Detailed Project Report

For

Gerneracion Eoilca India Private Limited

Prepared By:
Enercon (India) Limited

Index

1 Executive Summary

1.1 Introduction

GENERACION EOLICA INDIA PVT. LTD. (GEINDIA) is a Private Limited Company incorporated under Indian Laws. It is promoted by Eolica Navarra, S.L. (EN) and Generacion Eolica Internacional (GEI), S.L. This shall act as an SPV to set up wind energy projects in India for Ebro Energia Group of Spain. Ebro Energia is the parent body of EN and GEI.

Enercon (India) Limited (EIL), a closely held and non-listed company was incorporated in the year 1994. It is a subsidiary of Enercon GmbH, Germany, the third largest manufacturer of Wind Energy Generator (WEG) in the world. It has pioneered the gearless technology, which has a better generation than any equivalent WEG, with lower operating cost as well. EIL has a financial and technical collaboration with Enercon GmbH for manufacturing and selling of sophisticated WEGs. Enercon India Limited is the EPC & O&M contractor for the project

1.2 Salient Features Of The Project

The promoter of the SPV i.e. EN and GEI will contribute 25% of the total project cost as own contribution and the remaining 75 % will be in the form of a long-term debt. The Wind Turbine which will be used for this Project are 39 nos. Enercon make E – 48 which have a rated capacity of 800 KW totalling 31.20 MW. The project will sell power to the Discom on the basis of an executed 10 year Power Purchase Agreement (PPA) with a pre-determined tariff structure i.e Rs.3.40 for 10 years. Thereafter the tariff will be as per commission's order. The regulatory commission in India considers it appropriate to provide 16% ROE for computation of tariff. Therefore, tariff beyond the period of 10^{th} year is computed in the financial model providing 16% ROE and providing for recovery of cost.

GEI INDIA has placed orders on EIL for setting up the above project. Further, it will also enter into an agreement with EIL for Operation and Maintenance (O & M) of the proposed wind farm.

1.2.1 Site Location

The proposed site is near a small village kurtkoti (not in map), in Gadag district, Karnataka State.

Kurtkoti is well connected from Gadag road. Belgaum is well connected by rail, and the nearest airport is also at Hubli , which is around One and half hour drive by road from the proposed site. The site is about 15 km towards North West of Kapathaguda and is a declared windy site by the MNES (Ministry of Non-conventional Energy Sources, Govt. of India.

1.2.2 Approval from Regulatory Authorities

GEI INDIA shall obtain the necessary approvals from KREDL/ State Government for setting up of the project.

2 The Developers & EPC Contractors

2.1 Enercon (India) Limited

Enercon (India) Limited (EIL), a closely held and non-listed company was incorporated in the year 1994. It is a subsidiary of Enercon GmbH, Germany, the second largest manufacturer of Wind Energy Generator (WEG) in the world. It has pioneered the gearless technology, which has a better generation than any equivalent WEG, with lower operating cost as well. EIL has a financial and technical collaboration with Enercon GmbH for manufacturing and selling of sophisticated WEGs.

Enercon GmbH has a 56% shareholding in the equity capital of EIL with the Mehra family holding the balance stake.

EIL currently has three manufacturing units in Daman with the state of art facilities, where it manufactures WEGs. Its two models are the E-33, a 300 KW machine , E-48, an 800 KW machine.

EIL had set up wind farms in seven states, namely Maharashtra, Tamil Nadu, Karnataka, Gujarat, Madhya Pradesh, Andhra Pradesh and Rajasthan. The total installations by EIL in India are around 2426 nos. WEGs totalling 1520 MWs as on 1st March 2007. Some of the major customers of EIL are Madras Cements, Pidilite Industries, Bharat Forge, Tata Power , G.I. Power Corporation, BSES, Parle Products, Bannari Amman Sagar Group, Ghodawat Group, Shriram Group etc.

EIL has been accredited with ISO 9002 for manufacturing, installation and services.

