Report and Recommendation of the President to the Board of Directors

Project Number: 42902
March 2008

Proposed Loan
India: Gujarat Paguthan Wind Energy Financing Facility

In accordance with ADB's public communications policy (PCP, 2005), this abbreviated version of the RRP excludes confidential information and ADB's assessment of project or transaction risk as well as other information referred to in paragraph 126 of the PCP.

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 18 February 2008)

Currency Unit	–	Indian rupee/s (Re/Rs)
Re1.00	=	$0.0252
$1.00	=	Rs39.67

ABBREVIATIONS

ADB	–	Asian Development Bank
CDM	–	Clean Development Mechanism
CER	–	certified emission reduction
CLP	–	China Light and Power
CO_2	–	carbon dioxide
CSP	–	country strategy and program
DSCR	–	debt service coverage ratio
EIL	–	Enercon India Limited
GEDA	–	Gujarat Energy Development Authority
GERC	–	Gujarat Electricity Regulatory Commission
GETCO	–	Gujarat Electricity Transmission Company Ltd.
GPEC	–	Gujarat Paguthan Energy Corporation Private Ltd.
GHG	–	greenhouse gas
GUVNL	–	Gujarat Urja Vikas Nigam Ltd.
KERC	–	Karnataka Electricity Regulatory Commission
KREDL	–	Karnataka Renewable Energy Development Ltd.
KPTCL	–	Karnataka Power Transmission Company Ltd.
MNES	–	Ministry of Non-Conventional Energy Sources
MNRE	–	Ministry of New and Renewable Energy
O&M	–	operation and maintenance
PDD	–	project design document
PPA	–	power purchase agreement
RPO	–	renewable purchase obligation
SHE	–	safety, health, and environment
SOC	–	scheme of control agreement
TCE	–	TCE Consulting Engineers Limited
WTG	–	wind turbine generator

WEIGHTS AND MEASURES

GWh (gigawatt-hour)	–	1,000,000 kWh
Kcal	–	1,000 calories
kg (kilogram)	–	1,000 grams
km (kilometer)	–	1,000 meters
kWh (kilowatt-hour)	–	1,000 watt-hours
kV (kilovolt)	–	1,000 volts
m	–	meters
MCMD	–	1,000,000 cubic meters per day
MVA	–	1,000,000 volt-amperes
MW (megawatt)	–	1,000,000 watts
SCM	–	standard cubic meter

NOTES

(i) The fiscal year (FY) of the Government of India ends on 31 March. FY before a calendar year denotes the year in which the fiscal year ends.

(ii) In this report, "$" refers to US dollars.

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08-0464 HR

I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed loan of up to Rs4.45 billion to Gujarat Paguthan Energy Corporation Private Limited (GPEC) to finance the Samana Wind Power Project in Gujarat, India and the Saundatti Wind Power Project in Karnataka, India (the two projects collectively referred to as the Project). The design and monitoring framework and the development effectiveness framework are presented in Appendix 1.

II. INTRODUCTION

2. India is endowed with abundant renewable energy sources—solar, wind, biomass, and small hydroelectric—and the Government of India is working proactively to develop them. Under the "Power for All by 2012" initiative, the Government has envisaged universal electricity supply by 2012. The Ministry of New and Renewable Energy (MNRE) of the Government of India, formerly the Ministry of Non-Conventional Energy Sources (MNES), has proposed exploiting the full potential of renewable energy sources to increase generation capacity in the country. The National Electricity Policy, issued by the Ministry of Power, Government of India on 12 February 2005, also emphasizes the development of renewable energy sources.

3. Since its inception, India's renewable energy program has been driven by policies and promotional measures initially framed by MNRE and subsequently by India's respective state governments. The promotional measures available to renewable energy projects comprise a wide range of fiscal and financial incentives, including soft loans, concessional customs duties, exemption from excise duty, tax holidays, and accelerated depreciation benefits.

4. To accelerate the promotion of renewable energy development in their respective states, both the Gujarat Electricity Regulation Commission (GERC) and Karnataka Electricity Regulatory Commission (KERC) have stipulated minimum amounts of renewable energy purchase obligations on licensed distributors operating in the states. Starting 2010, GERC will require licensed distributors to procure at least 2% of their total energy input from renewable energy sources. The KERC has stipulated that 10% of energy purchase by distributors should be in the form of renewable energy.

5. GPEC is an existing, single-asset company that currently owns and operates a 655 megawatt (MW) gas-fired power plant at Bharuch, Gujarat, India. GPEC belongs to the CLP Group (founded in 1901 as the China Light and Power Company Limited) and is 100% indirectly owned by CLP Holdings Limited, Hong Kong. The CLP Group consists of a conglomerate of companies with a portfolio of over 30 generation assets and retail businesses in different countries in the Asia-Pacific region. The group has investments in over 30,000 MW gross generation assets. The Asian Development Bank (ADB) has an existing satisfactory relationship with the CLP Group through its 2003 financing of BLCP Power Limited, a 1,434 MW coal-fired power plant in Thailand[1]. Over the last few years, the CLP group has shown a strong commitment to the principles of sustainable development and has been taking a proactive stance towards addressing issues related to climate change. In 2004, the group set a target of generating 5% of its output from renewable sources by 2010, which was met 3 years ahead of time. As a part of the CLP Group, GPEC also has a major thrust toward renewable energy. In light of the increasing regulatory support for wind power generation in India, GPEC has decided to undertake a number of wind power projects throughout the country, of which the Project forms the first phase. With the successful financial closure of the Tata Power Company's Khandke and Bramenvel wind power

[1] ADB. 2003. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan and a Proposed Political Risk Guarantee to BLCP Power Thailand.* Manila.

projects[2] in India in 2007 (in which ADB provided long-term debt financing), GPEC has been in active discussions with ADB on its wind energy plans in India. It has approached ADB for long-term debt financing to implement its wind energy projects being set up at Samana, Gujarat and Saundatti, Karnataka. Concept clearance for the proposed loan was approved in December 2007 and environmental and social site visits were conducted in January 2008. If approved, this would be ADB's largest assistance to a private sector wind power project.

III. BACKGROUND

A. Sector Background in India

1. Demand and Supply of Power in India

6. India is the third largest electricity consumer in Asia behind the People's Republic of China and Japan. As of 31 December 2006, installed power generation capacity in India was 127,753 MW, of which 56% was owned and operated by state entities, 33% by central public sector undertakings, and 11% by independent power producers and other private sector utilities. Thermal power plants, mostly coal-fired, provide 66% of the installed capacity. Hydropower accounts for 26% of the capacity, with gas and oil-fired thermal plants, renewable energy plants, and nuclear plants providing the remaining 8%.[3] Industry buys approximately 35% of the electricity sold in India, followed by households at 25%, agriculture at 22%, and businesses and others at 18%.[4] Despite its growing economy, India's annual consumption per capita remains relatively low at slightly over 600 kilowatt hours (kWh). In addition, power quality remains poor, marked by high voltage fluctuations and recurring load shedding. India continues to suffer from chronic electricity shortages, with peak demand exceeding supply by 13.8% and the energy deficit at 9.6% in FY 2007.[5]

7. Power demand in India has grown rapidly as the economy has expanded at an annual average rate of 6.8% in real terms since FY1995.[6] As the 10th Five Year Plan (FY2003–FY2007) achieved only 52% of the targeted capacity addition, energy shortfalls will persist over the short to medium term. Target capacity has been expanded for the 11th Five Year Plan period (FY2008–FY2012) to 78,577 MW,[7] so as to catch up on the longer-term economic growth target. This is expected to allow India to achieve the national electricity policy goal of Power for All by 2012 and per capita availability of power to reach 1,000 kWh by FY2012.

8. Both Gujarat and Karnataka, the states where the Project will be implemented, face significant power shortages, as shown in Table 1 below.

