CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Title: GEI Wind Power Project in Karnataka, India
Version: 1.0
Date of completion of PDD: 01 December 2008

A.2. Description of the project activity:

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Objective of the Project

Generacion Eolica India Limited ("GEI") is designed to construct 31.2 MW wind power project ("Project") in the state of Karnataka, India. The project activity is to install and operate 39 wind energy converters, with each machine having a capacity of 800 kW. The objective of project activity is to develop, design, engineering, procure, finance, construct, operate and maintain the wind power project in the Indian state of Karnataka to provide reliable, renewable power to the Karnataka state electricity grid which is part of the Southern regional electricity grid. The project activity will assist the sustainable growth of Karnataka state by providing clean and green electricity to the state electricity grid. The Project will lead to reduced greenhouse gas emissions because it displaces electricity from fossil fuel based electricity generation plants.

Nature of Project

The Project harnesses renewable resources in the region, and thereby displacing non-renewable natural resources thereby ultimately leading to sustainable economic and environmental development. Enercon (India) Limited ("Enercon") will be the equipment supplier and the operations and maintenance contractor for the Project. The generated electricity will be supplied to Hubli Electricity Supply Company Ltd ("HESCOM") under a long-term power purchase agreement (PPA). The Project is owned by Generacion Eolica India Limited.

Contribution to Greenhouse Gas Emissions Reduction

The National CDM Authority (NCDNA) which is the Designated National Authority (DNA) for the Government of India (GoI) in the Ministry of Environment and Forests (MoEF) has stipulated four indicators for sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India[1]. The contribution of this project activity towards in terms of these four indicators is provided below:

1. **Social well being:**

- ✓ The project activity has led to the development of supporting infrastructure such as road network etc., in the wind park location, which also provides access to the local population.

[1] http://cdmindia.nic.in/host_approval_criteria.htm

- ✓ The project activity leads to alleviation of poverty by establishing direct and indirect benefits through employment generation and improved economic activities by strengthening of local grid of the state electricity utility.
- ✓ Use of a renewable source of energy reduces the dependence on imported fossil fuels and associated price variation thereby leading increased energy security.

2. **Environmental well being:**

- ✓ the project activity involves use of renewable energy source for electricity generation instead of fossil fuel based electricity generation which would have emitted gaseous, liquid and/or solid effluents/wastes.
- ✓ Being a renewable resource, using wind energy to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

3. **Economic well being:**

- ✓ the project activity requires temporary and permanent, skilled and semi-skilled manpower at the wind park; this will create additional employment opportunities.
- ✓ The generated electricity will be fed into the southern regional grid through local grid, thereby improving the grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants) which will provide new opportunities for industries and economic activities to be setup in the area thereby resulting in greater local employment, ultimately leading to overall development.

4. **Technological well being:**

- ✓ Increased interest in wind energy projects will further push R&D efforts by technology providers to develop more efficient and better machinery in future.

A.3. Project participants:

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Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (Host)	Generacion Eolica India Limited	No

The contact details of the entities are provided in Annex – 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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The host party to the project activity is the Government of India.

A.4.1.2. Region/State/Province etc.:

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The Project is located in the State of Karnataka that forms part of the Southern regional electricity grid of India.

A.4.1.3. City/Town/Community etc:

>>
The Project is located at Harthi, Kurtakoti & Malasamudra villages in Gadag district of Karnataka state in India.

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

>>
The Project consist of 39 number of E-48 WECs of 800 kW each. The details of the physical location are as follows:

Project Name	Project Capacity (MW)	Name of District	Name of Village	No. of WEC
GEI Wind Power Project in Karnataka, India	31.2 MW	Gadag	Harthi	22
			Kurtakoti	06
			Malasamudra	11
Total				39

The project area extends between latitude 15° 20' to 15° 23' North and longitude 75° 33' & 75° 35' East. The site is located at a distance of 420 km from Bangalore by road. The nearest railway station is at Gadag. A location map is attached at Appendix – 1.

A.4.2. Category(ies) of project activity:

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The project activity is considered under CDM category zero-emissions **'grid-connected electricity generation from renewable sources'** that generates electricity in excess of 15 MW (limit for small scale project). Therefore as per the scope of the project activity enlisted in the 'list of sectoral scopes and related approved baseline and monitoring methodologies (Version 09)', the project activity may principally be categorized in Scope Number 1, Sectoral Scope - Energy industries (renewable/ non-renewable sources).

A.4.3. Technology to be employed by the project activity:

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The Project involves 39 wind energy converters (WECs) of Enercon make (800 kW E-48) with internal electrical lines connecting the Project with local evacuation facility. The WECs generates 3-phase power at 400V, which is stepped up to 33 KV at the Project site and further stepped up to 220 KV at the Receiving sub station at Nagavi village, Gadag in the close vicinity of the existing

220 KV DC line between Hubli and Lingapur by line in line out (LILO) of both 220 KV circuits, for the purpose of interconnection with the KPTCL/HESCOM grid at the sub station of the KPTCL/HESCOM.

The Project can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V ± 12.5%. The other salient features of the state-of-art-technology are:

- Gearless Construction - Rotor & Generator Mounted on same shaft eliminating the Gearbox.
- Variable speed function – has the speed range of 18 to 33 RPM thereby ensuring optimum efficiency at all times.
- Variable Pitch functions ensuring maximum energy capture.
- Near Unity Power Factor at all times.
- Minimum drawal (less than 1% of kWh generated) of Reactive Power from the grid.
- No voltage peaks at any time.
- Operating range of the WEC with voltage fluctuation of -20 to +20%.
- Less Wear & Tear since the system eliminates mechanical brake, which are not needed due to low speed generator which runs at maximum speed of 33 rpm and uses Air Brakes.
- Three Independent Braking System.
- Generator achieving rated output at only 33 rpm.
- Incorporates lightning protection system, which includes blades.
- Starts Generation of power at wind speed of 3 m/s.

Enercon has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH, has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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Crediting Period for the Project: Fixed for 10 years

Years	Annual estimation of emission reductions in tonnes of CO_2e
01 June 2009 – 31 March 2010	55,747
01 April 2010 – 31 March 2011	67,153
01 April 2011 – 31 March 2012	67,153
01 April 2012 – 31 March 2013	67,153
01 April 2013 – 31 March 2014	67,153
01 April 2014 – 31 March 2015	67,153
01 April 2015 – 31 March 2016	67,153
01 April 2016 – 31 March 2017	67,153
01 April 2017 – 31 March 2018	67,153
01 April 2018 – 31 March 2019	67,153
01 April 2019 – 31 May 2019	11,407

Years	Annual estimation of emission reductions in tonnes of CO_2e
Total estimated reductions (tonnes of CO_2e)	671,530
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	67,153

A.4.5. Public funding of the project activity:

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There is no public funding involved in the Project.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Title: Consolidated baseline and monitoring methodology for "Grid-connected electricity generation renewable sources"

Reference: Approved consolidated baseline methodology ACM0002 (Version 09, EB 45)

ACM0002 draws upon the following tools, which have been used in the PDD:

- Tool to calculate the emission factor for an electricity system – Version 01.1, EB 35
- Tool for the demonstration and assessment of additionality – Version 05.2, EB 39

The approved consolidated baseline and monitoring methodology **ACM0002 Version 09** (27th Feb 2009) has been used. The titles of these baseline and monitoring methodologies are "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" and "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The Project is wind based renewable energy source, zero emission power project connected to the Karnataka state grid, which forms part of the Southern regional electricity grid. The Project will displace fossil fuel based electricity generation that would have otherwise been provided by the operation and expansion of the fossil fuel based power plants in Southern regional electricity grid.

This methodology is applicable to grid-connected renewable power generation project activities under the following conditions:

- Applies to electricity capacity additions from:
    - Run-of-river hydro power plants; hydropower projects with existing reservoirs where the volume of the reservoir is not increased.
    - New hydro electric power projects with reservoirs having power densities (installed power generation capacity divided by the surface area at full reservoir level) greater than 4 W/m^2
    - Wind sources;
    - Geothermal sources;
    - Solar sources;
    - Wave and tidal sources.
- This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available; and

Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities" (ACM0001).

The approved consolidated baseline and monitoring methodology ACM0002 Version 09 is the choice of the baseline and monitoring methodology and it is applicable because:

- the Project is grid connected renewable power generation project activity
- the Project represents electricity capacity additions from wind sources
- the Project does not involve switching from fossil fuel to renewable energy at the site of project activity since the Project is green-field electricity generation capacities from wind sources at sites where there was no electricity generation source prior to the Project, and
- the geographical and system boundaries of the Southern electricity grid can be clearly identified and information on the characteristics of the grid is available.

B.3. Description of the sources and gases included in the project boundary

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>>According to ACM0002 Version 09, for the baseline emission factor, the spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	In the baseline scenario the electricity would have been sourced from the NEWNE grid which in turn would be connected to fossil fuel fired power plants which emit CO_2.
		CH_4	No	No methane generation is expected to be emitted.
		N_2O	No	No nitrous oxide generation is expected to be emitted.

Project Activity	For geothermal power plants, fugitive emission of CH_4 and CO_2 from non-condensable gases contained in geothermal stream.	CO_2	No	The project activity does not emit any emissions.
		CH_4	No	No methane generation is expected to be emitted.
		N_2O	No	No nitrous oxide generation is expected to be emitted.
	For geothermal & solar power plants, CO_2 emissions from combustion of fossil fuels required to operate the power plants.	CO_2	No	The project activity does not emit any emissions.
		CH_4	No	No methane generation is expected to be emitted.
		N_2O	No	No nitrous oxide generation is expected to be emitted.
	For hydro power plants, emission of CH_4 from the reservoir.	CO_2	No	The project activity does not emit any emissions.
		CH_4	No	No methane generation is expected to be emitted.
		N_2O	No	No nitrous oxide generation is expected to be emitted.
	For all renewable energy plants, CO2 emissions from backup power generation.	CO_2	No	The project activity does not emit any emissions.
		CH_4	No	No methane generation is expected to be emitted.
		N_2O	No	No nitrous oxide generation is expected to be emitted.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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According to ACM0002, for project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following:

Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described below.