For More information on Enercon (India) Limited please refer to its website www.enerconindia.net

2.2 Enercon GmbH, Germany

Enercon GmbH (EG) was established in 1984 by Dr. Dipling Aloys Wobben, an electrical engineer and an authority on wind energy, to harness the tremendous potential of the wind energy market

EG is currently among the top 3 manufacturers of wind turbines in the world. EG is a pioneer in the gearless technology, which gives superior generation at a lower operating cost. It commenced production of gearless wind turbines in 1993 in response to high demand and the fundamental advantages in terms of output, reliability and service life. All key components such as the rotor, the ring generator and the grid feeding system are developed and manufactured in-house

EG's production facilities are based in Germany, Sweden, Brazil, India and Turkey and the total production area covered is approx. 300,000 square meters. EG has sales offices in 17 countries. The company's turnover in the financial year ending December 2004 was approximately Euro 1.40 bn

For More information on Enercon GmbH please refer to its website www.enercon.de

2.3 Commercial Aspect of Wind Power Projects

Wind has emerged as the fastest growing energy potential in the 1990s and expanding as the gross annual rate of 25% on the average in the last three decades. Over the last five years, the average annual growth of wind based turbine generators worldwide has been in the region of 25 %. Technological advances in the wind-generated designs have propelled this kind of growth. One of the main features has been the development of efficient flywheel and gearbox technology along with advance research in aerodynamics, which has enabled design of wind generators operating at variable speed ranges and at lower costs. The technology advancements improve wind capture; reduce mechanical stresses in the turbine design, thereby enhancing the life cycle of the WECs.

Even for that matter, the O&M (Operation and Maintenance) costs have dropped in the region of 1.25 to 1.50 cents per kWh (Rs. 0.40-Rs. 0.60 per kWh). These figures are likely to improve further due to advancements in the wind power generator design in the future. One of the most crucial features of improvement has been the fact that the wind power generation availability factors have now scaled upwards to a figure of 95% than the earlier range of 60%.

3 The Project

GEI INDIA shall commission the 31.2 MW Wind Energy Project consisting of 39 E-48 WECs at Harti, Kurtkoti and Mallasamudra in Gadag district, Karnataka State. The EPC suppliers i.e Enercon India Limited had mandated Centre for Wind Energy Technology, Chennai (CWET) for carrying out the wind and site assessment. CWET will submit its report in May 2007, which will exhaustively discuss the site, the wind and the generation estimates for the project. The extract of the generation estimate of Enercon is enclosed herewith as Annexure. The idea to mandate CWET is to have a third party review of the generation estimate.

3.1 Proposed Wind Farm

The proposed wind farm will be set up with the erection of 39 number of the E-48 model, a 800 KW machine.

The E-48 is suited for use both in central grid regions and in remote locations a long way from the mains electricity grids. It owes this remarkable flexibility to the development of an intelligent ENERCON grid feeding system: state-of-the-art technology for today's and tomorrows needs. Technical specifications of the E-48 are given in table 1 below.

Technical details of E 48 WEG

Particulars	
Rated Capacity	800 Kw
Rotor diameter	48 m
Hub Height	57 m/75 m
Rotor	With pitch control

Type	Upwind rotor with active pitch control
Direction of rotation	Clockwise
Number of blades	3
Blade material	Fibreglass (reinforced epoxy) with integral lighting protection
Rotor speed	Variable, 12-29 rpm
Pitch Control	3 synchronised blade pitch system with emergency supply Generator with drive train
Hub	Rigid
Bearings	Tapered Roller bearings
Generator	Synchronous Type
Grid feeding	Enercon Inverter
Braking System	3 independent aero Brakes
Yaw Control	Active Through Adjustment Gears, Friction Damping
Cut-in wind speed	2 .5m/s
Rated wind speed	12 m/s

3.2 Evacuation Plan

The power generated from the wind farm requires systematic studies to choose techno economical feasible power evacuation scheme which can sustain the efficient power evacuation over a period of years.

The important consideration in power evacuation system is the availability of the required grid voltage in the vicinity of the site. In the event of the available grid voltage in the vicinity is in question and is not matching with the requirements, suitable system voltage to be adopted and then stepped up to suit the Grid voltage.

The voltage for the proposed project are selected based on the following parameters.

- Quantum of Power to be evacuated
- Distance involved in transmission of the power
- Grid voltage available in the vicinity of the project site.