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[2] ADB. 2007. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan for Tata Power Wind Energy Financing Facility.* Manila.
[3] Ministry of Power. 2007. *Report of the Working Group on Power for Eleventh Plan (2007–2012).* New Delhi.
[4] Central Electricity Authority. 2007. *Report on Seventeenth Electric Power Survey of India.* New Delhi.
[5] Central Electricity Authority. 2007. *Monthly Review of Power Sector.* New Delhi (April).
[6] International Monetary Fund. *International Financial Statistics*. Washington, DC (various issues).
[7] This excludes the target for renewable energy generation capacity. The target capacity addition proposed by the Ministry of New and Renewable Energy for the 11th Five Year Plan period is 15,000 MW, including 14,000 MW of grid-interactive renewable power and 1,000 MW of off-grid renewable power.

Table 1: Energy and Peak Power Supply Position—Gujarat and Karnataka

State	Energy Supply Position			Peak Power Supply Position		
	Requirement (GWh)	Availability (GWh)	Shortage (%)	Demand (MW)	Met (MW)	Shortage (%)
Gujarat						
FY2007	62,464	54,083	13.4	11,619	8,110	30.2
FY2008 (9 months)	49,704	42,595	14.3	12,047	8,885	26.2
Karnataka						
FY2007	40,797	39,948	2.1	6,253	5,811	7.1
FY2008 (9 months)	28,848	28,270	2.0	6,583	5,506	16.4

FY = fiscal year, GWh = gigawatt-hour, MW = megawatt.
Sources: Central Electricity Authority. 2007. *Monthly Review of Power Sector*. New Delhi (April and December).

2. Wind Power Sector in India

9. As the Indian power sector has grown, India has become increasingly dependent on fossil fuels. With continued and sustained hikes in oil and gas prices in recent years, as well as the expected fossil fuel shortages in the future, the security of energy supply in India has generated increasing concern. The environmental concern over excess use of fossil fuels is also on the rise. In this context, India urgently needs to explore sustainable energy development, and the Government has been working proactively to promote the use of renewable energy sources.

10. Among the renewable power resources available in India, wind energy is a promising source for further development. India has over 45,000 MW of gross potential and 13,000 MW of technical potential for wind power. As of September 2007, India had over 7,700 MW of installed wind power capacity, ranking the country fourth in the world after Germany, United States, and Spain. While the 10th Five Year Plan targeted a 2,200 MW increase of installed wind power capacity, over 5,400 MW was actually installed.[8]

11. The Government has provided support measures to increase renewable energy contributions in the country. It has also issued policy guidelines for the state governments to establish and maintain state-specific policies to promote renewable power projects. These include permission to accelerate depreciation, concession or full exemption from customs duties, tax holidays, and soft loans available through government-owned agencies.

12. Gujarat and Karnataka are two of the leading states in wind generation in India. With long coastlines and certain suitable inland areas, these two states account for more than 36% of the gross potential to be harnessed from wind resources, with Gujarat accounting for an estimated 9,675 MW of gross potential and Karnataka 6,620 MW. As of 31 March 2007, installed wind power capacity was 667 MW in Gujarat and 849 MW in Karnataka, which in aggregate accounted for 21% of total installed wind capacity in the country and ranks them among the top four states in wind generation. A further 161 MW and 54 MW were installed during the April–September 2007 period in Gujarat and Karnataka, respectively. A detailed summary of the wind power sector in India is in Appendix 2.

[8] Ministry of New and Renewable Energy. 2007. *Annual Report 2006–2007*. New Delhi.

B. Asian Development Bank Operations

1. Country Strategy

13. Mainstreaming poverty reduction is the central organizing theme of ADB's country strategy and program (CSP) for India.[9] It draws on the three pillars of ADB's poverty reduction strategy: pro-poor growth, social development, and good governance. The strategy aims to support the Government's high-growth agenda by assisting fiscal consolidation, infrastructure development, and private sector development. Political and economic developments since finalizing the CSP indicate that its assistance strategy remains valid, especially the core strategy of poverty reduction through infrastructure-led growth supported by social development and good governance. The 2006–2008 CSP[10] update suggests that the objective of accelerating India's annual gross domestic product growth to 8% depends on upgrading infrastructure facilities and improving the efficiency of such public services. ADB's proposed assistance program reflects this priority, with infrastructure accounting for nearly 77% of the 3-year pipeline (not including private sector and other nonsovereign operations).

2. ADB's Sector Strategy

14. ADB's energy sector strategy[11] establishes its operational priorities as (i) reducing poverty by, among others, creating energy infrastructure for sustainable economic growth; (ii) promoting private sector involvement by restructuring the energy sector and creating an enabling environment for private investors; (iii) addressing regional and global environmental impacts; and (iv) promoting regional cooperation. In particular, the strategy strongly encourages ADB interventions to increase investment in the renewable energy subsector, as well as to increase private sector participation in the energy sector to take advantage of the higher operational efficiencies that private operators can achieve and to meet the large capital requirements.

15. ADB's assistance for the power sector, as outlined in the 2006–2008 CSP update, has six main priorities: (i) reforming the sector; (ii) promoting higher efficiency and low-carbon power sources that are locally available; (iii) expanding and optimizing transmission and distribution systems; (iv) supporting institutional strengthening to implement reforms required by the Electricity Act of 2003, including development of more flexible power delivery and trading systems; (v) promoting private sector participation; and (vi) encouraging energy conservation, and ensuring environmental and social sustainability. To support the Government's Power for All by 2012 initiative, ADB's strategy for the power sector will create synergy with the 11th Five Year Plan. This includes development of sustainable energy sources, particularly promotion of renewable energy projects.

IV. THE BORROWER

A. Background

16. GPEC owns and operates a single-asset: a 655 MW gas-fired combined cycle power plant at Paguthan, near Bharuch in Gujarat. The company was set up in 1992 under the name Gujarat Torrent Energy Corporation Limited as a joint venture between the Torrent Group of India, Powergen of UK, the government of Gujarat, and Siemens AG. In 2002, Powergen purchased the stakes of the other three entities in the joint venture, and in June 2003 divested its entire equity stake in favor of the CLP Group. CLP Holdings, the group holding company, currently has 100%

[9] ADB. 2003. *Country Strategy and Program (2003–2006): India.* Manila; and ADB. 2005. *Country Strategy and Program Update (2006–2008): India*. Manila.
[10] ADB. 2005. *Country Strategy and Program Update (2006–2008): India.* Manila.
[11] ADB. 2000. *Energy 2000: Review of the Energy Policy of the Asian Development Bank.* Manila.

ownership of GPEC through an offshore holding company structure. The combined cycle power plant has been operational since 1997 and sells its entire electrical output to GUVNL, which in turn sells it to four distribution companies in Gujarat.

B. Shareholders, Management, and Corporate Governance

17. The CLP Group is one of the leading investor-owned power utilities in Asia. It is a conglomerate of companies with a portfolio of over 30 generation assets and retail businesses in different countries in the Asia Pacific. CLP Holdings Limited (rated A [negative creditwatch]/A-1 [negative creditwatch] by Standard & Poor's/Moody's), is listed on the Hong Kong Stock Exchange and had a market capitalization of approximately $19 billion as of 31 January 2008. The CLP Group registered total revenues of $5.8 billion in 2006 and earnings of $1.3 billion. In Hong Kong, China, the CLP Group operates through CLP Power Hong Kong Limited, a vertically integrated electricity generation, transmission and distribution business with an installed capacity of 6,908 MW and a transmission capacity of 12,000 kilometers (km). The CLP Group supplies electricity to approximately 80% of the population in Hong Kong, China.

18. GPEC is the CLP Group's first investment in India and will be the investment vehicle for all of the group's wholly owned projects in the country. GPEC derives strong management, technical and financial support from its parent. Its top management is nominated by CLP's board and its managing director is a part of the CLP Group's senior management team. GPEC is managed by nine directors on its board, of which seven represent the CLP Group and two represent local financial institutions. Rajiv Mishra, the managing director of the company, handles the day-to-day management of GPEC under the supervision and control of the board of directors. As of 30 June 2007, the company had 119 employees.