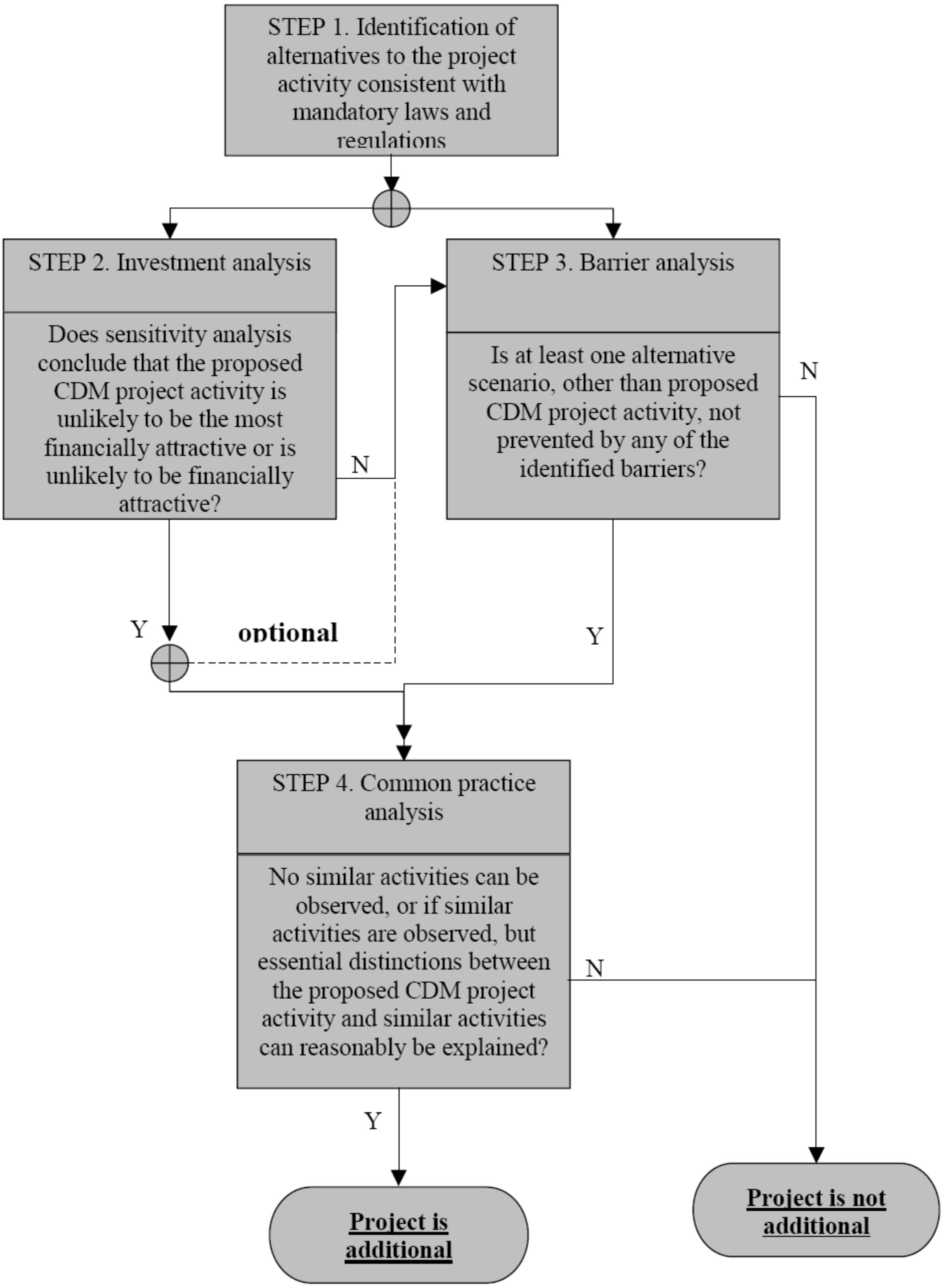
As the Project does not modify or retrofit an existing generation facility, the baseline scenario is the emissions generated by the operation of grid-connected power plants and by the addition of new generation sources. This is estimated using calculation of Combined Margin multiplied by electricity delivered to the grid by the Project.

Variable	**Data Source**
EG_y – Electricity generated	Records maintained by project proponent
Parameter	**Data Source**

$EF_{OM,y}$ = Operating Margin Emission Factor (tCO_2/MWh)	CEA Data
$EF_{BM,y}$ = Build Margin Emission Factor (tCO_2/MWh)	CEA Data
EFy – Grid Emission Factor	Calculated as the weighted average of the operating margin and build margin

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

The latest additionality tool i.e. Tool for the demonstration and assessment of additionality version 05.2 approved by CDM Executive Board in its 39th meeting is used to demonstrate project additionality.


STEP 1. Identification of alternatives to the project activity consistent with mandatory laws and regulations
STEP 2. Investment analysis
Does sensitivity analysis conclude that the proposed CDM project activity is unlikely to be the most financially attractive or is unlikely to be financially attractive?
STEP 3. Barrier analysis
Is at least one alternative scenario, other than proposed CDM project activity, not prevented by any of the identified barriers?
N
N
Y
optional
Y
STEP 4. Common practice analysis
No similar activities can be observed, or if similar activities are observed, but essential distinctions between the proposed CDM project activity and similar activities can reasonably be explained?
N
Y
Project is additional
Project is not additional

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

1. Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity. These alternatives are to include:

- The proposed project activity undertaken without being registered as a CDM project activity;
- All other plausible and credible alternatives to the project activity scenario that deliver outputs and on services (e.g. electricity, heat or cement) with comparable quality, properties and application areas;
- If applicable, continuation of the current situation (no project activity or other alternatives undertaken).

Alternative(s) available to the project participants or similar project developers include:

(a) The Project is not undertaken as a CDM project activity.

(b) Setting up of comparable utility scale fossil fuel fired or hydro power projects that supply to the Karnataka grid under a PPA.

Continuation of the current situation where no project activity or any of the above Alternatives are undertaken would not be applicable as Karnataka had energy (MU) shortages of 0.7% and peak (MW) shortages of 9.8% in 2005-06 (Source: Southern Region Power Sector Profile, August 2006, Ministry of Power).

Outcome of step 1 a:

Alternatives a and b, as identified above are realistic and credible alternatives to the project activity.

Sub-step 1b. Enforcement of applicable laws and regulations

2. The alternative(s) shall be in compliance with all applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. This sub-step does not consider national and local policies that do not have legally-binding status.

3. If an alternative does not comply with all applicable legislation and regulations, then show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that non-compliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration.

4. If the proposed project activity is the only alternative amongst the ones considered by the project participants that is in compliance with all regulations with which there is general compliance, then the proposed CDM project activity is not additional.

There are no legal and regulatory requirements that prevent Alternatives (a) and (b) from occurring.

Outcome of step 1 b

Both alternative a and alternative b are in compliance with mandatory laws and regulations taking into account the enforcement in the region or country and EB decision on national and sectoral policies. Hence Alternative a and b as identified in the step 1 a, are realistic and credible alternatives to the project activity.

Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both steps 2 and 3.)

Step 2: Investment Analysis

Determine whether the proposed project activity is the economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reductions (CERs). To conduct the investment analysis, use the following sub-steps:

Sub-step 2a. - Determine appropriate analysis method

1. Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (sub-step 2b). If the CDM project activity generates no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III).

Sub-step 2b. – Option I. Apply simple cost analysis

2. Document the costs associated with the CDM project activity and demonstrate that the activity produces no economic benefits other than CDM related income.

Sub-step 2b. – Option II. Apply investment comparison analysis

3. Identify the financial indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g., levelized cost of electricity production in $/kWh or levelized cost of delivered heat in $/GJ) most suitable for the project type and decision-making context.

Sub-step 2b. – Option III. Apply benchmark analysis

4. Identify the financial indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g., levelized cost of electricity production in $/kWh or levelized cost of delivered heat in $/GJ) most suitable for the project type and decision context. Identify the relevant benchmark value, such as the required rate of return (RRR) on equity. The benchmark is to represent standard returns in the market, considering the specific risk of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer. For example, benchmarks for IRR, NPV, etc. can be derived from:
   - (a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert;
   - (b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;
   - (c) A company internal benchmark (weighted average capital cost of the company) if there is only one potential project developer (e.g. when the project activity upgrades an existing process). The project developers shall demonstrate that this benchmark has been consistently used in the past, i.e. that project

Option I – Simple cost analysis is not applicable as the project activity sells electricity to the grid and obtains economic benefits in the form of electricity tariffs.

The project participant proposes to use **Option III – Benchmark analysis** and the financial indicator that is identified is the post-tax return on equity or the equity IRR.

As per Guidance to investment analysis issued in EB 41 (paragraph 11), the required return on equity can be considered as appropriate benchmark for Equity IRR. In light of this, we have considered the cost of equity[2] applicable to the project type i.e. electricity generation projects, as the suitable benchmark for the project. The cost of equity has been determined using the Capital Asset Pricing Model (CAPM) considering Beta values of all listed power generating companies in India. The CAPM economic model is widely used to determine the required/expected return on equity based on potential risk of an investment. The CAPM framework is the Nobel award winning work of financial economist Dr. William Sharpe.

In line with the requirements of the Guidance to Investment Analysis (paragraph 12), data and parameters used in calculation of cost of equity i.e. beta values of power generating companies in India, risk free rate of return, market risk premium etc. have been derived from publicly available data sources. The detailed calculations of cost of equity along with an elaboration of the approach are provided in Annex 5.

As can be seen, the benchmark cost of equity works out to 20.00 %.

Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):

5. Calculate the suitable financial indicator for the proposed CDM project activity and, in the case of Option II above, for the other alternatives. Include all relevant costs (including, for example, the investment cost, the operations and maintenance costs), and revenues (excluding CER revenues, but including subsidies/fiscal incentives where applicable), and, as appropriate, non-market cost and benefits in the case of public investors.
6. Present the investment analysis in a transparent manner and provide all the relevant assumptions in the CDM-PDD, so that a reader can reproduce the analysis and obtain the same results. Clearly present critical techno-economic parameters and assumptions (such as capital costs, fuel prices, lifetimes, and discount rate or cost of capital). Justify and/or cite assumptions in a manner that can be validated by the DOE. In calculating the financial indicator, the project's risks can be included through the cash flow pattern, subject to project-specific expectations and assumptions (e.g. insurance premiums can be used in the calculation to reflect specific risk equivalents).
7. Assumptions and input data for the investment analysis shall not differ across the project activity and its alternatives, unless differences can be well substantiated.
8. Present in the CDM-PDD submitted for validation a clear comparison of the financial indicator for the proposed CDM activity and:

[2] In line with the Guidance to investment analysis (paragraph 13), we have not used company or project specific parameters for the calculation of the benchmark (such as company Beta etc.).

(a) The alternatives, if Option II (investment comparison analysis) is used. If one of the other alternatives has the best indicator (e.g. highest IRR), then the CDM project activity can not be considered as the most financially attractive;

(b) The financial benchmark, if Option III (benchmark analysis) is used. If the CDM project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.

The key assumptions used for calculating the benchmark (post-tax equity IRR) are set out below:

Financial Assumptions

Capacity of Machines in kW	800
Number of Machines	39
Project Capacity in MW	31.20
Project Commissioning Date	31-Mar-08
Project Cost per MW (Rs. In Millions)	49.8

Operations	
Plant Load Factor	26.5%
Insurance Charges @ % of capital cost	0.25%
Operation & Maintenance Cost base year @ % of capital cost	1.25%
% of escalation per annum on O & M Charges	5.0%

Tariff	
Base year Tariff for 10 years - Rs./kWh	3.40
Annual Escalation (Rs./kWh per Year)	0.00
Tariff applicable after 10 years (Rs/kWh)	Cost plus 16% return on equity

Project Cost	Rs Million
Land and Infrastructure, Generator & Electrical Equipments, Mechanical Equipments, Civil Works, Instrumentation & Control, Other Project Cost, Pre operative Expenses, etc.	
Total Project Cost	1,554

Means of Finance		Rs Million
Own Source	24%	368
Term Loan	76%	1,187
Total Source		1,554

Terms of Loan		
Interest Rate	10.25%	
Tenure	10	Years
Moratorium	12	Months

Income Tax Depreciation Rate (Written Down Value basis)	
on Wind Energy Generators	80%
On other Assets	10%
Book Depreciation Rate (Straight Line Method basis)	
On all assets	4.50%
Book Depreciation up to (% of asset value)	90%

Income Tax	
Income Tax rate	30%
Minimum Alternate Tax	10%
Surcharge	10%
Cess	2%

Working capital	
Receivables (no of days)	45
O & m expenses (no of days)	30
Working capital interest rate	12%

Crediting period starts	1-June-09
Length of Crediting period	10

Baseline Emission Factor for Southern Region (tCO2/GWh)	927.18

The equity IRR for the Project (without CDM revenues) is 9.88 % i.e. less than the benchmark equity IRR of 20 %.

Sub-step 2d. Sensitivity analysis (only applicable to options II and III):

9. Include a sensitivity analysis that shows whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favor of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive (as per step 2c para 8a) or is unlikely to be financially attractive (as per step 2c para 8b).