An extensive load flow studies has been performed with help of MI-Power software package to bring out an optimal and efficient solution for a given set of input parameters such as conductor type, voltage levels, distance etc.

The above analysis brings out objective of building an efficient reliable and economical 'Evacuation scheme'.

Existing KPTCL Infrastructure to Evacuate the Power. The Grid network in the region and the Upstream is quite dense.

We have a Double Circuit 220Kv Line passing through our Proposed Wind farm which is Originating from KPTCl's substation at Hubli and Terminating at the KPTCL's station at Lingapur. The Length of this Line is about
150 Kms . On One circuit of this line the 220/110 Kv Gadag Substation is connected through a LILO arrangement.

The Hubli substation is Fed from the 400/220 Kv Power Grid Corporation Limited (PGCL) Substation at Narendra Village . The 220 circuit line of PGCL's at Narendra village is further connected on the Upstream to Belgaum, Chikodi and further to the Interstate Line of Maharastra. Hubli and Belgaum happens to be one of the load centers where ample large scale & small scale industries are operating.

After the study of Power Evacuation Facility available in the vicinity of the Project ,a LILO (Line in Line Out) arrangement on second Circuit of the 220 KV line between Hubli and Lingapur has been identified as the most appropriate Scheme for the Evacuation of the Power from the above Project.

From the Performance Records of the Grid it is inferred that the Grid is Healthy and it is expected that the entire quantum of Power proposed to be evacuated from this project can be done without any constraints.

EIL's Proposed Evacuation Scheme.

The power from the WEC is generated at 400V and in normal practice this 400V needs to be stepped up to either 11KV or 22KV or 33 kV in order to minimize on the Transmission losses.

Though adopting 33 kV system is costlier, considering the advantages of the 33 kV system in terms of transmission losses 33 kV voltage system is chosen.

The power from the WEC which is of 400V is stepped up to 33 kV using a Tower mounted unit transformer, and is transmitted to the First stage pooling structure, where the energy generated from a group of individual WECs will be pooled.

There can be several First stage pooling structures depending on the terrain and grouping of the machines. The transmission from the individual WECs to the first stage pooling structure would be on 33 KV single circuit over head line with `RABBIT/COYOTE/PANTHER/LYNX conductor supported on 200 X 100 RSJ / 175 x 85 RSJ Poles and fitted with V-X Arms.

For the sake of convenience these 33KV Transmission lines interconnecting the machines are termed as Internal Lines. The first stage pooling structure shall have 33KV Vacuum Circuit Breaker depending on the number of WECs in the group and shall comply with the statutory requirements of Electrical Inspectorate and IE Rules.

The power collected at the several first stage pooling structure will have to transmitted to a common place where all the generated energy from the entire windfarm shall be pooled together.

This is the Second stage pooling and is essentially at the Evacuating Station proposed to be built at a convenient location to windfarm. This location has been identified near the village Nagavi

The transmission of power from the First stage to the Second stage pooling points is planned to be done on 33 KV Single/Double circuit over head lines with `COYOTE / PANTHER` conductor depending on the requirements supported on 200 X 100 RSJ Poles and fitted with V-X Arms.

For the sake of convenience these 33KV Transmission lines are termed as External Lines. The lengths of these lines are estimated to be varying between 5 Kms to a longest of 15 Kms.

In order to connect to the KPTCL's grid the voltage levels at the windfarms have to match with that of KPTCL's grid and essentially for the techno – commercial reasons.

The voltage that is suitable for evacuating the entire power from the windfarm is to adopt 220KV considering the quantum of Power and the distance from the Enercon's pooling station. Hence, the 33KV received from the windfarm needs to be stepped up to 220KV levels.

This calls for an Evacuating station with 33KV/220KV references to be constructed with adequate size of Power Transformers for evacuating the power generated from all the windfarms.

The 220/33 kV Evacuating substation will be equipped with Two nos of 100 MVA power transformers with all necessary protection schemes and accessories what so ever required for the completion of the Evacuating Station.