19. The CLP Group has a well-established code on corporate governance and policies. The code applies to directors, officers, and employees of CLP Holdings; its wholly owned subsidiaries; and joint ventures or companies in which the group holds a controlling interest. In the case of joint ventures or companies in which the CLP Group does not hold a controlling interest, the CLP representatives concerned are expected to act in accordance with the code themselves and to do everything possible to influence those with whom they are working to ensure that they also act to similar standards of integrity and ethical behavior. The CLP corporate governance framework lays down procedures applicable to enforcement of shareholder rights, activities of the board and board committees, management and staff, and auditors. Eight board committees have been created to oversee various aspects of the board's operations, including audit; remuneration; and social, environmental, and ethics-related issues. In addition, the CLP Group has formulated a number of policies including a fair disclosure policy, guidelines on related-party transactions, an anti-fraud policy, and procurement values and principles. As a fully owned subsidiary, GPEC is also obligated to adhere to the principles enunciated by the CLP Group.

C. Operational Performance

20. GPEC's power plant at Paguthan is a critical source of power to the state of Gujarat and accounts for about 8% of the state's power needs. The plant has shown strong operating performance since inception and has consistently achieved a plant availability close to 90%, while keeping forced outages at very low levels. GPEC's operations and maintenance strategy has focused on maximizing plant availability, ensuring operational safety and optimizing maintenance costs. Critical maintenance activities such as hot gas path inspections have been carried out in accordance with the recommendations of the original equipment suppliers on a regular basis. GPEC has also consistently achieved high levels of plant load factors. A detailed analysis of GPEC is in Appendix 3.

V. THE PROPOSED PROJECT

A. Project Description

21. The Samana Wind Power Project is located at Samana Taluka, Jamnagar district, Gujarat, about 7 km from Rajkot. The Saundatti Wind Power Project is located at Saundatti Taluka, Belgaum district, Karnataka state, and is about 85 km from Belgaum and about 80 km from Hubli. Both sites are well connected by roads to a number of mid-sized cities in their respective states.

22. The Samana Wind Power Project involves the construction and operation of 100.8 MW of wind power generation facilities. The Project is physically a part of a larger wind energy farm currently being developed by Enercon (India) Limited (EIL) for GPEC and other interested power producers. Upon completion, the Samana wind farm as a whole will have 450 wind turbine generators (WTGs) with a combined power generation capacity of 360 MW (0.8 MW per WTG). Of the 450 WTGs, 126 WTGs will be owned by GPEC as a part of the Project while the remaining 324 WTGs will be owned by other power producers. Power from each WTG will be transmitted at 33kV to a power collection system at the Sadodar substation located inside the wind farm. The substation will be owned and operated by EIL and is proposed to have four 100 million volt-amp (MVA) transformers to step up the power from 33 kV to 220kV.

23. The Saundatti Wind Power Project involves the construction and operation of 82.4 MW of wind power generation facilities (103 units of 0.8 MW each). This project is also being developed by EIL exclusively for GPEC. Power generated at the wind farm will be pooled through a power collection system and fed into the Karnataka Power Transmission Corporation Limited (KPTCL) substation located near Saundatti town on the southern ridge of the wind farm. The substation currently has 2 X 20 MVA transformers to step up power from 33 kV to 110 kV.

24. The combined Project will be the largest wind project undertaken by the CLP Group to date and will increase its renewable energy portfolio by almost one third.

B. Implementation Arrangements

25. EIL has received the requisite permissions from Gujarat Energy Development Agency (GEDA) and government of Karnataka for developing wind energy farms in Samana and Saundatti. Subsequently it approached GPEC with proposals to transfer the two projects to GPEC and develop them on a turnkey basis covering all aspects of development and commissioning. GPEC conducted its own legal and technical due diligence on the projects, including a detailed wind assessment study with the assistance of Hydro Tasmania Consulting.[12] Further, the commercial and technical feasibility of each Project was evaluated by GPEC covering plant load factor projections, grid losses, technology, grid availability, operation and maintenance (O&M) charges, capital cost, and state tariff policies. The proposals were negotiated between GPEC and EIL and eventually GPEC executed separate facilitation agreements with EIL for developing the two projects. The facilitation agreements are comprehensive in nature. Under these agreements, EIL will transfer the projects to GPEC and will be responsible for (i) design, development, construction, and commissioning; (ii) land procurement/acquisition; and (iii) all regulatory and statutory approvals. The contracts are fixed price turnkey contracts with suitable provisions for recovery of liquidated damages for delays in implementation.

[12] Hydro Tasmania is a government business enterprise owned by the state of Tasmania in Australia. Hydro Tasmania Consulting, an arm of Hydro Tasmania, draws on around 100 years of expertise of Hydro Tasmania in the areas of renewable energy and power engineering.

26. EIL is a 56:44 joint venture between Enercon GmbH of Germany (the second largest wind energy company in the world) and the Mehra group of Mumbai. EIL started commercial operations in 1995, and crossed the milestone of 1,000 WTGs and 500 MW capacity during 2004–2005. Worldwide, Enercon GmbH has already installed over 7,400 WTGs with an installed capacity of 6,600 MW. EIL has strong financials, with 2006–2007 revenues exceeding Rs22 billion and a net worth of Rs4.7 billion.

27. Wind power generation technology is well established and as such the Project does not face significant technological risks. EIL will employ for the Project E-53 WTGs, which are currently the most advanced wind turbines being manufactured by EIL in India. The E-53 WTGs have a proven track record and are being used in a Tata Power wind energy project earlier funded by ADB. The E-53s are upgraded versions of the already established E-48 WTGs but with larger blade diameters. Each wind turbine generator will be installed at a hub height of 74 meters (m) with a rotor diameter of 53 m. The E-53 design also features a recently developed high-efficiency blade with root spoilers and winglet tips. This design enables more energy to be extracted from the same swept area when compared with a conventional blade design and reduces the noise from the blade tips. Other features include the class S features to specifically cater to Indian wind conditions (extreme wind velocity of 57 meters per second [m/s] and an average wind speed velocity equivalent to 7.5 m/s) and a gearbox-free design.

28. Wind data for both locations was initially provided by EIL based on raw data collected over about 2 years. This data was reviewed in house by Roaring 40s Renewable Energy Pte. Ltd., which is a joint venture between the CLP Group and Hydro Tasmania. This joint venture has extensive experience in wind assessment and construction of wind farms across Australia, the People's Republic of China, and India. Hydro Tasmania Consulting modeled 20-year synthesized data resulting in the generation of long-term annual energy output estimates for both the sites.

29. GPEC has also signed comprehensive warranty O&M agreements with EIL for both the projects, whose scope includes repairs and/or replacement of defective parts, operations and maintenance (scheduled and unscheduled) and assistance in manning site office and record maintenance. The O&M contracts stipulate a fixed price payable to EIL per WTG (increasing over the years) for an initial period of 10 years. The contract comes with an availability guarantee (97% for the high-wind season and 95% for the low-wind season) and performance guarantees. GPEC will take a comprehensive insurance cover during the operational phase of the Project.

30. The Samana Project started in July 2007 and the first set of 11 WTGs will be commissioned by April 2008. The entire project is expected to be commissioned by January 2009. For the Saundatti Project, delivery of the WTGs will commence in a phased manner starting March 2009 and the Project is expected to be fully commissioned by June 2009.