Sensitivity analysis of the Equity IRR to the Plant Load Factor (the most critical assumption) has been carried out considering a plant load factor of 23% and 28% (the range indicated in KERC Order dated 18 January 2005). Plant Load Factor is the key variable encompassing variation in wind profile, variation in off-take (including grid availability) including machine downtime. The post tax Equity IRRs at the stated PLFs are as follows:

Sensitivity	PLF at 23%	PLF at 28%
Post tax Equity IRR without CER revenues	5.63%	12.05%

As can be seen from above, the Project is not the most financially attractive (as per step 2c para 8b) we proceed to Step 4 (Common practice analysis).

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:
Sub-step 4b. Discuss any similar options that are occurring:

1. Provide an analysis of any other activities implemented previously or currently underway that are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities are not to be included in this analysis. Provide quantitative information where relevant.

We analyze the extent to which wind energy projects have diffused in the electricity sector in Karnataka. Installed capacity of wind in India is about 15% of its potential. In Karnataka against an assessed wind potential of 7023 MW, the state currently has installed wind capacity of 853 MW as of 31 March 2007, which is about 12% of its potential. In 2006, when the project activity was started, the installed capacity of wind in Karnataka was around 600 MW, barely 8.5 % of its potential. The table below provides details of wind capacity additions in Karnataka since the promotional policy for wind was first introduced in 1994-95.

SL.NO	Financial year	Capacity allocated in MW	Capacity commissioned in MW
1	1994-95	0.55	0.55
2	1995-96	4.00	1.35
3	1996-97	14.56	3.95
4	1997-98	32.50	12.04
5	1998-99	45.60	1.25
6	1999-00	394.16	18.09
7	2000-01	125.60	3.75
8	2001-02	358.30	28.80
9	2002-03	806.05	55.46

10	2003-04	409.10	83.17
11	2004-05	555.40	204.55
12	2005-06	1,575.10	174.63
13	2006-07	2,397.20	265.95
14	2007-08	305.00	-
	Total	**7,023.12**	**853.54**

(http://www.kredl.kar.nic.in/docs/Yearwise_allotment_and_commissioned_wind_power_projects.xls)

More than 75% of Karnataka's wind capacity has been added in the last three years. It is interesting to note that during this period the regulatory framework for wind investments in Karnataka have reduced the tariff benefits to wind projects. We analyze the tariff that would be applicable to the project under the different regulatory policy regimes that have come up for wind power projects in Karnataka over the years.

Electricity tariff (Rs/kWh)	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Average
MNES Policy[3]	3.60	3.72	3.83	3.94	4.05	4.17	4.28	4.39	4.50	4.62	4.11
KERC Order 2003[4]	3.29	3.35	3.41	3.47	3.53	3.60	3.66	3.72	3.78	3.84	3.57
KERC Order 2005[5]	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40

Clearly the various policies and regulatory directives have progressively decreased the electricity tariffs benefits for wind power projects in the state.

A more relevant common practice test is the amount of wind power generation as compared to the overall electricity generation availability for Karnataka. In 2004–05, wind electricity generation in Karnataka was 489.53 GWh[6] and the total electricity availability at bus-bar in the state of Karnataka was 33,523.92 GWh[7]. This works out to 1.45%, showing that wind energy generation is insignificant as compared to other power generation sources in Karnataka. Please note that this wind generation is for all wind projects (including CDM projects). If one were to remove the CDM wind generation from the above data, the percentage would be still lower.

Sub-steps 4a is satisfied.

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[3] MNES came out with its tariff guidelines for NCE projects on 13.09.1993. The policy states that tariff would be Rs.2.25 for 1994-95 and 5% annual escalation thereafter, http://mnes.nic.in/wp4.htm

[4] Rs.3.10 for 2003-04 and 2% annual escalation thereafter, http://www.kerc.org/orders2003/Void%20PPAs-2.doc

[5] Rs.3.40 for 2005-06, fixed for next 10 years, http://www.kerc.org/order2005/Order%20on%20NCE%20Tariff%20(FINAL).doc

[6] Table 3.4 titled "Gross Electrical Energy Generation (Utilities Only) Primemoverwise, Regionwise / Statewise During 2004-05" in chapter 3 of the CEA general review 2006 available at http://www.cea.nic.in/power_sec_reports/general_review/index_general_Review.html

[7] Table 5.3 titled "Statewise System Losses During 2004-05" in chapter 5 of the CEA General review 2006 available at http://www.cea.nic.in/power_sec_reports/general_review/index_general_Review.html

2. If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive (as contended in Step 2) or faces barriers (as contended in Step 3). Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially attractive (e.g., subsidies or other financial flows) or did not face the barriers to which the proposed project activity is subject.

3. Essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects where carried out. For example, new barriers may have arisen, or promotional policies may have ended, leading to a situation in which the proposed CDM project activity would not be implemented without the incentive provided by the CDM. The change must be fundamental and verifiable.

Since 2003-04, close to 720 MW of wind projects have come up in Karnataka. Out of the projects that are currently available on the UNFCCC website, 190 MW of registered wind projects are from Karnataka, close to 269 MW of wind projects are under the validation and registration process and another 150 MW of wind is currently in project development stage which will enter the CDM pipeline soon. Out of the 720 MW that has come up, 609 MW[8] of capacity or close to 85% are already in the CDM pipeline and more are expected to follow.

According to the additionality tool version 05.2 "If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive (as contended in Step 2) or faces barriers (as contended in Step 3). The above analysis clearly shows that wind power project development in Karnataka is insignificant when compared to the power sector of Karnataka. Further, wind power project development is substantially dependent on CDM mechanism and thus is not common practice. Similar activities are not widely observed and hence as per additionality tool version 05.2 step 4 (b) is not applicable.

Sub-steps 4b is satisfied.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>
According to the approved methodology ACM0002 (Version 09) Emission Reductions are calculated as

$$\mathbf{ER_y = BE_y - PE_y - LE_y}$$

Where:

ER_y	Emission reductions in year *y* (t CO_2e/yr)

[8] Source for the information is the UNFCCC website http://cdm.unfccc.int and the CDM pipeline database prepared by UNEP available at www.cd4cdm.org

BE_y	Baseline emissions in year *y* (t CO_2e/yr)
PE_y	Project emissions in year *y* (t CO_2e/yr)
LE_y	Leakage Emissions in year *y* (t CO_2e/yr)

Estimation of Baseline Emissions

Baseline emissions (BEy in tCO_2) due to displacement of grid-electricity is calculated as the product of the Baseline Emissions Factor (EFy in tCO_2e/MWh) calculated as described below, times the electricity supplied by the project activity to the grid (EG_y – $EG_{baseline}$ in MWh), over the crediting period.

$$BE_y = (EG_y - EG_{baseline}) \text{ X } EF_{grid,CM,,y}$$

Where:

BE_y	Baseline emissions in year y (tCO_2/yr)
EG_y	Electricity supplied by the project activity to the grid (MWh)
$EG_{baseline}$	Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero. As this is a new power plant this is zero for the project
$EF_{grid,CM,,y}$	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system”

According to the tool the baseline emission coefficient will be determined using the following steps:

STEP 1. Identifying the relevant electric power system

Historically, the Indian power system was divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covered several states (see Table). Since August 2006, however, all regional grids except the Southern Grid have been integrated and are operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids will be treated as a single grid and is being named as NEWNE grid in this document from FY 2007-08 onwards for the purpose of this CO_2 Baseline Database. The Southern grid has also been planned to be synchronously operated with rest of all Indian Grid by early 12th Plan (2012-2017). Presently Southern grid is connected with Western and Eastern grid through HVDC link and HVDC back to back systems.

Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets its demand with its own generation facilities and also with allocation from power plants owned by the Central Sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the Central Sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. The regional grid thus represents the largest electricity grid where power plants can be dispatched without significant constraints and thus, represents the “project electricity system” for the Project. As the Project is connected to the Southern regional electricity grid, the Southern grid is the “project electricity system”.

NEWNE Grid				Southern Grid
Northern	**Eastern**	**Western**	**North-Eastern**	**Southern**
Chandigarh	Bihar	Chhattisgard	Arunachal Pradesh	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	**Karnataka**
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar and Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Pondicherry
Punjab	Andaman-Nicobar	Maharashtra	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	
Uttar Pradesh				
Uttarakhand				

STEP 2. Select an operating margin (OM) method

According to the tool the calculation of the operating margin emission factor is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

Any of the four methods can be used, however, the simple OM method (option a) can only be used if low cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

The Share of Low Cost / Must-Run (% of Net Generation) in the generation profile of the different grids in India in the last five years is as follows:

	2000-01	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**
North (N)	25.90%	25.70%	26.10%	28.10%	26.80%	28.10%
East (E)	10.80%	13.40%	7.50%	10.30%	10.50%	7.20%
West (W)	8.20%	8.50%	8.20%	9.10%	8.80%	12.00%
North-East (NE)	42.20%	41.70%	45.80%	41.90%	55.50%	52.70%
South	**28.10%**	**25.50%**	**18.30%**	**16.20%**	**21.60%**	**27.00%**
NEWNE	21.78%	22.33%	21.90%	22.35%	25.40%	25.00%

Source: CO_2 Baseline Database for the Indian Power Sector – Central Electricity Authority

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) for the Southern regional grid is less than

50 % of the total generation. Hence the Simple OM method can be used to calculate the Operating Margin Emission factor.

The project proponents choose an ex ante option for calculation of the OM with a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

STEP 3. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option C)

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO_2 Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the “Tool to calculate the emission factor for an electricity system”. We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

The CEA database uses the option B i.e. data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit, to calculate the OM of the different regional grids.

The simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$\mathbf{EF_{grid,OM,simple,y} = \Sigma\ (EG_{m,y} \times EF_{EL,m,y})\ /\ \Sigma EG_{m,y}}$$

Where:

$EF_{grid,OM,simple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	All power units serving the grid in year y except low-cost / must-run power units
y	Either the three most recent years for which data is available at the time of submission of the CDM PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

The emission factor of each power unit m has been determined using Option B

$$\mathbf{EF_{EL,m,y} = (\Sigma\ FC_{i,m,y}\ x\ NCV_{i,y}\ x\ EF_{CO2,I,y}) / EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,I,y}$	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
m	All power units serving the grid in year y except low-cost / must-run power units
i	All fossil fuel types combusted in power unit m in year y
y	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

STEP 4. Identify the cohort of power units to be included in the build margin

The sample group of power units m used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project Participant should use the set of power units that comprises the larger annual generation.
Accordingly, the CEA database calculates the build margin as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation.
The build margin emission factor has been calculated ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. This option does not require monitoring the emission factor during the crediting period.

STEP 5. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$\mathbf{EF_{grid,BM,y} = (\Sigma\ EG_{m,y}\ x\ EF_{EL,m,}) / \Sigma\ EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m Power units included in the build margin
y Most recent historical year for which power generation data is available

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per the procedures given in step 3 (a) for the simple OM, using options B1 using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

STEP 6. Calculate the combined margin emissions factor
The Emission Factor *EFy* of the grid is represented as a combination of the Operating Margin (OM) and the Build Margin (BM). Considering the emission factors for these two margins as $EF_{OM,y}$ and $EF_{BM,y}$, then the *EFy* is given by:

$$EFy = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Where:
$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM} Weighting of operating margin emissions factor (%)
w_{BM} Weighting of build margin emissions factor (%)
(where $w_{OM} + w_{BM} = 1$).

According to ACM0002 the weights for OM and BM are 0.75 and 0.25 respectively.

Using the values for operating and build margin emission factor provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) is 927.18 tCO_2e/GWh or 0.92718 tCO_2e/MWh.