This evacuating station is planned to evacuate a total of 182.4 MW of wind power generation. After being stepped up to 220KV levels a Transmission line of 220 KV Double circuit overhead transmission line with Drake ACSR conductor will be run for a distance of 1 Kms and get connected to the KPTCL's 220 KV DCOH (Line in Line out {LILO }) line running between KPTCL's Hubli Substation and KPTCL's Lingapur Station

4 Cost Structure

The total cost of the project is estimated to be Rs 15991 lakh and the proposed means of finance is as follows:

Means of Finance

Particulars	Rs in lakhs
Own Contribution	4,000.0
Long Term Debt	11,991.0
Total	**15,991.0**

4.1 Securities Offered

The long-term loan will be backed by the following securities:

- Mortgage of the Project Land.
- Hypothecation of the Plant and Machinery for the Project.
- Trust and Retention Account Agreement for the Project revenues.
- Assignment or Project documents by way of English mortgage.

4.2 Returns

The project returns for the project activity is estimated at 8.06% and equity returns are estimated at 6.11% which are low for the investment to made in the project activity.

The project activity is eligible under Kyoto protocol to earn CDM revenues. After incorporating CDM revenues, project and equity returns are projected as 13.57% and 16.55% respectively which may be considered appropriate for investment in wind power projects in India.

Therefore it is important to run the CDM registration process in parallel with implementation of the project activity and appropriate steps being taken to secure the same to make the project financially viable.

5 Industry Overview

5.1.1 Industry Overview

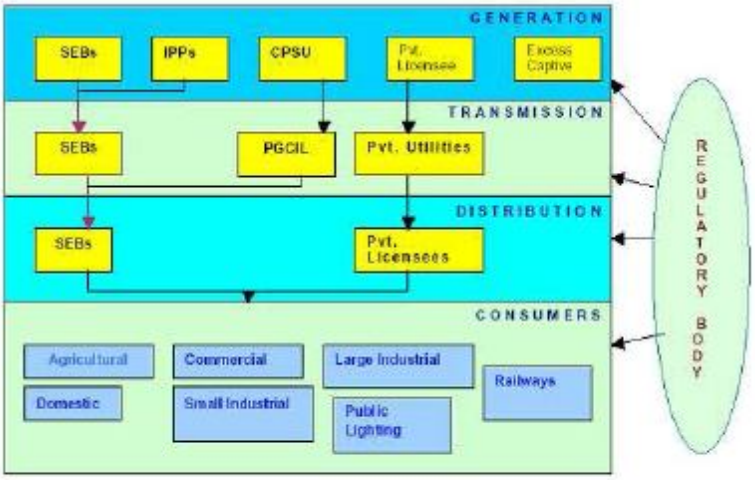
India is currently ranked fifth in the world in total energy consumption and has invested over Rs 1,000 bn since independence on development of the power sector. The installed power capacity as at FY 2004 was about 112,000 MW. The annual per capita consumption, at about 350 kWh is among the lowest in the world and still faces a continuous deficit of 8-10%.

Based on the 16th Electric Power Survey report, it has been estimated that, to ensure Power on Demand, additional power generating capacity of almost 1,00,000 MW needs to be added by 2012. This would amount to doubling the capacity installed in the last half century, in the coming decade. This would also necessitate mobilization of substantial resources including for investments in the Transmission and Distribution (T&D) sector. It has been estimated that in order to achieve the above targets, India would require financing of Rs. 90,000 crores.

5.1.2 Industry Structure

The power sector in the country is almost vertically integrated, with the State Electricity (SEBs) owning the generation, transmission and distribution business. In addition to own generation, SEBs source power from Joint Venture projects, Private Utilities and Central Public Sector Units

While interstate transmission of power is the responsibility of the Power Grid Corporation of India, SEBs look after the transmission and distribution of electricity within their respective states. A few states have allowed private utilities to undertake distribution in identified areas Power is placed in the list of concurrent subjects under the Indian Constitution with the Center and the States both having jurisdiction. A schematic presentation of the organization of the power sector is given below:



5.1.3 Demand and Supply Conditions

India suffers from power shortages in most regions. The demand –supply gap is expected to persist in the future, as the increase in capacity required to meet the demand is large. The demand growth is expected to grow at a Compounded Annual Growth Rate (CAGR) of 9 % annually.

