan Repayment	5.83	5.83	4.38	-	-	-	-
Interest Payment	2.36	1.66	0.96	0.26	-	-	-
Net Project Cash flow	7.57	7.31	7.00	6.72	8.34	9.92	9.80

Year	15	16	17	18	19	20	21
Year Ending	31/03/26	31/03/27	31/03/28	31/03/29	31/03/30	31/03/31	31/03/32
Net Cash flow	9.71	6.35	6.31	6.22	6.14	6.06	13.48
Project Cost							
Loan Repayment	-	-	-	-	-	-	-
Interest Payment	-	-	-	-	-	-	-
Net Project Cash flow	9.71	6.35	6.31	6.22	6.14	6.06	13.48

TABLE 6:- Sensitivity Analysis

Variation In Project Cost	0%
Variation In Operating & Margin	0%
Variation In Interest Rate	0%
Variation In Tariff	0%
Variation In PLF	0%

Project IRR (20- Year Cash flow)	12.34%

Project IRR (20-Year Cash flow) Without CDM Revenue	-10%	0%	10%
Variation In Project Cost	14.00%	12.34%	10.90%
Variation In Operating & Margin	12.49%	12.34%	12.20%
Variation In Interest Rate	12.25%	12.34%	12.44%
Variation In Tariff	10.74%	12.34%	13.84%
Variation In PLF	10.74%	12.34%	13.84%

It is assumed that CDM revenue is started from year 31/03/2014 to 31/03/2023 for 10 years. Assumed that 1 year is taken to process of documentation & other purpose from date of commissioning.

Selection of the Benchmarks:-

According to the "Assessment of Investment Analysis" benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculation. Local commercial lending rates or weighted average cost of capital (WACC) are appropriate benchmark for project IRR. PLR is defined as the benchmark rate for all bank loans. PLR has been rate at which banks lend to the best borrower one who is the safest or least likely to default on the loan. According to this taken the weighted average benchmark prime lending rate. If we are selecting the State Bank of India for lending money then the weighted average benchmark prime lending rate are 14.75% p.a.

Calculation of Baseline Emission factor for the Northern Grid:-

Year	2008-2009	2009-2010	2010-2011
Simple Operating Margin (Including Imports)	1.0065	0.97773	0.97066
Net Generation in Operating Margin (In MWh)	4218022632.89	458043084.55	476986721.34
Build Margin for Northern Grid	0.6754	0.8123	0.8587

(All value is taken from the As per CEA Database version 7.0)

1. Net Emission in Operating Margin in Year

2008-09= 1.0065*421802632.89= 424544350.00 (In tCO_2)

2009-10= 0.9777*458043084.55=447842465.06 (In tCO_2)

2010-11= 0.9706*476986721.34=462991930.94 (In tCO_2)

2. Operating Margin Emission factor

= (Sum of Net Emission in Operating Margin in all year /Net Generation in Operating Margin)

= (1356832438.78/1335378746.00)

= 0.9842 (tCO_2/MWh)

3. Combined Margin for Northern Grid

= (Operating Margin for Northern grid*Wom) + (Build Margin for Northern grid*Wbm)

$$= (0.9842*0.75) + (0.8587*0.25)$$

$$= 0.9528 \qquad (tCO_2/ MWh)$$

Value of Wom & Wbm are taken from "Tool to calculate emission factor for an electricity system".

Result:-

In sensitivity analysis project IRR (20-year cash flow) without CDM revenue fall in the range of 10.74% to 14.00% in all scenario. Which is not cross the selected benchmark of 14.75%. So, overall investment analysis clearly indicates that the project is financially unattractive without CDM revenue.

Conclusion:-

From above benchmark and results it is clearly shows that the projects is financially not viable if the CDM revenues is not given to the project i.e., project is financially unattractive. So, CDM revenue is most important factor to establish the wind power projects.

Discussion:-

When we are analysing the various banks BPLR rate for the year 2011-2012 including the public, private & foreign banks it varies between the 14.25% to 18.25% and mostly banks BPLR rates are 14.25% to 14.75%. If we are lending the money from other banks that the project is also not viable because the sensitivity analysis scenarios do not cross the selected benchmark. So, project is definitely financially unattractive And CDM revenues help to the establishment of the project.

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