C. Evacuation and Selling Arrangements

31. The Samana wind farm is already connected to the high-tension grid. Power generated by the various WTGs will be pooled into a common substation located at Sadodar within the wind farm, then metered and fed into the Gujarat Electric Transmission Corporation (GETCO) grid for sale to GUVNL. EIL will suitably expand the Sadodar substation as more WTGs come into operation at the site and EIL will be responsible for the substation's O&M. Power from the Saundatti wind farm will be pooled from the WTGs and evacuated through the KPTCL substation located near Saundatti town. GPEC had commissioned a study to review the adequacy of power evacuation infrastructure in Saundatti, which has reported adequate evacuation arrangements.

32. GPEC will sell its output from the Samana Project to GUVNL under a 20-year PPA in line with the new renewable energy policy in effect in the state. The PPA will be executed prior to commissioning of the Project. The tariff has been fixed at Rs3.37 per kWh for the entire tenor of

the PPA. Twenty-five percent of gross Clean Development Mechanism (CDM) revenues through the sale of certified emission reductions (CERs) will be shared with GUVNL. GPEC has already initiated the CDM registration process for this Project and has submitted the project design document (PDD) for the first phase (comprising 63 WTGs) to the Ministry of Environment and Forest, Government of India, which is the designated national authority. PDD for the second phase will be prepared upon acquisition of land for the same. The model PPA is a "take-and-pay" contract, which grants a "must-run" status to the Project. It provides for complete offtake with explicit clauses providing for shutdowns only in emergency situations. This dilutes any risk of shutdowns as a result of capacity-requirements-based back-down situations. With the Gujarat Electricity Regulatory Commission (GERC) stipulating a minimum renewable purchase obligation (RPO) on utilities (currently 1% of total purchase, to be increased to 2% from 2010), significant renewable generation capacity of up to 780 MW will require to be set up in the state, largely through the wind sector. The Samana Project is therefore assured of offtake by GUVNL, both as per the terms of the PPA as well as RPO obligations imposed by GERC.

33. Output from the Saundatti Project will be sold under a 20-year PPA to be executed with one of the electricity distribution companies in the state. As per terms of the facilitation agreement with EIL, EIL is responsible for facilitating the execution of a PPA in the following order of preference: Bangalore Electricity Supply Company (BESCOM), Mangalore Electricity Supply Company (MESCOM), Hubli Electricity Supply Company (HESCOM), Chamundeswari Electricity Supply Company (CHESCOM), and Gulbarga Electricity Supply Company (GESCOM). The model PPA has tariff fixed at Rs3.40 for the first 10 years. Tariffs beyond the first 10 years will be determined by the regulator. The PPA does not provide for any CDM revenue-sharing arrangement with the offtaker and qualifies as a base load generating station that is not subject to merit order dispatch. The PDD for CDM registration will be prepared in due course upon receipt of ownership of land. The KERC has determined the minimum RPO for state distribution companies at 10%, out of which about 7% can be met through wind generation.[13] This translates to additional potential wind capacity in the state of about 800 MW until 2012. The Saundatti Project, which will be commissioned by mid-2009 will play a critical role in enabling the electricity distribution companies meet their RPO requirements.

34. Table 2 provides the incremental wind generation capacities required in Gujarat and Karnataka for meeting the respective states' renewable purchase obligations.

Table 2: Additional Wind Energy Capacity Required for Meeting Renewable Purchase Obligations

	Gujarat			Karnataka		
Fiscal Year	**RPO** (%)	**RPO** (GWh)	**Additional Capacity required** (MW)	**RPO** (%)	**RPO** (GWh)	**Additional Capacity required** (MW)
2008	1	62.3	284	7	40.0	368
2009	1	67.3	23	7	42.6	83
2010	2	72.8	357	7	45.8	104
2011	2	78.8	55	7	49.5	116
2012	2	85.5	61	7	53.5	130

GWh = gigawatt-hour, MW = megawatt, RPO = renewable purchase obligation.
Sources: Gujarat Paguthan Energy Corporation Private Limited and Central Electricity Authority Utilities Consumption Data 2007.

[13] Source: Karnataka Renewable Energy Development Limited.

D. Environmental Aspects and Social Dimensions

35. The Project has been classified as category B for environment because it is unlikely to create any significant environmental impact during construction and operation. Comprehensive environmental impact studies for the two projects were completed in January 2008 in line with ADB's environmental safeguard policies for environmental category B projects. As per Ministry of Environment and Forest (MOEF), notification S.O. 1533 dated 14 September 2006, environmental clearance is not required for the proposed capacity of the wind power projects. The summary initial environmental examination for the Project is in Appendix 4.

36. The perceptible environmental impacts are noise and visual impacts, but both are considered to be insignificant at most given the considerable setback of turbines to the nearest settlements and the landscape values of the site. The environmental disturbance normally associated with construction activities (i.e., land disturbance, vegetation clearance, erosion and sedimentation, construction noise and traffic, and waste generation) is considered temporary due to the limited extent and significance of consequences. The implementation of the environmental management plan will minimize or mitigate these impacts that will be continued during project operations, and will also include monitoring arrangements.

37. The Project is classified as category C for involuntary resettlement. Land to be acquired for the Project is located on government, forest, and private lands. Sites located on government or forest land would be first leased by the government to EIL which, on commissioning, would be transferred to GPEC through a transfer lease agreement. For privately owned land, the land will be purchased by EIL and later transferred to GPEC after legal due diligence by GPEC. The private land will be acquired through private negotiations between EIL and the owners on a willing-buyer-to-willing-seller basis. Erection of the WTGs will be on uninhabited land and will not cause displacement, affect any physical structures, or lead to the loss of livelihoods. The project will indirectly contribute to poverty reduction by supporting economic development through increased power generation in the states of Gujarat and Karnataka. Other socioeconomic benefits of the Project will include limited employment to community members in the vicinity of the WTGs.

38. As the Project is classified as category C for indigenous peoples, an indigenous peoples' plan is not required. There are no indigenous peoples (scheduled tribes) living close to or within the sites identified for the two projects. The Project has no perceptible impacts on distinct tribal groups in the project areas. Since the forest land on both sites is degraded forest with thorny bushes and shrubs, it hosts no forest-dependent peoples.

E. Development Impacts

1. Impact, Outcome, and Output

39. The Project aims to promote sustainable growth in India through contributions toward achieving minimum share targets for renewable energy in the generation mix and toward India's Power for All goal. The Project, which aims to construct 183.2 MW of wind energy generation facilities, will be one of the largest such initiatives in the country. The Project will catalyze private sector investment in India's renewable energy sector, mitigate significant amount of greenhouse gas (GHG) emissions and improve the energy security of the country by developing indigenous energy sources. It will help reduce the current energy and peak power shortages in the Indian states of Gujarat and Karnataka. The Project is part of a unique model for private sector participation in renewable energy envisaging successful collaboration between a private turnkey project developer and a strategic investor. The Project's design and monitoring framework is in Appendix 1.

2. Development Effectiveness

40. The development effectiveness of the Project will be assessed in terms of private sector development, business success, and economic sustainability as per the guidelines for implementing the Good-Practice Standards for Evaluation of Private Sector Investment Operations,[14] prepared by the Evaluation Cooperation Group of the multilateral development banks. The Project will lead to private sector development by introducing a new business model of collaboration between a private turnkey developer and a strategic investor. Being one of the largest private sector wind operations in the country, the Project will have a demonstration effect for future private sector investments in wind generation using this model. The Project is financially and economically sustainable and also plays a significant role in mitigating GHGs, thus leading to global environmental benefits. The Project's development effectiveness framework is provided in Appendix 1.

VI. THE PROPOSED ASSISTANCE

A. Loan

41. ADB will provide a local currency loan of up to Rs4.45 billion from its ordinary capital resources to GPEC without a government guarantee. Proceeds from the loan will be used for eligible expenditures for the Project. The proposed loan will have a maturity of up to 13 years from the date of first disbursement, with an availability period of 15 months and semiannual repayments starting 3 months from scheduled project completion. The loan will carry an interest rate, as well as commitment and front-end fees, to be approved by ADB's pricing and credit enhancement committee.