Demand and Supply Condition

	2003-04			2002-03		
(Mn. KWh)	Demand	Supply	Surplus/ (Deficit) (%)	Demand	Supply	Surplus/ (Deficit) (%)
North	161595	152743	(5.5)	156610	144218	(7.9)
West	191680	171236	(10.7)	180877	157126	(13.1)
South	144372	136844	(5.2)	140316	130229	(7.2)
East	54977	52287	(4.9)	51653	50260	(2.7)
North - East	6640	6288	(5.3)	5298	5606	5.8
All India	**559264**	**519398**	**(7.1)**	**534754**	**487439**	**(8.8)**

Source: CRIS INFAC

In order to improve the financial situation of the power sector, it has become necessary to remove the inherent inefficiencies in the distribution of power. The approach adopted is to create several distribution zones and then privatise them over a period of time. These distribution zones have been carved out in a manner to give each of them a more or less equal prospect of becoming financially viable over a period of time by providing them roughly the same kind of consumer mix in terms of urban-rural and industrial-non industrial consumers.

In the next 10 years, new capacity additions of about 1,00,000 MW is required to be added to meet this demand. This is equivalent to 80% of the current capacity and entails substantial investment and privatisation of distribution.

5.2 Emerging Energy Market

Power Trading Corporation (PTC): PTC was set up to facilitate the Mega Power Project (MPP) Scheme wherein the MPP would not supply power to just one particular SEB but to several SEBs. Under this scheme, the MPP actually negotiates only a single Power Purchase Agreement with PTC, which in turn enters into specific PPAs' with various SEBs. PTC would eventually facilitate power trading by moving towards a higher efficiency in the whole of the power sector, providing open access to all generators and giving consumers a choice of electricity supplier.

Future Market: In the future, there will be market operators taking control of the retail market for power. They will be responsible for load forecasting on the short, medium and long term basis, and will also enter into supply agreements on the best price, quality and reliability criteria.

Such a restructuring will create a dynamic market resulting in more generating capacities, broader fuel mix, reduced prices and improved standards of service. Since the market will be open and more competitive, downtime of the transmission lines and equipment will be better controlled.

There will also be a dynamic tariff structure based on the time of the day, i.e. separate charges for the peak and off peak hours, and regional imbalances within India would not exist. These tariffs would also be negotiated directly between the buyer and the seller. Forward trading in tariffs is also possible with forward tariffs based on the time of the day or the season. However wind power generation suffers from the disadvantage of being schedules because of its infirm nature.

Opportunities for Low Cost Producers and Distributors of Energy: In the emerging scenario where the IPP would directly negotiate with the customer for sale of power and price would be market determined, efficiency in production would be the value driver for power projects. The cost / MW of electricity generated would be the most important factor affecting profitability. This provides an opportunity for wind power projects as the cost of generation of power per unit comes down significantly due to low operating expenses once the capital cost is recovered.

5.3 Renewable Energy Scenario

Energy is a major input for overall socio-economic development. Use of fossil fuels would continue to fuel the economic development process of a majority of the world population over the next few decades. However, at some time in the first half of this century, fossil fuel reserves are likely to be exploited to the maximum. Additionally environmental externalities would be built into the cost of generating electricity from fossil fuels. As a result the cost of power produced through these sources will become increasingly higher as opposed to the cost of power produced from renewable sources.

Environment friendly renewable energy, therefore, is expected to account for 50 to 60 per cent of the total global energy supply in the second half of the current century. By the first decade of the current century, increasing efficiencies and reducing costs of generating renewable energy as opposed to increasing costs of conventional energy, would make it cost effective to generate and supply renewable electricity aggregating to several thousand megawatts. Besides grid supply augmentation, renewable electric technologies offer possibilities of distributed generation at or near points of use, which can reduce peaking loads and save on costly upgradation and maintenance of transmission and distribution networks growing demand.

Kyoto Protocol: One of the most serious environmental issues facing the world is human-inducted climatic change. This would have an adverse effect on human health, ecological systems and the economy, a threat recognized by most countries. In a move to counter this threat, the Framework Convention on Climate Change was negotiated during the 1990s.