Details of Baseline data:

Data of Operating and Build Margin for the three financial years from 2005-06 to 2007-08 has been obtained from –

The CO_2 Baseline Database for the Indian Power Sector
Ministry of Power: Central Electricity Authority (CEA)
Version 4.0
Dated: October 2008
Key baseline information is reproduced in annex 3.
The detailed excel sheet is available at:
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Estimation of Project Emissions
The project activity involves harnessing of wind energy and its conversion to electricity. Hence according to ACM0002 Version 09, there will be no project emissions in the project activity (PEy = 0).

Estimation of Leakage Emissions
As per ACM0002 Version 09, no leakage has been considered for the calculation of emission factor (LEy = 0).

The details on OM, BM and CM estimates as provided by the CEA are shown in Annex-3.

B.6.2. Data and parameters that are available at validation:

>>

Data / Parameter:	***$EF_{OM,y}$***
Data unit:	tCO_2e/MWh
Description:	Operating Margin Emission Factor of Southern Regional Electricity Grid
Source of data used:	"CO_2 Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value applied:	2005 – 06: 1005.67 2006 – 07: 999.12 2007 – 08: 990.62
Justification of the choice of data or description of measurement methods and procedures actually applied :	Operating Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with ACM0002.

Data / Parameter:	***$EF_{BM,y}$***
Data unit:	tCO_2e/MWh
Description:	Build Margin Emission Factor of Southern Regional Electricity Grid
Source of data used:	"CO_2 Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value applied:	2007– 08: 0.71332
Justification of the choice of data or description of measurement methods and procedures actually applied :	Build Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with ACM0002.

B.6.3 Ex-ante calculation of emission reductions:

>>

Ex-ante calculation of emission reductions is equal to ex-ante calculation of baseline emissions as project emissions and leakage are nil.

Baseline emission factor (combined margin)
= 927.18 tCO_2e/GWh

Annual electricity supplied to the grid by the Project
= 31.2 MW (Capacity) x 26.5% (PLF) x 8760 (hours) / 1000 GWh
= 72.427 GWh

Annual baseline emissions
= 927.18 tCO_2e/GWh x 72.427 GWh
= 67,153 tCO_2e

B.6.4 Summary of the ex-ante estimation of emission reductions:
>>

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
01 June 2009 – 31 March 2010	0	55,747	0	55,747
01 April 2010 – 31 March 2011	0	67,153	0	67,153
01 April 2011 – 31 March 2012	0	67,153	0	67,153
01 April 2012 – 31 March 2013	0	67,153	0	67,153
01 April 2013 – 31 March 2014	0	67,153	0	67,153
01 April 2014 – 31 March 2015	0	67,153	0	67,153
01 April 2015 – 31 March 2016	0	67,153	0	67,153
01 April 2016 – 31 March 2017	0	67,153	0	67,153
01 April 2017 – 31 March 2018	0	67,153	0	67,153
01 April 2018 – 31 March 2019	0	67,153	0	67,153
01 April 2019 – 31 May 2019	0	11,407	0	11,407
Total estimated reductions (tonnes of CO_2e)	**0**	**6,71,530**	**0**	**6,71,530**

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

>>

Data / Parameter:	**EGy**
Data unit:	MWh (Mega-watt hour)
Description:	Net electricity supplied to the grid by the Project
Source of data to be used:	Electricity supplied to the grid as per the tariff invoices raised on KPTCL/HESCOM.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Annual electricity supplied to the grid by the Project = 31.2 MW (Capacity) x 26.5% (PLF) x 8760 (hours) MWh = 72.427MWh
Description of measurement methods and procedures to be applied:	Metering system for the project activity consists of one main and one check meter. Both the meters are **two-way trivector meters capable of recording import and export of electricity** and provide output in the form of net electricity supplied to the grid. The procedures for metering and meter reading will be as per the provisions of the power purchase agreement. Refer Annex – 4 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by KPTCL/HESCOM pursuant to the provisions of the power purchase agreement. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data (electricity supplied to the grid) will be archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity whichever occurs later.

B.7.2 Description of the monitoring plan:

>>

Approved monitoring methodology ACM0002 Version 09 Sectoral Scope: 1, "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", by CDM – Meth Panel is proposed to be used to monitor the emission reductions.

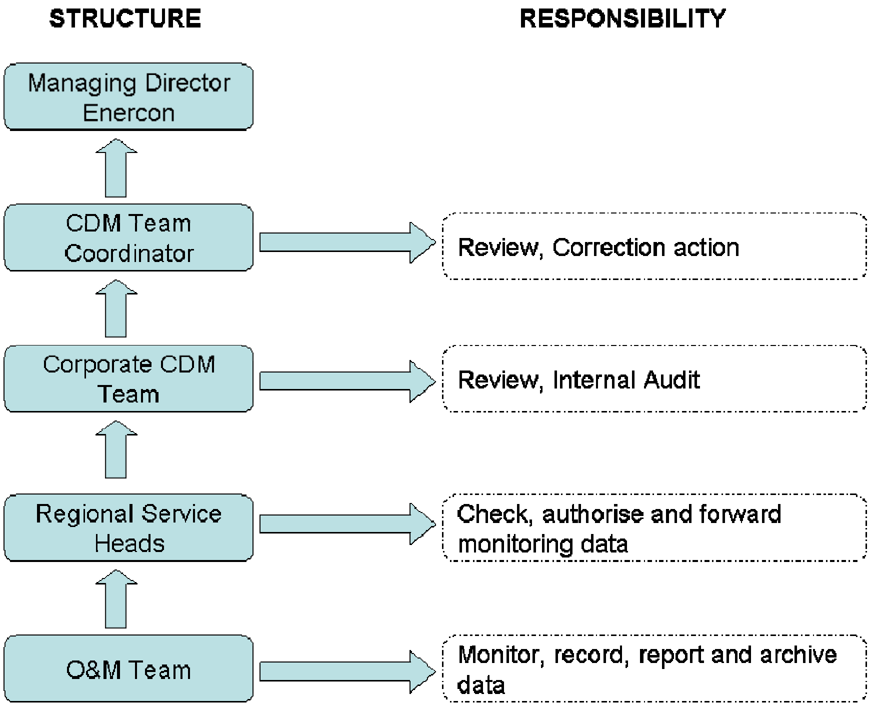
This approved monitoring methodology requires monitoring of the following:

- Electricity generation from the project activity; and
- Operating margin emission factor and build margin emission factor of the grid, where *ex post* determination of grid emission factor has been chosen

Since the baseline methodology is based on ex ante determination of the baseline, the monitoring of operating margin emission factor and build margin emission factor is not required. Further, wind based electricity generation is not associated with any kind of leakages. Hence, the sole parameter for monitoring is the electricity generated by the project and supplied to the grid.

The Project is operated and managed by Enercon (India) Limited. Enercon India Limited is an ISO 9001:2000 certified Quality Management system from Germanischer Lloyd. Enercon India Limited follows the documentation practices to ensure the reliability and availability of the data for all the activities as required from the identification of the site, wind resource assessment, logistics, finance, construction, commissioning and operation of the wind power project.

The operational and management structure implemented by Enercon is as follows:



The accuracy of monitoring parameter is ensured by adhering to the calibration and testing procedure. The project will adhere to all the mandatory regulatory and statutory requirements at the state as well as national level.

Training and maintenance requirements:

Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the Wind Energy Converters (WECs), it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that Enercon's service staff is deft at handling technical snags on top of the turbine, the necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. The Enercon Training Academy provides need-based training to meet the training requirements of Enercon projects. The training is contemporary, which results in imparting focused knowledge leading to value addition to the attitude and skills of all trainees. This ultimately leads to creativity in problem solving.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>
Date of completion: 01 February 2008

Name of responsible person/entity: **M/s. Generacion Eolica India Limited.** (a Project Participant) and their CDM consultant (not a Project Participant)

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
15 March 2007 being the date of placement of purchase order for the wind energy generators.

C.1.2. Expected operational lifetime of the project activity:

>>
20 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>> Not Applicable.

C.2.1.2. Length of the first crediting period:

>> Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01 June 2009, being the date on which the Project is expected to be Registered.

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

GEI gave the responsibility to Enercon for conducting EIA for its projects. Enercon appointed Care Sustainability to conduct rapid environmental impact assessment study for the wind power project of GEI to assess the impact of the project on the local environment.

Environmental Impact Assessment (EIA) of this project is not an essential regulatory requirement, as it is not covered under the categories as described in EIA Notification of 1994 or the Amended Notification of 2006. However, GEI conducted the EIA to study impacts on the environment resulting from the project activity.

The EIA study included identification, prediction and evaluation of potential impacts of the CDM activities on air, water, noise, land, biological and socio-economic environment within the study area. The ambient air concentrations of Suspended Particulate Matter, Respirable Particulate Matter, Oxides of Nitrogen, Sulphur Dioxide and Carbon Monoxide were monitored and were found under limits as specified by CPCB. The noise levels were observed through out the study period and were found to be in the permissible range. Water quality monitoring studies were carried out for determination of physiochemical characteristics of bore wells. The ph level of water was found to be under the specified limits.

The study area represents part Gadag district. The project area doesn't fall under any protected land for wildlife and it has no adverse ecological impacts on the surroundings, flora and fauna found in the vicinity of the project area. The wind-farms do not affect the path of migratory birds.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

EIA demonstrated that there is no major impact on the environment due to the installation and operation of the windmills. The local ecology is not likely to get impacted by this type of project activity. The local population confirmed that there is no noise or dust nuisance due to windmills. The EIA also ruled out any adverse impacts due to the project activity.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

The comments from local stakeholders were invited through a local stakeholder meeting conducted in Gadag District on 23 November 2007. GEI identified local communities, farmers, officials of Gram Panchayat and O & M contractor Enercon as the most important stakeholders with an interest in the CDM activities. The local stakeholder consultation meeting had representatives from the nearby villages and representatives of Enercon. The minutes of the meeting are set out in Appendix 1.

E.2. Summary of the comments received:

>>

The queries/comments from local villagers during meeting in Gadag district included:

- Comment that there is a significant impact on the economic and social life in and around Gadag villages due to the wind power project.
- The nature of benefits that local stakeholders will get.
- Query on effect on rainfall due to wind turbine.
- Query on impact on crops.
- Query on impact on flora and fauna.

E.3. Report on how due account was taken of any comments received:

>>

The following responses have been provided in relation to the comments received from the local stakeholders during meeting in Gadag district:

- The benefits to the local stakeholders will be through employment opportunities provided by the project in construction work and for safeguarding the project asset. It will also lead to better road connectivity to nearby towns and villages.
- There is no relation between wind turbine and rainfall. Rain is natural phenomenon and is not affected.
- There is no noise because of the wind turbines on the account of the gearless technology of Enercon.
- There is no damage to the crops since the wind turbine machines are running 50 meters above.
- There is no effect on flora and fauna because of project activity.
- No water draining or soil erosion occurs due to wind turbine.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	**M/s. Generacion Eolica India Limited**
Street/P.O.Box:	3, Amrit Keshav Nayak Marg, Fort
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State/Region:	Maharashtra
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FAX:	+91-22-22072666
E-Mail:	jjaguerrea@eolicanavarra.es
URL:	
Represented by:	Mr. Juan Jose Aguerrea
Title:	Director
Salutation:	Mr.
Last Name:	Aguerrea
Middle Name:	Jose
First Name:	Juan
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Direct FAX:	+91-22-22072666
Direct tel:	+91-22-22071721
Personal E-Mail:	jjaguerrea@eolicanavarra.es

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The Project activity does not involve any public funding.