42. The loan will be documented in a loan agreement, which will contain terms and conditions standard for private sector loans without government guarantees, as well as covenants relating to ADB's policies.[15] The ADB loan will share common terms and conditions with other lenders' loans as far as possible. The loan will be subject to conditions precedent to the disbursement, including all necessary government, creditor, and shareholder approvals and consents; and all contractual and financial arrangements satisfactory to ADB. The loan agreement will include (i) appropriate representations and warranties; (ii) covenants, including affirmative, negative, financial, and information covenants; and (iii) events of default.

43. The proposed loan is a secured corporate loan, and ADB will rely on GPEC's balance sheet, cash flows from GPEC's existing generating asset, and wind power generation revenues. As security, ADB will require the creation of a first ranking charge over all movable and immovable assets of GPEC, which include the gas-based power plant as well as the wind power assets. ADB will also require that the security from GPEC be created and perfected as a condition precedent to drawdown or, for certain types of asset classes (e.g., immovable property and rights under contracts) as and when practicable during the term of the loan, having regard to Indian law and procedure on perfection of security and GPEC's timetable for entry into project-related contracts. Lenders will also require the establishment of a trust and retention account mechanism whereby all receipts of GPEC will be deposited and utilized only in a pre-determined priority of utilization. In addition, a debt–service reserve account will be created in favor of the lenders, which will be funded to the extent of prospective 6 months' debt service obligations. All future financing by GPEC will be subject to corporate level covenants, namely a debt–equity ratio not to exceed 2.33:1 and a DSCR not below 1.3 times.

[14] Multilateral Development Banks Evaluation Cooperation Group. 2006. *Good-Practice Standards for Evaluation of Private Sector Investment Operations – Third Edition*.

[15] These covenants include compliance with ADB's (i) environmental and social safeguard policies; (ii) combating money laundering, antiterrorism, and anticorruption policies; and (iii) procurement policy to the extent that GPEC must use the loan proceeds for financing eligible goods and services procured from the ADB's member countries.

B. Justification

44. The proposed loan merits ADB's support for the following reasons:

(i) The proposed loan is consistent with ADB's CSP for India, which emphasizes infrastructure development, private sector participation, and renewable energy development. Particularly in the power sector, policy dialogue by ADB's South Asia Department has focused on (a) supporting sector reform and restructuring, (b) enhancing energy efficiency and clean energy development, and (c) promoting balanced physical infrastructure development. The proposed ADB loan is in line with this strategy and dovetails with the efforts including ongoing dialogues with the Government under the public sector operations. The Project will aid in meeting the significant energy and power shortages in the states of Karnataka and Gujarat. If approved, it will be the largest financing by ADB of a private sector renewable energy project.

(ii) The proposed loan is consistent with ADB's energy sector policy (footnote 11). It also forms a part of ADB's clean energy and environment program, which was launched in response to the communiqué by the Group of 8 at the Gleneagles Summit in July 2005.[16] ADB's energy policy states that ADB will promote the development of renewable energy sources in developing member countries, and that ADB will also assist in implementing such projects, preferably through private sector involvement to ensure their sustainable long-term operations. The clean energy and environment program includes implementation of renewable energy investment opportunities. The Project may also benefit from assistance from ADB's Asia Pacific Carbon Fund for upfront financing of future revenues from CERs.

(iii) The proposed loan helps increase power generation from renewable energy sources in India. India has been trying to reduce its dependence on fossil fuels and to develop renewable energy sources, which are abundant in the country, to increase energy security and promote environmentally sustainable economic development. The proposed ADB loan will assist in adding 12% more wind power generation capacity in the state of Gujarat, 9% more wind power generation capacity in the state of Karnataka and approximately 2.5% in the country as a whole.

(iv) The proposed loan will help GPEC and its parent, the CLP Group, to meet their stated commitment to increase the share of clean energy in their generation portfolio. With the implementation of the Project, the CLP Group will be able to increase the share of wind in its generation portfolio to over 5%. The Project will also help distribution licensees in Gujarat and Karnataka meet their renewable purchase obligations.

(v) The proposed loan helps improve the country's environmental standards by reducing greenhouse gas emissions. The Project will reduce greenhouse gas emissions by over 400,000 tons of carbon dioxide (CO_2) per year and by approximately 8 million tons of CO_2 during the minimum project life of 20 years.

(vi) The proposed loan, which will provide long-term, fixed-interest rupee financing, will offer the best possible solution to the Borrower under current market circumstances. The Borrower values such long-term, fixed-interest rupee

[16] Group of 8. 2005. *The Gleneagles Communiqué.* Gleneagles.

financing by ADB since such a product is not readily available in Indian financial markets. As all of GPEC's revenues are in Indian rupees, the rupee financing helps avoid a currency mismatch between revenues and expenditures. The feed-in tariff for wind energy projects does not allow financing costs to be passed through. As such, the long-term, fixed-interest rate will increase stability of the Project's financing plan. This will also help to make wind energy generation a "stand alone" business, thereby encouraging more investments by Indian and foreign utilities.

C. Anticorruption Policy, and Combating Money Laundering and the Financing of Terrorism

45. ADB's *Anticorruption* Policy (1998, as amended to date) and *Combating Money Laundering and the Financing of Terrorism Policy* (2003) were explained to GPEC. Consistent with its commitment to good governance, accountability, and transparency, ADB will require GPEC to maintain and comply with internal procedures and controls following international best practice standards for the purpose of preventing corruption or money laundering activities or the financing of terrorism; and covenant with ADB to refrain from engaging in such activities. The financing documentation between ADB and GPEC will further allow ADB to investigate any violation or potential violation of these undertakings.

VII. INVESTMENT LIMITATIONS

46. Once approved, the proposed loan of up to Rs4.45 billion to GPEC will represent 2.6% of ADB's nonsovereign operations' portfolio. The proposed loan is within ADB's aggregate country, industry, group, and single-project exposure limits for nonsovereign investments.

VIII. ASSURANCES

47. Consistent with the Agreement Establishing the Asian Development Bank, the Government will be requested to confirm that it has no objection to the proposed assistance to GPEC. No funding will be disbursed until ADB receives such confirmation. ADB will enter into suitable documentation, in form and substance satisfactory to ADB, following approval of the proposed financing by the Board of Directors.

IX. RECOMMENDATION

48. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Asian Development Bank (ADB) and recommend that the Board approve the loan of up to Rs4,450,000,000 denominated in Indian rupees, without government guarantee, to Gujarat Paguthan Energy Corporation Private Limited for the Samana Wind Power Project and the Saundatti Wind Power Project from ADB's ordinary capital resources, with a term of up to 13 years, with an availability period of 15 months, an interest rate to be determined based on the procedures applicable to ADB local currency loans for private sector operations, and such other terms and conditions as are substantially in accordance with those set forth in this report, and as may be reported to the Board.