The Kyoto Protocol, which guides implementation of the Convention, includes specific emission reduction targets, and provisions to meet these commitments to reduce emissions in the most cost effective manner. There are three such flexible mechanisms:

First, the Protocol allows carbon emissions rights trading among industrialized countries; enabling one industrialized country to purchase emissions reductions achieved by another, and counts them towards its own emissions reduction target. Second, the Protocol allows for "joint implementation" of projects by industrialized countries, including those with economies in transition. Under this provision, Country X invests in a project that will reduce greenhouse gas emissions or improve their absorption in Country Y. In return for its investment, Country X would acquire the resulting emissions reductions, which it could use itself or sell.

Third, the Protocol provides for similar project-based carbon offset trading between industrialized and developing countries under the so-called Clean Development Mechanism (CDM). The objective is to assist developing countries to grow in a sustainable way through the transfer of cleaner technology and financial resources for specific projects, and at the same time, to lower carbon emissions.

Prototype Carbon Fund (PCF): The PCF's objective is to create a market for emissions reductions under the Kyoto Protocol. Established in the World Bank with investments from governments and private companies, the PCF will invest in cleaner technologies in developing countries aimed at reducing their greenhouse emissions. These emissions reductions will be independently verified and certified, and then transferred back into the Fund's investors in the form of emissions reduction certificates.

The Bank will act as a broker in helping to negotiate a price for both buyers and sellers of emissions reductions. In this way developing countries will benefit by acquiring cleaner technology and making a profit from trade in a potentially plentiful product – greenhouse gas emissions reductions. Industrialized country investors will gain by paying a lower price for emissions reductions than is available in their own countries / companies.

According to the PCF analysis there are many opportunities to reduce emissions of greenhouse gases in developing countries at a cost of between $15 per ton of carbon. This compares with a marginal abatement cost upwards of $50 a ton of carbon in advanced economies. This difference in cost to industrialised and developing countries of reducing greenhouse gas emissions provides the opportunity for mutually beneficial trading relationships. The PCF anticipates negotiated prices for emissions reductions at about $15 per ton of carbon.

5.4 Fiscal Incentives

Direct Taxes

The concession under the Income Tax rules for non-conventional energy projects are:

Particular	Tax benefit

Section 32	Accelerated 80% deprecation in the first year of operation is available on the assets specified under renewable energy generation.
Section 80 IA	Profits and gains from industrial undertakings or enterprises engaged in infrastructure development are allowed 100% deduction any 10 consecutive assessment years falling within a period of 15 assessment years beginning with the assessment year in which that industrial undertaking or the enterprise develops or begins to operate any infrastructure facility.

6 Annexure

- Financial Projections
- Financial Results
- Enercon Estimate of Generation

Financial Projections

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)	51.25
Operations	
Plant Load Factor	25.5%
Transmission Loss up to metering point	5.0%
Grid Availability	98.0%
Effective PLF	23.7%
Insurance Charges @ % of capital cost	0.2%
Operation & Maintenance Cost base year @ % of capital cost	1.10%
% of escalation per annum on O & M Charges	5.0%
Tariff	
Tariff for first 10 years - Rs./Kwh	3.40

Tariff applicable after 10 years (Rs/kWh)	Cost + 16% ROE		
Project Cost	Rs Million		
Total Project Cost	1,599.10		
Means of Finance		Rs Million	
Own Source	25%	400.00	
Term Loan	75%	1,199.1	
Total Source		1,599.1	
Terms of Loan			
Interest Rate	11.25%		
Tenure	10	Years	
Income Tax Depreciation Rate (Written Down Value basis)			
on Wind Energy Generators	80%		
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	33.66%		
Minimum Alternate Tax	11.22%		
Working capital			
Receivables (no of days)	45		
O & m expenses (no of days)	120		

Financial Results based on cash Flow

Base Case	
Post Tax Project IRR without CDM	8.06%
Post Tax Project IRR with CDM	13.57%
Post Tax Equity IRR without CDM	6.11%
Post Tax Equity IRR with CDM	16.55%

Enercon Estimate of Generation

The estimated generation that is provided by Enercon in its offer is 17.85 lakhs units per WTG as measured by WTG controller meter at 100% grid availability. The generation is guaranteed for one year from date of commissioning.

Therefore to arrive at the effective PLF following corrections are applied:-

Transmission loss up to metering point:-5%

Grid Availability:-98%