Annex 3

BASELINE INFORMATION

The Operating Margin data for the most recent three years and the Build Margin data for the Southern Region Electricity Grid as published in the CEA database are as follows:

Simple Operating Margin

	tCO_2e/GWh
Simple Operating Margin – 2005-06	1005.67
Simple Operating Margin – 2006-07	999.12
Simple Operating Margin – 2007-08	990.62
Average Operating Margin of last three years	998.47

Build Margin

	tCO_2e/GWh
Build Margin- 2007-08	713.32

Combined Margin calculations

	Weights	tCO_2e/GWh
Operating Margin	0.75	998.47
Build Margin	0.25	713.32
Combined Margin		**927.18**

Detailed information on calculation of Operating Margin Emission Factor and Build Margin Emission Factor is available at www.cea.nic.in.

Annex 4

MONITORING INFORMATION

- **Metering:** The electricity generated by the project is metered by the Parties (KPTCL/HESCOM, the Project Participant and Enercon) at the high voltage side of the step up transformer installed at the Project Site. The delivered energy is metered by the Parties at the high voltage side of the step up transformer installed at the Receiving Station.

- **Metering Equipment:** Metering system for the project activity consists of one main and one check meter. Both the meters are **two-way trivector meters of accuracy class 0.2 capable of recording import and export of electricity** and provide output in the form of net electricity supplied to the grid. The main meter is installed and owned by the Project, whereas check meters are installed and owned by KPTCL/HESCOM. The metering equipment is maintained in accordance with electricity standards prevalent in Karnataka State. The meters installed are capable of recording and storing half hourly and monthly readings of all the electrical parameters for a maximum period of 35 days with digital output.

- **Meter Readings:** The Net electricity supplied to the grid is recorded by taking a monthly Joint Meter Reading (JMR) in the presence of Parties (Officials from off-taking Utility (HESCOM) and Enercon). The Joint meter reading contains the value of energy imported and exported and the net export to the grid during the recording period. This Joint meter reading is certified by the Executive engineer of the off-taking utility and by Enercon Officials. These certified readings are then used by the off-taking Utility (HESCOM) to prepare the tariff invoices. Thus the sole monitoring parameter for the project activity is the net electricity supplied to the grid as mentioned in the JMR, which will be crosschecked with the value mentioned in the invoices.

- **Inspection of Energy Meters:** All the main and check energy meters (export and import) and all associated instruments, transformers installed at the Project are of 0.2 accuracy class. Each meter is jointly inspected and sealed on behalf of the Parties and is not to be interfered with by either Party except in the presence of the other Party or its accredited representatives.

- **Meter Test Checking:** All the main and check meters are tested for accuracy with reference to a portable standard meter which is of an accuracy class of 0.1%. The portable standard meter is owned by KPTCL/HESCOM. The main and check meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2% accuracy class. The consumption registered by the main meters alone will hold good for the purpose of metering electricity supplied to the grid as long as the error in the main meters is within the permissible limits.

  If during the meter test checking,

  - the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the permissible limits, then the meter reading will be as per the main meter as usual. The check meter shall, however, be calibrated immediately.
  - the main meter is found to be beyond permissible limits of error, but the corresponding check meter is found to be within permissible of error, then the meter reading for the month

up to the date and time of such test shall be as per the check meter. There will be a revision in the meter reading for the period from the previous calibration test up to the current test based on the readings of the check meter. The main meter shall be calibrated immediately and meter reading for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.

- both the main meters and the corresponding check meters are found to be beyond the permissible limits of error, both the main meters shall be immediately calibrated and the correction applied to the reading registered by the main meter to arrive the correct reading of energy supplied for metering electricity supplied to the grid for the period from the last month’s meter reading up to the current test. Meter reading for the period thereafter till the next monthly reading shall be as per the calibrated main meter.
- If during any of the monthly meter readings, the variation between the main meter and the check meter is more than the permissible limit for meters of 0.2 accuracy class, all the meters shall be re-tested and calibrated immediately.

Annex 5

COST OF EQUITY CALCULATION

Calculation of Cost of Equity:

The expected return on equity has been determined using the Capital Asset Pricing Model (CAPM)[9]. The CAPM economic model is used worldwide to determine the required/expected return on equity based on potential risk of an investment. The CAPM framework is the Nobel award winning work of financial economist Dr. William Sharpe.

Ke = Rf + B x (Rm – Rf)
where:
Ke = Rate of return on equity capital;
Rf = Risk-free rate of return;
B = Beta;
Rm – Rf = Market risk premium;

Risk free rate:

The risk free rate is understood as the rate of return on an asset that is theoretically free of any risks, therefore the rate of interest on government bonds are considered as risk free rates. Page 191 of text book on "Corporate Finance Theory and Practice" by Dr. Aswath Damodaran[10] of Stern School of Business, New York University (attached as Appendix 5) describes that the long term government bond rates are suitable indicators of risk free rates since the time horizon for this investment is long term.

Accordingly the risk free rate has been taken from long dated Indian government bond rates at the project start date (which is Mar 2007) which has been considered as it was in the year of investment (i.e in that year, the company had the alternative of this long term risk free investment). The data on government bond rates is published by Reserve Bank of India. (Web-link: http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/80303.pdf)

The applicable risk free rate is 7.34%.

Risk Premium:

The most common approach for estimating the risk premium is to base it on historical data, in the CAPM, the premium is estimated by looking at the difference between average return on stocks and average return on government securities over an extended period of history [page 190, Corporate Finance Theory and Practice, Dr. Aswath Damodaran. Attached as appendix 4]. It is preferred to use long term premimums, i.e over a period of 25 years, since considering shorter time periods can

[9] The Capital Asset Pricing Model (CAPM) was published in 1964 by William Sharpe, for his work on CAPM Sharpe received the Nobel Prize in 1990. http://www.investopedia.com/articles/06/CAPM.asp

[10] Dr. Damodaran is one of the foremost authorities in the world in the field of Investment Analysis

lead to large standard errors because volatility in stock returns [page 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran. Attached as appendix 5]. It is also preferred to calculate the risk premium based on geometric mean of the returns since arithmatic mean overstates the risk premium. Geometric mean is defined as the compounded annual return over the same period [page 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran. Attached as appendix 5].

Therefore the risk premium has been calculated as the difference in compounded annual return bewteen the BSE-Sensex and the Government bond rates since the year of inception of BSE Sensex, i.e. 1979 – 80. The detailed calculations are presented in the attached excel sheet.

Source: BSE Stock Exchange (www.bseindia.com)

The applicable risk premium is 8.73 %.

Beta:

Beta (B) indicates the sensitivity of the company to market risk factors. For companies that are not publicly listed, the beta is determined by referring beta values of publicly listed companies that are engaged in similar types of business. The project activity type is wind power generation; the approach therefore should be to base the beta for the project on the beta values of listed wind power generation companies in India. However, there was only one wind energy or renewable energy power generation company (BF Utility) listed on any stock exchange in India (both BSE- Bombay Stock Exchange and NSE-National Stock Exchange) in year 2006[11]. Therefore, in the absence of adequate data on companies which are exclusively into the exactly same type of business (i.e wind power projects), the next best option for assessing the risk of these projects is to consider the data available on companies which are involved in similar businesses.

Therefore, we have considered beta values of all electricity generating companies in India. The group of companies considered includes renewable as well as conventional power generating companies. Investors demand a higher return from renewable energy projects than from conventional energy ones, given the higher risks in renewable, including risks of technology, risks from significantly varying and unpredictable resource availability (e.g. wind), and a lower established support base for such projects relative to that for conventional power (e.g. grid connections, bank finance, suppliers, etc.). The use of this Beta value is therefore considered conservative, as it does not add for the higher risk of non conventional energy.

The applicable Beta value has been determined on the basis of the Beta values of all power generating companies in India which were listed on the stock exchange at the time of this investment. Beta values of individual companies have been sourced from Bloomberg and screenshots are available in appendix 3.

The table below summarises the beta values:

Bloomberg Symbol	Company Name	Beta

[11] This can be verified from the database available at the web-link www.securities.com (This website is owned by a Euromoney Institutional Investor Company and It delivers hard-to-get information on more than 80 emerging markets through its award-winning online Emerging Markets Information Service.)

RELE IN Equity	RELIANCE ENERGY	1.02
GIP IN Equity	GUJARAT INDS	1.14
TPWR IN Equity	TATA POWER CO	1.32
NLC IN Equity	NEYVELI LIGNITE	1.15
CESC IN Equity	CESC LTD	1.71
BFUT IN Equity	BF Utility	2.37
		1.45

Source: Bloomberg[12]

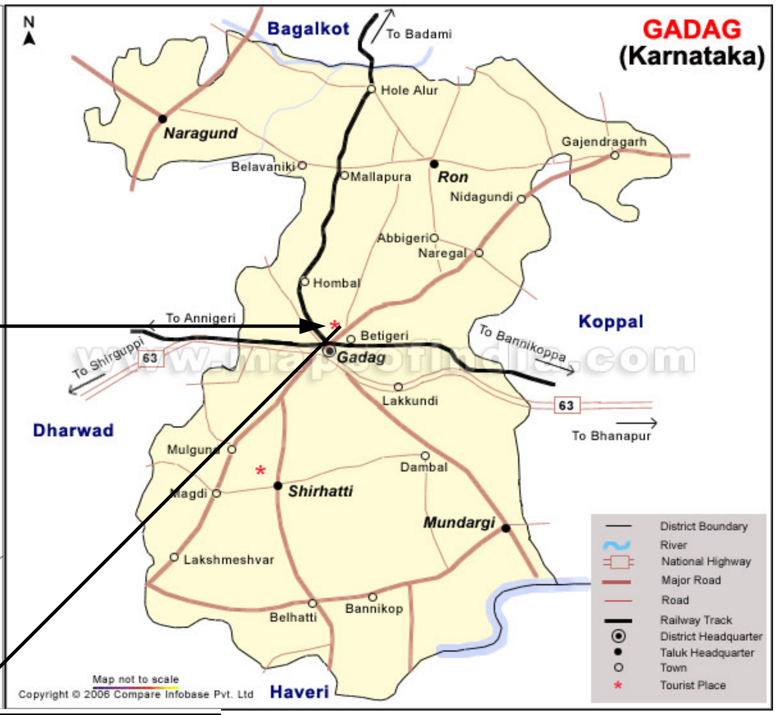
Accordingly, the benchmark cost of equity works out to: Rf + B (Rm – Rf) = 7.34% + 1.45 x 8.73%
Cost of Equity = 20.0%