Haruhiko Kuroda
President

19 March 2008

DESIGN AND MONITORING AND DEVELOPMENT EFFECTIVENESS FRAMEWORKS

Table A1.1: Design and Monitoring Framework

Design Summary	Performance Targets/Indicators	Data Sources/ Reporting Mechanisms	Assumptions and Risks
Impact • Sustainable growth through contributions toward achieving minimum share targets for renewable energy in the generation mix and toward India's Power for All goal	• Generation mix has 2% of renewable energy in Gujarat and 7% in Karnataka by 2012 • 20% reduction in peak and energy shortages in the states of Gujarat and Karnataka by 2012	• National macroeconomic data • State-level power sector statistics, as reported by state and central regulators	**Assumptions** • Continued macroeconomic and political stability • Continued implementation of power sector reforms
Outcome • Increased renewable energy installed capacity • Increased renewable energy based power generation • Increase in private sector investment in India's renewable energy sector • Mitigation of GHG emissions • Increased reliance on indigenous energy sources	• Increased wind energy capacity by 12% in Gujarat and by 9% in Karnataka • Project achieves forecasted plant availability (95%–97%) and load factors (33.2% at Samana and 27.7% at Saundatti) • At least 260 MW of additional wind capacity developed through the successful collaboration between a private turnkey project developer and a strategic investor • Project generates about 8 million tons of CO_2 savings	• GPEC's operating reports • Statistics and information disclosed by the regulator and state government agencies • Registration of the Project by the CDM executive board	**Assumptions** • The Project is completed in a timely manner. • Offtakers comply with their purchase and payment commitments. • Stable and consistent regulatory policies for the renewable energy sector • Continuation of existing regime on CDM post-Kyoto protocol

Design Summary	Performance Targets/Indicators	Data Sources/ Reporting Mechanisms	Assumptions and Risks
	during the first 20 years of operation • Project saves about 4.4 million tons of coal imports over 20 years		
Outputs • Installation and operation of wind power generating facility and associated infrastructure	• 100.8 MW of wind power capacity commissioned at Samana by January 2009 • 82.4 MW of wind power capacity commissioned at Saundatti by June 2009 • Annual sale of 272 GWh and 190 GWh of energy at Samana and Saundatti, respectively	• GPEC reports • Statistics and information disclosure by the regulator and state government agencies	**Assumptions** • Construction and O&M contractors perform in a timely manner and in accordance with guaranteed performance standards as per respective contracts **Risks** • Wind conditions are insufficient in meeting projected generation levels • Grid availability is lower than expected
Activities with Milestones • Facilitation agreements signed with Enercon India Limited for turnkey implementation of the Samana project and Saundatti Project in July 2007 and November 2007, respectively • Construction work in progress, as scheduled. • Phase 1 commissioning (63 WTGs) at Samana—30 June 2008 • Phase 2 commissioning (63 WTGs) at Samana—31 January 2009 • Commissioning of 103 WTGs at Saundatti—30 June 2009			**Inputs** Equity from GPEC • Rs1.98 billion from internal cash accruals ADB • Rs4.45 billion loan Other co-lenders • Rs3.46 billion

ADB = Asian Development Bank, CDM = Clean Development Mechanism, CO_2 = carbon dioxide, GHG = greenhouse gas, GPEC = Gujarat Paguthan Energy Corporation Private Limited, MW = megawatt, GWh = gigawatt-hour, O&M = operation and maintenance, WTG = wind turbine generators.

Table A1.2: Development Effectiveness Framework

Objective	Impact	Performance Targets	Measurement
Private Sector Development	**Project Company Impact**		
	• Diversifies the company's generation base by introducing renewable energy sources in its asset portfolio	• Technically and operationally viable performance of 100.8 MW of wind power generating station in Samana and 82.4 MW wind power generating station in Saundatti, translating to a 12% increase in wind energy capacity in Gujarat and 9% in Karnataka	• GPEC's operating, financial and environmental performance reports • GPEC's success in identifying and developing other projects in the renewable sector • Statistics and information disclosed by central and state government agencies
	• Successfully introduces global standards for wind technology	• Project achieves high plant availability factors (95%-97%) through access to reliable technology	
	• Possible revenue generation from sale of GHG emissions reduction	• Sale of about 8 million tons of CERs during the first 20 years of operations	
	Beyond-Company Impact		
	• Has a demonstration effect for future private sector investments in the wind power sector	• Replication of the new business model of collaboration between private turnkey developer and strategic investor. At least 5% of the remaining all-India wind potential developed based on a similar model by 2012	
	• Supports development of technical and operational skills to develop and manage wind power generating stations in India	• Increased scale of wind power projects undertaken by the private sector	
	• Demonstrates effectiveness of	• Increased private sector participation in	

Objective	Impact	Performance Targets	Measurement
	regulatory environment	the renewable energy based power sector	
Business Success	• Financially profitable and sustainable operations	• Timely repayment of debt • Satisfactory financial internal rate of return (greater than weighted average cost of capital)	• Amortization of loans • Financial internal rate of return • GPEC financial reports
Economic Sustainability	• Contributes to economic growth through mitigation of power shortages • Improvement of the environment • Decreases reliance on energy imports	• Economic internal rate of return greater than 12% • Increase in per capita consumption of power • Reduction in GHG emission • Lower energy imports, equivalent to 4.4 million tons of coal	• Economic rate of return • Power shortage in the respective states reduced • Electricity sales

CER = certified emission reduction, GHG = greenhouse gas, GPEC = Gujarat Paguthan Energy Corporation Private Limited, MW = megawatt.

WIND POWER SECTOR IN INDIA

A. Growth of Generation Capacity

1. As the Indian power sector has grown, India has become increasingly dependent on fossil fuels. With recent continued and sustained hikes in oil and gas prices, as well as the expected shortages of fossil fuels in the future, the security of India's energy supply is generating increasing concern. The environmental concern over excess use of fossil fuels is also rising. In this context, India urgently needs to explore sustainable energy development, and the Government has been working proactively to promote use of renewable energy sources.

2. Among the renewable power resources available in India, wind energy is a promising source for further development. India has 45,000 megawatts (MW) of gross potential, assuming 1% of land availability for wind power generation in the potential areas. Sites with annual mean wind density exceeding 200 watts per square meter are considered suitable for wind power projects, and 216 such sites have been identified in the country by the Center for Wind Energy Technology (C-WET). The states with the largest number of sites include Tamil Nadu (41), Gujarat (38), Andhra Pradesh (32), Maharashtra (31) and Karnataka (26). However, India's technical potential is limited to only about 13,000 MW, assuming 20% grid penetration, which will rise with the augmentation of grid capacity in potential states. As of September 2007, India had installed wind power capacity of over 7,700 MW, ranking the country fourth in the world after Germany, Spain, and the United States. While the 10th Five Year Plan targeted a 2,200 MW increase of installed wind power capacity, over 5,400 MW has been installed.[1] The installed wind power capacity and gross potential in India by state is provided in Table A2.

Table A2: Installed Wind Power Capacity and Potential in India by State
(MW)

State	As of 31 March 2005	As of 31 March 2006	As of 30 September 2007	Gross Potential
Andhra Pradesh	120.5	121.0	121.0	8,275
Gujarat	253.5	338.1	828.0	9,675
Karnataka	410.8	584.6	903.0	6,620
Kerala	2.0	2.0	2.0	875
Madhya Pradesh	28.9	40.3	71.0	5,500
Maharashtra	456.2	1,001.3	1,620.5	3,650
Rajasthan	284.8	358.1	494.0	1,700
Tamil Nadu	2,034.9	2,892.5	3,662.5	5,400
West Bengal	1.1	1.1	1.6	3,050
Others	1.6	1.6	1.6	450
Total	**3,594.3**	**5,340.6**	**7,705.2**	**45,195**

MW = megawatt.
Source: Ministry of New and Renewable Energy.

3. Both Gujarat and Karnataka are leading states in wind resources availability (with gross potential of 9,675 MW and 6,620 MW respectively), as well as in wind generation capacity (with installations of 828 MW and 903 MW respectively). Both the states actively promote wind power generation.

[1] Ministry of New and Renewable Energy. 2007. *Annual Report 2006–2007*. New Delhi.

B. Regulatory Framework for Wind Power in India

4. The Government is proactively encouraging development of renewable energy sources. The Government's efforts to promote renewable energy started in the early 1980s after the first and second global oil price shocks. The Government created the Commission for Additional Sources of Energy in 1981 and Department of Non-Conventional Energy Sources in 1982. The Department of Non-Conventional Energy Sources was transformed into the Ministry of Non-Conventional Energy Sources (MNES) in 1992, and then was renamed the Ministry of New and Renewable Energy (MNRE) in 2006. The National Electricity Policy, issued by the Ministry of Power in 2005, contains a major thrust toward the development of renewable energy sources. MNRE is the nodal ministry in the Government for all matters relating to new and renewable energy. Its main functions include (i) policymaking and planning, (ii) program formulation and implementation, (iii) research and development, (iv) technology development and commercialization, (v) promotion of demonstration and pilot projects, and (vi) implementation of fiscal and financial incentives.

5. The MNES (now MNRE) established the Centre for Wind Energy Technology at Chennai as an autonomous research and development institution of the Government and as a technical focal point for India's wind power development. The center provides developers with technical services, including wind resource assessment for project sites, testing and certification services for equipment, and training and capacity-building services.

6. Technological advancements are gradually increasing the commercial viability of wind power projects. The replacement of old 250-kilowatt wind turbines at a height of 30 meters (m) with 1-MW units at 50 m height has made wind power more attractive as an investment. Higher wind power density due to increased height, lower installation cost per MW, and less land requirement make a case for choosing higher unit size of wind turbines. India's advantage is that wind turbines of 1 MW and above are being manufactured in the country.

7. Fiscal and financial incentives provided by the Government and the state governments have traditionally driven the development of wind power projects in India. The incentives being provided by the Government include (i) 80% accelerated depreciation of project costs for wind power projects; (ii) concessions or full exemption on customs duties of certain imported components of wind turbines; (iii) tax holiday for a maximum of 10 consecutive years within 15 years of commissioning, which is available for infrastructure projects; and (iv) concessional loans available through Government-owned agencies, including Indian Renewable Energy Development Agency Limited, Power Finance Corporation Limited, and Rural Electrification Corporation Limited.

8. Recently, the focus of the regulatory framework for the renewable energy sector has changed from being driven by supply to being driven by demand. The Electricity Act, 2003[2] requires all state-level energy regulatory commissions to ensure that electricity distributors procure a specified minimum percentage of power generation from renewable energy sources. The midterm appraisal of the 10th Five Year Plan by Planning Commission (footnote 1) included the following recommendations for the renewable energy sector:

[2] Section 86 of the Electricity Act, 2003 states: "The State Commission shall discharge the following functions, namely:…(e) promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution license;…"

(i) switch incentives and support from the supply-driven programs to demand-driven programs and technologies;
(ii) explore alternative subsidy structures that encourage utilities to integrate wind, small hydroelectric, cogeneration, etc., into their systems;
(iii) phase out capital subsidies linked to the creation of renewable capacity in favor of subsidies linked to renewable energy generated;
(iv) state electricity regulatory commissions should mandate the purchase of energy from renewable sources, as per the provisions of the Electricity Act; and
(v) improve coordination and synergize the programs of MNES (currently MNRE) with similar programs of other central ministries and state governments.

C. Wind Power in Gujarat

9. Gujarat has a long coastline and certain inland areas that have significant potential for wind energy generation. As of 30 September, 2007, the total installed wind power capacity in the state of Gujarat was 828 MW against a total gross potential of 9,675 MW and a technical potential of 1,780 MW. Significant potential therefore exists for further wind generation in the state. About 50 sites have been declared to have potential as wind farms on the basis of long-term data on wind speeds collected under the aegis of MNRE. The first demonstration wind farm was set up in the state in 1986 at the Okha coast, followed by a few more wind farms with a combined capacity of about 16 MW. The satisfactory performance of these wind farms led to the announcement of an incentive scheme in 1993, as per which the sector was opened up for private sector participation. Under this scheme, wind farm capacity of about 150 MW more was set up during 1993–1998. In 2002, the state government declared a new wind power generation policy. However, the tariff envisaged under this policy (Rs2.60 per kWh) was not considered enough of an incentive to attract any significant investment in this sector.

10. In August 2006, the GERC announced an order to bring into effect a new renewable energy policy.[3] This policy covers wind energy, and envisages the following:

(i) a full-project life PPA with a term of 20 years would be signed between GUVNL or other distribution licenses and the power generator prior to commissioning of the plant;
(ii) a fixed, levelized tariff of Rs3.37 per kWh for the entire tenor of the PPA;
(iii) 25% of CDM benefits to be shared with GUVNL;
(iv) PPA to provide for a “must-run” status covering the entire offtake of the wind farms, thus envisaging shutdowns only under explicit emergency situations;
(v) a minimum percentage of GUVNL’s total energy purchase (known as the renewable purchase obligation, RPO) has to be from renewable energy sources. The RPO has been set at 1% for FY2009, to be increased to 2% during FY2010–FY2012.

11. In June 2007, the government of Gujarat released a new Wind Power Policy—2007[4] to accelerate investment in the sector. The policy will remain in effect until June 2012, and all wind turbine generators installed and commissioned before that date would be eligible for various incentives declared under the policy. The policy allows (i) captive use and third-party sales of power; (ii) 4% of energy fed into the grid as wheeling charges; (iii) exemption from payment of

[3] GERC. 2006. *Determination of Price for Procurement of Power by the Distribution Licenses in Gujarat from Wind Energy Projects*. Ahmedabad.
[4] Government of Gujarat. 2007. Government Resolution No EDA – 102001-3054-B. Gandhinagar.

electricity duty, except for third party sales; and (iv) a tariff of Rs3.37 per kilowatt-hour (kWh). Under the policy, the Gujarat Electricity Development Agency is the focal point for implementing the policy.

D. Wind Power in Karnataka

12. Karnataka is one of the leading states in wind energy generation in India with a gross potential of about 6,600 MW. As of 30 September 2007, Karnataka had an installed wind generation capacity of 903 MW. Significant potential therefore exists for further wind generation in the state. The Karnataka Renewable Energy Development Limited (KREDL) is the nodal agency responsible for promoting renewable energy generation in the state. KREDL also operates as the primary agency for promoting wind power in the state.

13. The KERC has passed various regulations from time to time to encourage wind power generation in the state. In accordance with the tariff policies issued by the Government, the KERC issued the Power Procurement from Renewable Sources by Distribution Licensees Regulations dated 27 September 2004 (the RPO regulations). Under the RPO regulations, each of the four distribution licensees (now five) in the state must purchase a minimum of 5% and a maximum of 10% of the total electricity consumption in its area of supply from renewable sources. KERC had reserved the right to review the RPO policy every 3 years. With the first 3-year period expiring in October 2007, the government of Karnataka concluded that the maximum limit prescribed by the KERC might be an impediment to the development of renewable energy projects. The government of Karnataka has therefore, by an order dated 2 March 2007, opined that the RPO be enhanced to 20% in light of the fact that the maximum limit prescribed by the RPO regulations has already been achieved or will be achieved shortly. The KERC has since heard the order in October 2007 and an order to this effect is awaited.

14. KERC, by an order in January 2005, stipulated a tariff of Rs3.40 per kWh without any escalation for the first 10 years of operations for wind power projects in the state. In August 2005, the KERC also approved a standard PPA to be executed between the generator and the distribution licensee. The salient features of the model PPA include:

(i) a term of 20 years;
(ii) fixed, non-escalable tariff of Rs3.40 per kWh for the first 10 years of the PPA; tariff beyond the first 10 years to be determined by KERC;
(iii) no sharing of CDM benefits with distribution licensees; and
(iv) “take-and-pay” provision, allowing for a “must-run” status and qualification as a base load generating station that is not subject to merit-order dispatch.

GUJARAT PAGUTHAN ENERGY CORPORATION PRIVATE LIMITED

A. Overview

1. Gujarat Paguthan Energy Corporation (GPEC) was set up in 1992 under the name of Gujarat Torrent Energy Corporation Limited as a joint venture between the Torrent Group of India (46%), Powergen of UK (28%), the government of Gujarat (12%), and Siemens AG (14%). In 2002, Powergen purchased the stakes of the other three entities in the joint venture. In June 2003, Powergen divested its entire equity stake in favor of the CLP Group. GPEC is a company that owns and operates a single asset: a 655 megawatt (MW) gas-fired combined-cycle power plant at Paguthan, near Bharuch in Gujarat. The combined-cycle power plant has been operational since 1997 and sells its entire electrical output to the Gujarat Urja Vikas Nigam Limited (GUVNL) under a long-term PPA, which in turn sells it to four distribution companies in Gujarat. Along with the acquisition of GPEC, the CLP Group also acquired the ownership of Powergen India Pvt. Ltd. (now renamed CLP Power India Private Limited, or CPIPL), the operations and maintenance (O&M) arm of Powergen.