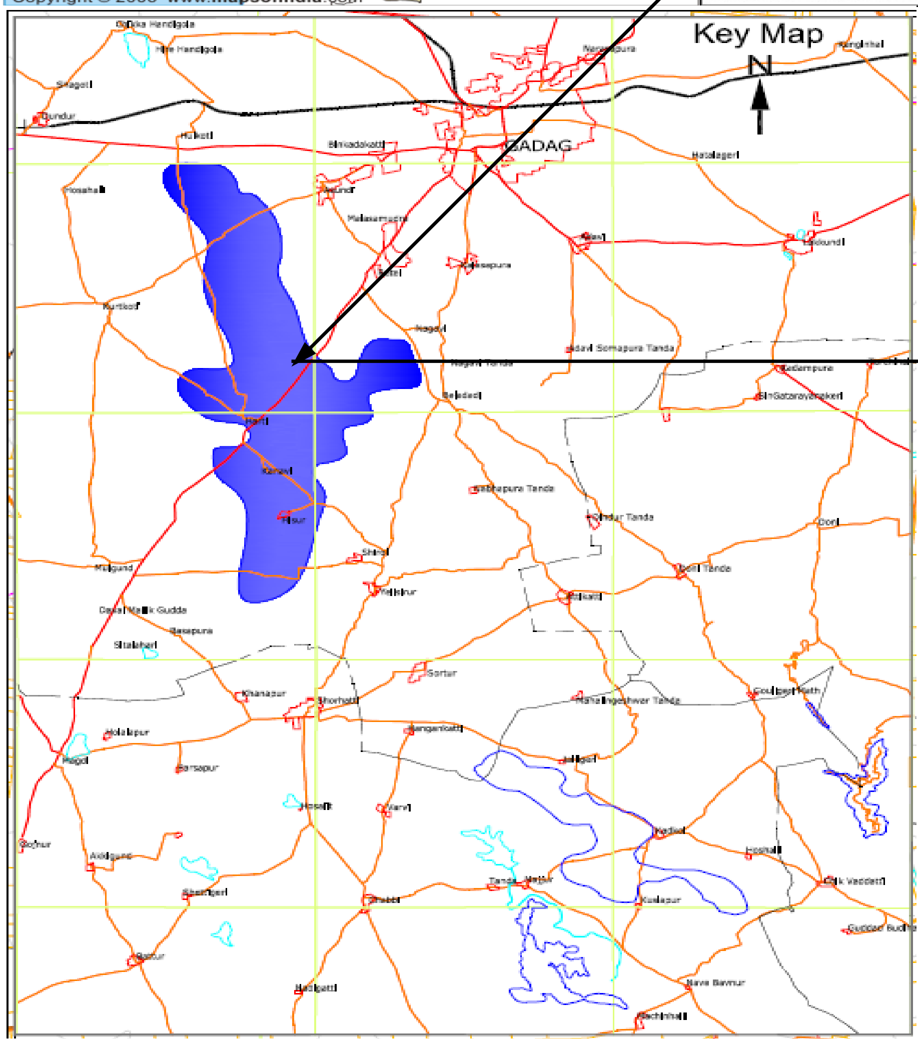
[12] The beta value used, are the regression betas calculated by Bloomberg based on periodic stock returns. Bloomberg also provides an adjusted beta value after making the following adjustments:

Adjusted Beta=Regression Beta (denoted as Raw beta) *(0.67) +1.00*(0.33)

Bloomberg states that this is a default adjustment on the assumption that in future, over a period of time all betas may tend towards the average beta i.e. one. The approach outlined in corporate finance states: the conventional approach to estimate the beta of an investment is a regression of return on investment against returns on a market index (please see attached page no. 196 from "Corporate Finance Theory and Practice by Aswath Damodaran as Appendix 6). Accordingly, the regression beta (and not the adjusted beta) value has been considered.

Appendix 1 – Location Map





Location of Project Activity: Gadag Planes Site, Gadag District, Karnataka State

Appendix 2 – Minutes of stakeholder consultation meeting

Public Stakeholder's Meeting of Clean Development Mechanism Project of Generacion Eolica India Limited, at Site – Gadag Planes, Gadag District, Karnataka State.

Venue: Enercon Office - Gadag District, Karnataka State.

Date: 23rd November 2007

Members from Villages:

1. Sri. Gurusiddappa Honnappanavar
2. Sri. Mahantesh G. Patil

and 13 Village Members.

Members from Enercon (India) Limited

1. Sri. Basavaraj Patil
2. Sri. C.B.Poonacha
3. Sri. C. Ravidhara
4. Sri. Brij Mohan

Agenda of the Meeting:

1. Welcome Address
2. Introduction and Description about Wind Farms.
3. Project Profile
4. Suggestions and Opinions
5. Queries and Responses from the Stakeholders.
6. Vote of Thanks.

1. Welcome Address and Introduction:

Sri. M. Basavaraj Patil: On welcoming the Chairperson and the Chief Guest on the dais and welcoming the Stakeholders from villages of Harti, Kurthkoti and Malasamudra. Mr. Basavaraj Patil stated that Enercon is a Wind Energy Converter Company and it generates Green power. It is an eco friendly project and there is no harm to the nature by installing wind turbine. We have been establishing wind turbine all over India since last 12 years and it is helpful in reducing the power shortage to some extent. Greenhouse Gas emission level has increased in most of the developed countries and in order to balance it, UNFCCC has developed a Kyoto Protocol to promote the projects under Clean Development Mechanism. Power generated by conventional method viz. Coal and wood firing emits more gases into the nature resulting in Global Warming. Deforestation causing climatic change and projects like Wind Energy Converts are helping in combating such type of threats to the nature, he admitted. Mr. Patil also sought wholehearted co-operation of all the villagers, leaders in establishing such projects which also participate in curbing the power crisis and helps in developing the Nation. Such projects also helps in developing the villages and increases the employment opportunities, he claimed.

2. Project Profile:

Mr. Ravidhara: Enercon is the first company which has developed a synchronised generator and it has a capacity to generate power with low wind, he said. And he described how the Wind Mill generate electricity and supply to the grid. In India Tamil Nadu stands first in generating electricity by wind energy and tapped around 10000 MW capacity there, he quoted. In Karnataka also it is planned to develop wind farms to that extent. Wind farms are successfully running in Karnataka and it is a boon to our state, he said.

3. Address by Village Leaders:

President's Speech:

Sri. Gurusiddappa Honnappanavar:

Sri. Gurusiddappa Honnappanavar in his speech observed that all human beings after taking birth have to live rich. Enercon Company, by developing wind farms in our villages, is contributing in development of the Nation. By installing these type of projects the villages are developed economically and socially. Hence we have to support in installing and developing such wind farms in our villages. We have to come forward to lend our revenue lands to such companies and help in developing the villages. We have formed a committee and already given permission from our Panchayat to establish Wind Farms in our village. There will be a positive support from our Gram Panchayat for developing your windmill project, he assured.

Chief Guest:

Sri. Mahantesh Gouda Patil:

Sri Mahantesh Gouda Patil in his address quoted that Enercon is purchasing lands in our villages and installing wind turbines. It has helped our villagers economically. Usually in our country most of the villages have less revenue since there will not be any industries in villages and establishing such industries in villages will add much tax revenue to the villages and it helps in developing infrastructure of the villages. Hence we are thankful to GEI for developing windmills in our villages. Our support will always be there, he expressed. At the same time company also cooperate with the villagers while developing the project, he claimed.

4. Suggestions and Opinions:

Sri. Basavaraj Patil: In order to establish our wind farm villagers cooperation is very badly required. Without their support we cannot do any projects. Though the company is investing money, it cannot run the project against the villager's willingness. Hence we have to win the confidence of the villagers first to establish such wind farms. So, we humbly seek the fullest support from all the villagers and we do undertake many kinds of social services in the villages he said. Since the wind velocity is very good in these villages it is feasible to establish windmills here which helps in developing such economically backward areas.

5. Questionnaire by Villagers and Answers by the Company delegates:

i) There is a feeling among the villagers that by establishing wind farms rainfall will be reduced?

Ans. Installation of windmills will reduce the rainfall is dismissed as rumour.

ii) Due to more Wind velocity the clouds are scattering and driven away. Whether it is true?

Ans. No, It is false. Maximum height of WEC is 75-100 Mtrs. Whereas the height of the cloud is much higher.

iii) Any type of damages to crops by these machines?

Ans. No, there is no damage to the crops due to running of wind mills.

iv) By installing the wind mills how it affects the birds?

Ans. There is no harm to the birds due to wind turbine installations

Sri. Bhandi:

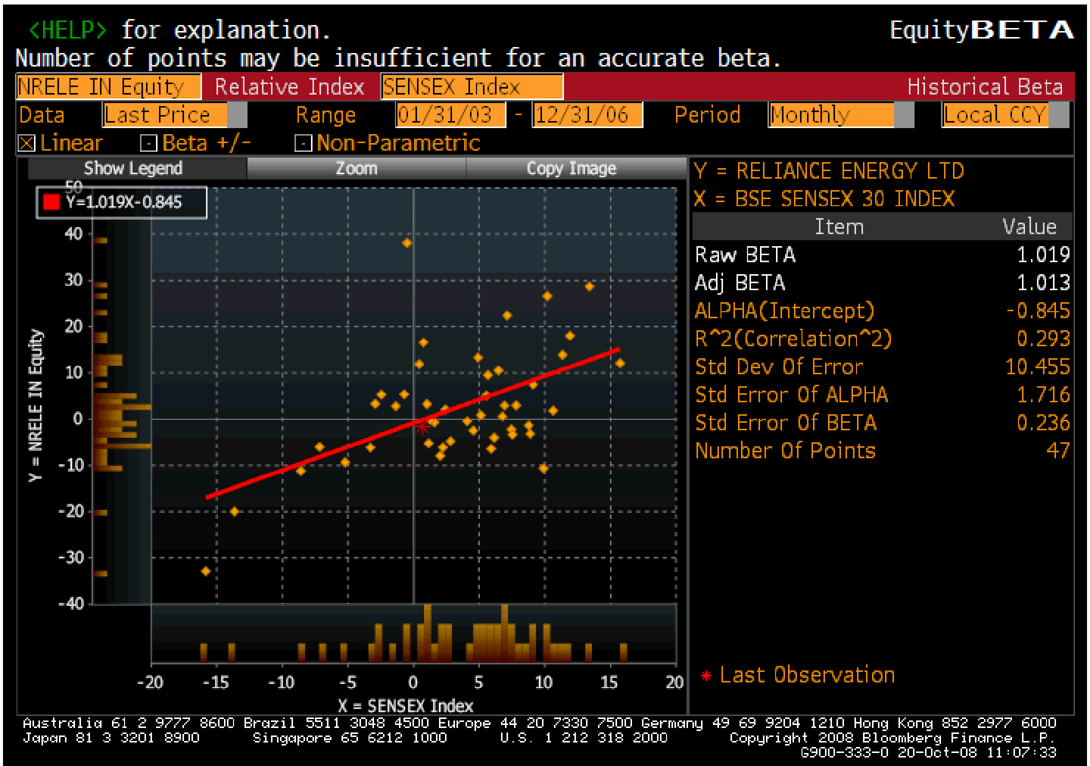
Mr. Bhandi (Teacher) has categorically informed that installation of windmills will reduce the rainfall is totally blind belief. Generating the power by best utilisation of such natural resources is scientific one and it helps in development of economy and employment opportunities.

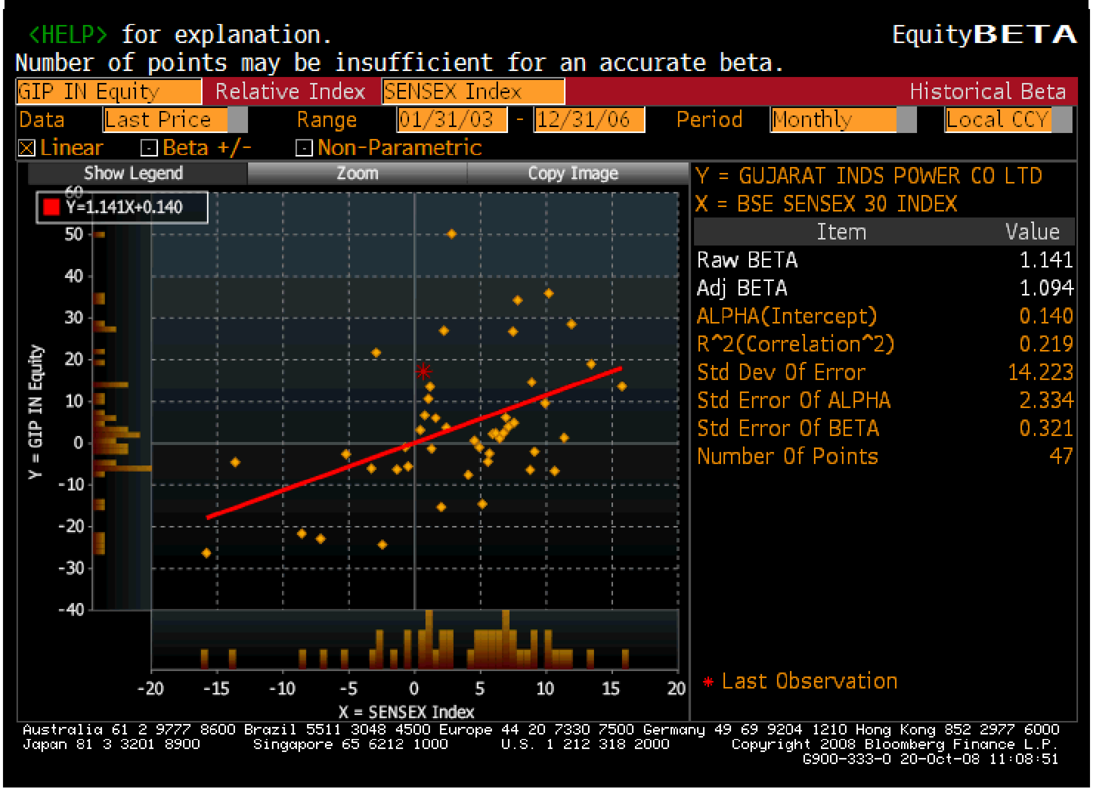
Vote of Thanks:

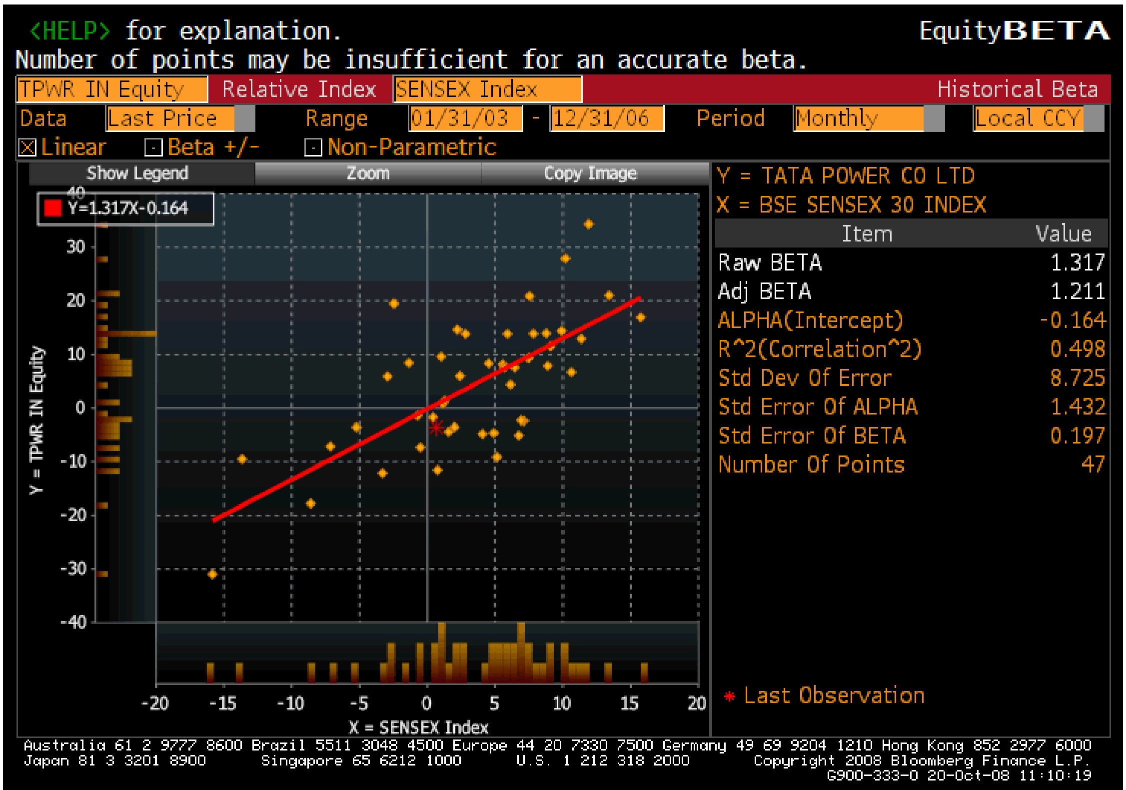
Mr. C.B.Poonacha:

Sri C.B. Poonacha has offered thanks on behalf of the company to the delegates. He also extended special thanks to all the stakeholders who have made up their valuable time to attend this meeting.

Appendix 3: Bloomberg's screenshots of individual companies for Beta Value



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EquityBETA
Number of points may be insufficient for an accurate beta.
TPWR IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
01/31/03 - 12/31/06
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Show Legend
Zoom
Copy Image
Y=1.317X-0.164
Y = TPWR IN Equity
X = SENSEX Index
Y = TATA POWER CO LTD
X = BSE SENSEX 30 INDEX
Item Value
Raw BETA 1.317
Adj BETA 1.211
ALPHA(Intercept) -0.164
R^2(Correlation^2) 0.498
Std Dev Of Error 8.725
Std Error Of ALPHA 1.432
Std Error Of BETA 0.197
Number Of Points 47
Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2008 Bloomberg Finance L.P.
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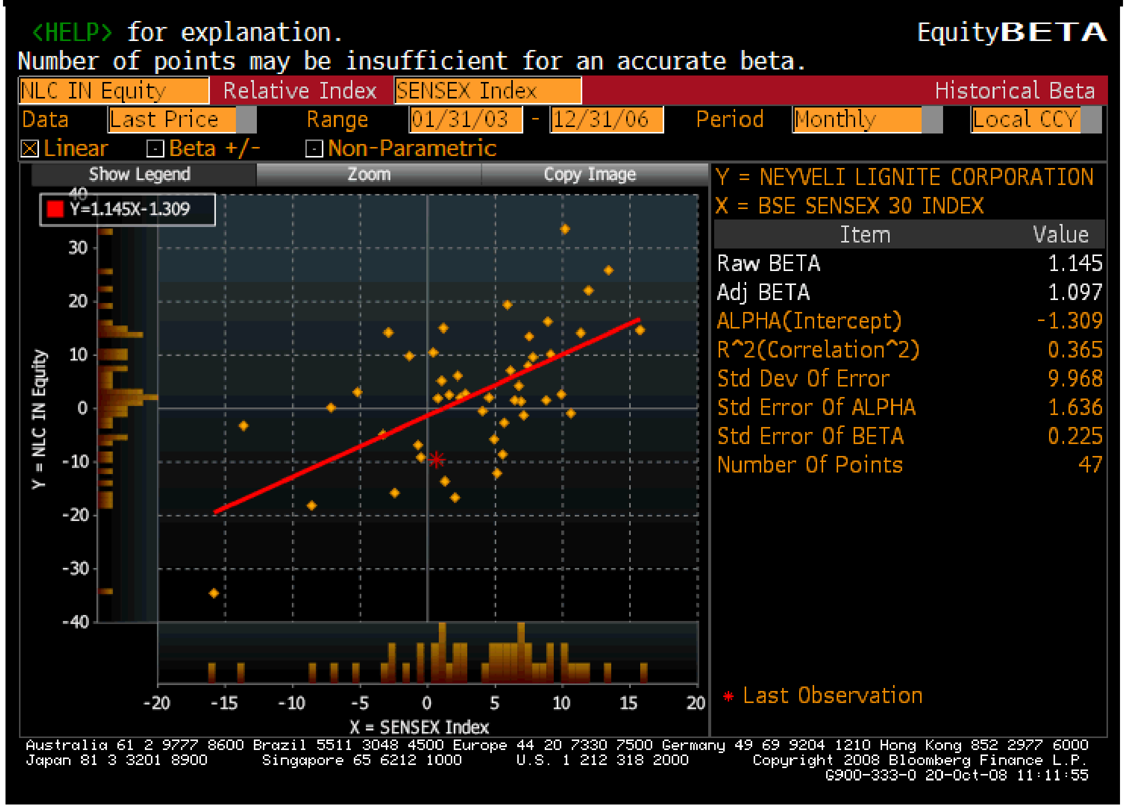
<HELP> for explanation.
EquityBETA
Number of points may be insufficient for an accurate beta.
NLC IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
01/31/03 - 12/31/06
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Show Legend
Zoom
Copy Image
Y=1.145X-1.309
Y = NLC IN Equity
X = SENSEX Index
Y = NEYVELI LIGNITE CORPORATION
X = BSE SENSEX 30 INDEX
Item Value
Raw BETA 1.145
Adj BETA 1.097
ALPHA(Intercept) -1.309
R^2(Correlation^2) 0.365
Std Dev Of Error 9.968
Std Error Of ALPHA 1.636
Std Error Of BETA 0.225
Number Of Points 47
Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2008 Bloomberg Finance L.P.
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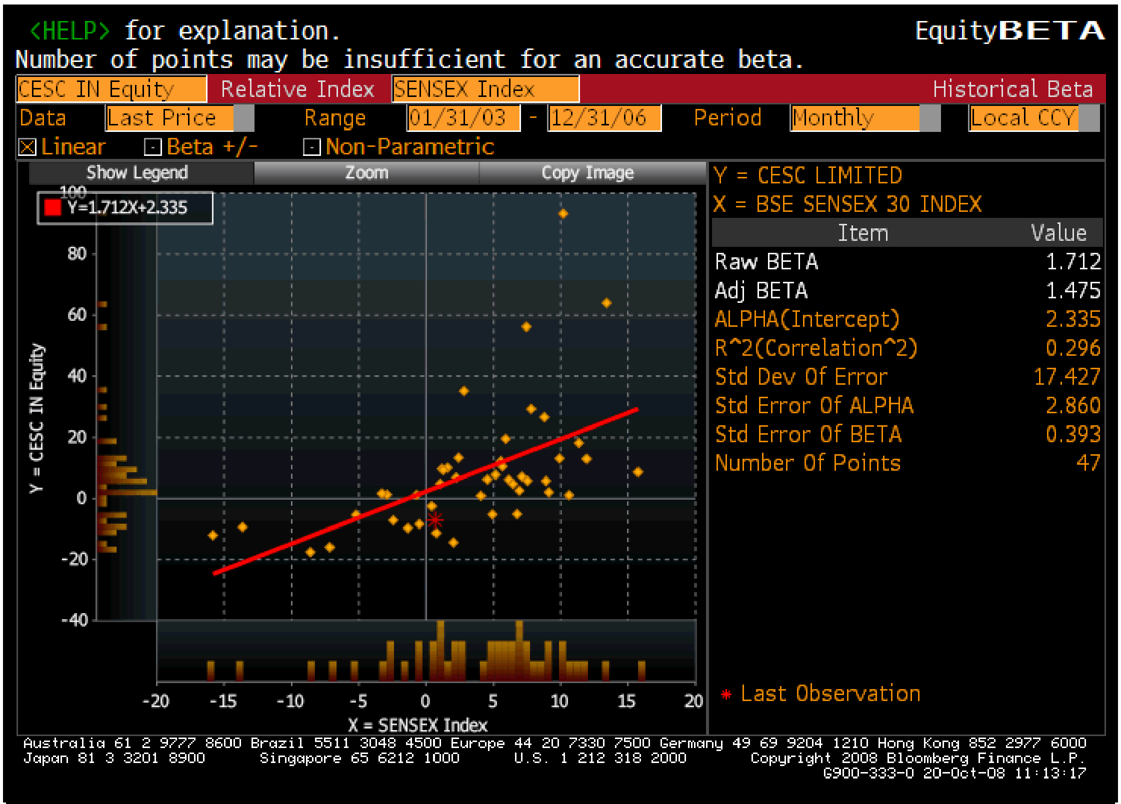
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EquityBETA
Number of points may be insufficient for an accurate beta.
CESC IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
01/31/03 - 12/31/06
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Show Legend
Zoom
Copy Image
Y=1.712X+2.335
Y = CESC IN Equity
X = SENSEX Index
Y = CESC LIMITED
X = BSE SENSEX 30 INDEX
Item Value
Raw BETA 1.712
Adj BETA 1.475
ALPHA(Intercept) 2.335
R^2(Correlation^2) 0.296
Std Dev Of Error 17.427
Std Error Of ALPHA 2.860
Std Error Of BETA 0.393
Number Of Points 47
Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2008 Bloomberg Finance L.P.
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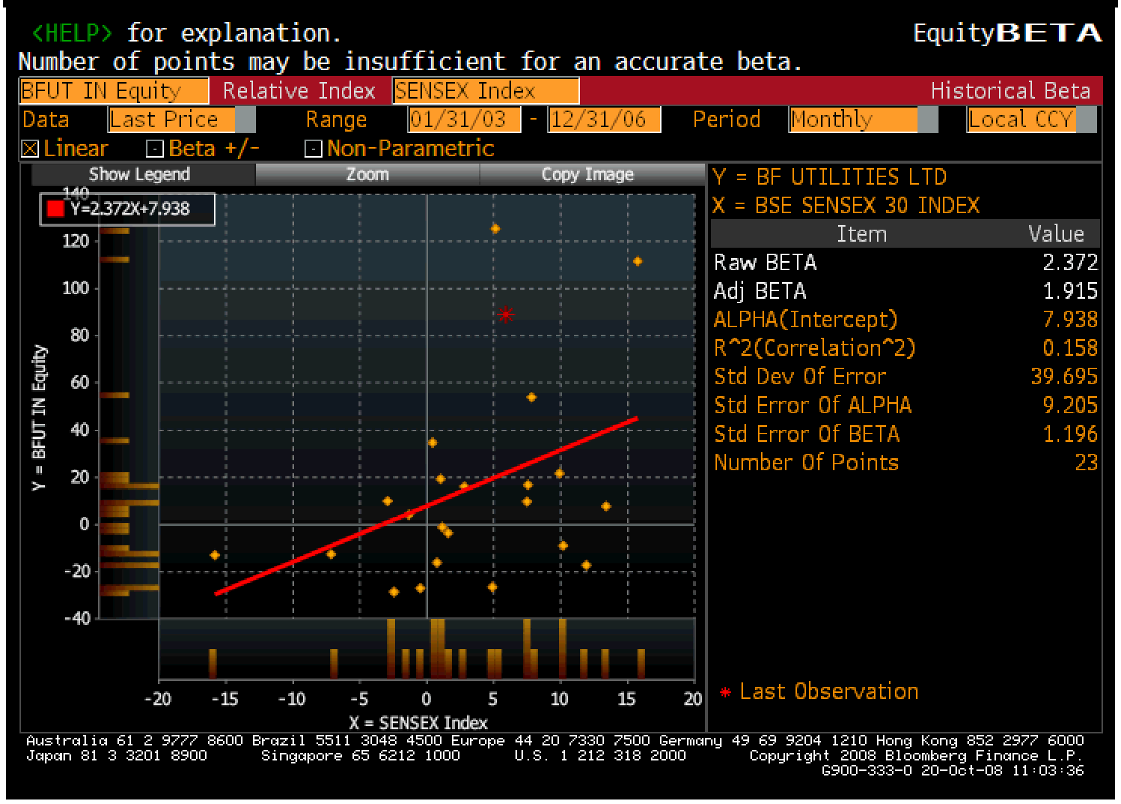
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EquityBETA
Number of points may be insufficient for an accurate beta.
BFUT IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
01/31/03 - 12/31/06
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Show Legend
Zoom
Copy Image
Y=2.372X+7.938
Y = BFUT IN Equity
X = SENSEX Index
Y = BF UTILITIES LTD
X = BSE SENSEX 30 INDEX
Item Value
Raw BETA 2.372
Adj BETA 1.915
ALPHA(Intercept) 7.938
R^2(Correlation^2) 0.158
Std Dev Of Error 39.695
Std Error Of ALPHA 9.205
Std Error Of BETA 1.196
Number Of Points 23
Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2008 Bloomberg Finance L.P.
G900-333-0 20-Oct-08 11:03:36

Appendix 4: Page 190 of text book on "Corporate Finance Theory and Practice"

- If no such securities exist in the market in which you are attempting to estimate a real riskless rate, it can be approximated by the long-term real growth rate of the economy. Thus, the real riskless rate in China may be set equal to 6% because that is what you expect the long-term real growth rate in the Chinese economy to be. It will be much lower (2–3%) for more mature, slower growth economies.

Risk Premium

The risk premium is a significant input in all the asset pricing models. In the following section, we begin by examining the fundamental determinants of risk premiums and then look at practical approaches to estimating these premiums.

What Is the Risk Premium Supposed to Measure? The risk premium measures the "extra return" that would be demanded by investors for shifting their money from a riskless investment to an average risk investment. It should be a function of how risk-averse investors are and how risky they perceive stocks (and other risky investments) to be, relative to a riskless investment. Because each investor in a market is likely to have a different assessment of an acceptable premium, the premium will be a weighted average of these individual premiums, where the weights will be based on the wealth the investor brings to the market. Investors with more wealth, like Warren Buffett, will therefore have their risk premiums weighted more than investors with less wealth.

✔ ***CQ 7.1:*** **Assume that stocks are the only risky assets and that you are offered two investment options. One is a riskless investment on which you can make 6.7%, and the other is a stock mutual fund. How much more than 6.7% would you need to be offered, on an expected basis, to pick the latter? Would you ever settle for less than 6.7%?**

Estimating Risk Premiums We look now at two ways to estimate the risk premium in the capital asset pricing model. One is to look at the past and estimate the premium earned by risky investments (stocks) over riskless investments (government bonds); this is called the **historical premium.** The other is to use the premium extracted by looking at how markets price risky assets today; this is called an **implied premium.**

Historical Risk Premiums. The most common approach to estimating the risk premium is to base it on historical data. In the arbitrage pricing model and multifactor models, the raw data on which the premiums are based are historical data on asset prices over very long time periods. In the CAPM, the premium is estimated by looking at the difference between average returns on stocks and average returns on riskless securities over an extended period of history.

In most cases, we follow these steps to find historical risk premiums. First, we define a time period for the estimation, which can range as far back as 1926 for U.S. data.[4] Then, we calculate the average returns on stocks and average returns on a riskless security over the period. Finally, we calculate the difference between the returns

[4] The most widely used database, from Ibbotson Associates, has returns going back to 1926. Jeremy Siegel at Wharton recently presented data going back to the early 1800s.

Appendix 5: Page 191 of text book on "Corporate Finance Theory and Practice"

on stocks and the riskless return and use it as a risk premium to predict future returns. When we use historical premiums, we implicitly assume that the risk aversion of investors has not changed across time and that the relative riskiness of the risky portfolio (stocks) has not changed over time either.

In calculating the average returns over past periods, a measurement question arises: Should we use arithmetic or geometric averages to compute the risk premium? The arithmetic mean is the average of the annual returns for the period under consideration, whereas the geometric mean is the compounded annual return over the same period. The following example demonstrates the difference.

Year	*Price*	*Return*
0	$50	
1	100	100%
2	60	–40%

The arithmetic average return over the two years is 30%, while the geometric average is only 9.54% ($1.2^{0.5} - 1 = 1.0954$). Those who use the arithmetic average premium argue that it is much more consistent with the framework[5] of the CAPM and a better predictor of the risk premium in the next period. The geometric mean is justified on the grounds that it takes into account compounding and that it is a better predictor of the average premium in the long term. There can be substantial differences in risk premiums based on the choices made at this stage, as illustrated in Table 7.1. The data in the table are based on historical data on stock, treasury bill, and treasury bond returns and provide estimates of historical risk premiums. As you can see, the historical premiums can vary widely depending on whether we go back to 1926, 1962, or 1981, whether we use T. Bills or T. Bonds as the riskless rate, and whether we use arithmetic or geometric average premiums.[6] Although it is impossible to prove one premium right and the others wrong, we are biased toward

- *Longer term premiums,* since stock returns are volatile and shorter time periods can provide premiums with large standard errors. For instance, the premium extracted from 25 years of data will have a standard error[7] of about 4 to 5%.
- *Long-term bond rates as riskless rates,* since our time horizons in corporate financial analysis tend to be long term, and we use the treasury bond rate as our riskless rate.
- *Geometric average premiums,* since arithmetic average premiums overstate the expected returns over long periods.[8] The geometric mean yields lower premium

---

[5] The CAPM is built on the premise of expected returns being averages and risk being measured with variance. Since the variance is estimated around the arithmetic average, and not the geometric average, it may seem logical to stay with arithmetic averages to estimate risk premiums.

[6] Booth (1999) examines both nominal and real equity risk premiums from 1871 to 1997. Although the nominal equity returns have changed over time, he concludes that the real equity return has been about 9% over this period. He suggests adding the expected inflation rate to this number to estimate the expected return on equity.

[7] Assuming that returns in individual years are independent, the standard error of a 25-year estimate can be calculated by dividing the annual standard deviation in stock prices in the United States (about 25%) by the square root of the number of years ($\sqrt{25} = 5$), yielding a standard error of 5% (25%/5) in the estimate.

[8] When we look at markets like the United States that have survived for 70 years without significant breaks, we are looking at the exception. To provide a contrast, consider the other stock markets in which one could have invested in 1926; many of these markets did not survive, and an investor would have lost much of his or her wealth.

Appendix 6: Page 196 of text book on "Corporate Finance Theory and Practice"

Betas

The second set of inputs that we need to put risk and return models into practice are the betas for investments. In the CAPM, the beta of an investment is the risk that the investment adds to a market portfolio. In the APM and multifactor model, the betas of the investment relative to each factor have to be measured. Three approaches are available for estimating these parameters. One is to use historical data on market prices for individual investments; the second is to estimate the betas from the fundamental characteristics of the investment; and the third is to use accounting data. We describe all three approaches in this section.

Historical Market Betas The conventional approach to estimating the beta of an investment is a regression of returns on the investment against returns on a market index. For firms that have been publicly traded for a length of time, it is relatively straightforward to estimate returns that an investor would have made by investing in the firm's stock each interval (such as a week or a month) over that period. In theory, these stock returns on the assets should be related to returns on a market portfolio, that is, a portfolio that includes all traded assets, to estimate the betas of the assets. In practice, we tend to use a stock index, such as the S&P 500, as a proxy for the market portfolio, and we estimate betas for stocks against the index.

The standard procedure for estimating betas is to regress stock returns (R_j) against market returns (R_m).

$$R_j = a + bR_m$$

where

a = Intercept from the regression

$$b = \text{Slope of the regression} = \frac{\text{Covariance}(R_j, R_m)}{\sigma^2_m}$$

The *slope* of the regression corresponds to the beta of the stock and measures the riskiness of the stock.

The *intercept* of the regression provides a simple measure of performance of the investment during the period of the regression, when returns are measured against the expected returns from the capital asset pricing model. To see why, consider the following rearrangement of the capital asset pricing model:

$$R_j = R_f + \beta(R_m - R_f)$$
$$= R_f(1 - \beta) + \beta R_m$$

Compare this formulation of the return on an investment to the return equation from the regression:

$$R_j = a + bR_m$$

Thus, a comparison of the intercept (a) to $R_f(1 - \beta)$ should provide a measure of the stock's performance, at least relative to the capital asset pricing model.[14] In summary, then:

[14] The regression is sometimes calculated using returns in excess of the riskless rate, for both the stock and the market. In that case, the intercept of the regression should be zero if the actual returns equal the expected returns from the CAPM, greater than zero if the stock does better than expected, and less than zero if it does worse than expected.