B. Ownership, Management, and Corporate Governance

2. The CLP Group has 100% ownership of GPEC through an offshore holding company structure. GPEC has 728 million fully paid-up shares, of which 99.99% are held by CLP Power (GPEC) Limited, a Mauritius entity. The remaining 0.01% of GPEC shares are held by CPIPL, which is also 100% owned by the CLP Group. CPIPL has been converted into the business development arm of the CLP Group in India besides continuing to play the role of the O&M operator for the Paguthan plant. Given that both GPEC and CPIPL are 100% owned by the CLP Group, it is likely that these two entities will be merged in the near future, subject to required lender and statutory approvals.

3. The CLP Group, founded in 1901 as China Light and Power Company Limited in Hong Kong, China, is one of the leading investor-owned power utilities in Asia. It is a conglomerate of companies with a portfolio of over 30 generation assets and retail businesses in different countries in the Asia-Pacific region. The group has investments in over 30,000 MW gross generation assets. The group holding company, CLP Holdings Limited (rated A [negative creditwatch]/A-1[negative creditwatch] by Standard & Poor's/Moody's), is listed on the Hong Kong Stock Exchange and had a market capitalization of approximately $19 billion as of 31 January 2008. The Group registered total revenues of $5.8 billion in 2006 and earnings of $1.3 billion. In Hong Kong, China, CLP operates a vertically integrated electricity generation, transmission, and distribution business, with an installed capacity of 6,908 MW and a transmission capacity of 12,000 kilometers. CLP supplies electricity to approximately 80% of the population in Hong Kong, China. The utility is operated by CLP Power Hong Kong Limited under a regulatory regime created through a scheme of control agreement (SOC) with the government and accounts for over 80% of CLP Holdings' operating cash flow. There has been a recent change in the regulatory arrangements under the SOC, which envisages a lower permitted return to the utility, which in turn could limit its ability to raise debt financing and affect its commitment to provide cleaner and stable power to Hong Kong, China. Standard and Poor's and Moody's have therefore placed CLP Holding's credit rating on negative creditwatch for a potential downgrade.

4. GPEC is CLP's first investment in India. In future, CLP proposes using GPEC as its investment vehicle for all of its wholly owned projects in India. In addition to GPEC, CLP also has a presence in India through Roaring 40s, a joint venture between the CLP Group and Hydro

Tasmania, which has recently financed a 50.4 MW wind farm in the state of Maharashtra. GPEC is strategically important to the CLP Group and it derives strong management, technical, and financial support from its parent. GPEC's top management is nominated by CLP's board and GPEC's managing director is a part of the CLP group's senior management team. GPEC is managed by nine directors on its board, of which seven represent the CLP Group and two represent local financial institutions. Mr. Rajiv Mishra, the managing director of the company, handles the day-to-day management of GPEC under the supervision and control of the board of directors. As of 30 June 2007, the company had 119 employees.

5. The CLP Group has a well-established code on corporate governance and policies. The code applies to directors, officers and employees of CLP Holdings, its wholly owned subsidiaries, and joint ventures or companies in which CLP holds a controlling interest. In the case of joint ventures or companies in which CLP does not hold a controlling interest, the CLP representatives concerned are expected to act in accordance with the code themselves and to do everything possible to influence those with whom they are working to ensure that they also act to similar standards of integrity and ethical behavior. The CLP corporate governance framework lays down procedures applicable to enforcement of shareholder rights, activities of the board and board committees, management and staff, and auditors. Eight board committees have been created to oversee various aspects of the board's operations, including audit, remuneration, social, environmental, and ethics-related issues. In addition, the CLP Group has formulated a number of policies including a fair disclosure policy, guidelines on related-party transactions, an anti-fraud policy, and procurement values and principles. As a fully owned subsidiary of the CLP Group, GPEC is also obligated to adhere to the principles enunciated by the CLP Group.

C. Operational Performance

6. The Paguthan plant is located about 10 kilometers from Bharuch in Gujarat state. The power plant consists of 3 Siemens V94.2 gas turbines, 3 heat recovery steam generators, and one steam turbine generator. The power is evacuated to the Gujarat Electricity Transmission Company Limited (GETCO) substations through a switchyard owned by GPEC. The power plant has shown a strong operating performance since inception and has consistently achieved plant availability exceeding or close to 90%, while keeping forced outages at extremely low levels. The power plant is a critical source of power for the state of Gujarat and accounts for about 8% of the state's total power needs. GPEC's operations and maintenance strategy has focused on maximizing plant availability, ensuring operational safety, and optimizing maintenance costs. Critical maintenance activities such as hot gas path inspections have been regularly carried out in accordance with recommendations of the equipment suppliers.

7. GPEC adopts the CLP Group's environmental and social safeguard policies and has established and efficiently implemented its safety, health, and environment (SHE) policy through a system and procedures based on international best practices. In addition, GPEC also initiates and implements community health and education development projects in consultation with the beneficiary communities. GPEC's SHE performance is exemplary considering its ISO 14001 certification (since 1999), several awards related to SHE received over the years, accidental rates below the industry norm, full compliance with all applicable national SHE regulations, effective waste management, well-established SHE management systems and procedures, staff training on a continuing basis, and staff participation in the SHE management. There are no outstanding issues related to resettlement and there are no tribal communities living in the vicinity of the power plant area.

8. GPEC is conscious of its social responsibility toward the communities within which it operates. In September 2000, GPEC, under its corporate social responsibility initiative, established The Paguthan Power Plant Social Development Trust with the aim of upgrading, strengthening, and empowering the rural communities surrounding the plant. The trust takes up activities that benefit the community as a whole, and it focuses on education, health, and environmental awareness programs covering 10 surrounding villages. Some of these activities are now extended to major parts of the Bharuch district. The trust's development programs are implemented with the participation and contribution of communities and stakeholders such as the Government, donor agencies, other voluntary organizations, and experts.

SUMMARY INITIAL ENVIRONMENTAL EXAMINATION

A. Introduction

1. Gujarat Paguthan Energy Corporation Private Limited (GPEC) has executed a contract with Enercon (India) Limited (EIL), a leading wind turbine manufacturer in India, to develop the 100.8 MW Samana and 82.4 MW Saundatti wind farm projects and its facilities on a turnkey basis. The Samana and Saundatti wind farms are expected to be completed by January 2009 and June 2009, respectively.

2. This summary of initial environmental examination (SIEE) is based on comprehensive environmental impact study reports[1] for Samana and Saundatti wind energy projects and has been prepared for the Asian Development Bank (ADB) in line with its environmental and social safeguards policies and information disclosure requirements for category B projects. Under the Ministry of Environment and Forest (MOEF) Notification S.O. 1533 dated 14 September 2006 environmental clearance is not required for this proposed capacity of wind power project as such projects in India are categorized as green projects.

B. Description of the Project

1. Project Scope

3. The Project involves construction, operation, and maintenance of the Samana and Saundatti wind power generation facilities. Technical parameters designed for the proposed projects are presented below:

Table A4.1: Technical Parameters

Technical Parameter	Samana	Saundatti
No. of Wind Turbine Generators (WTG)	126	103
Required Area per WTG	0.5 hectare	0.5 hectare
Total Area Required	234 acres	135 acres
Power Generation Capacity (0.8 MW per WTG)	100.8 MW	82.4 MW
Hub height	74 m	74 m
WTG Model	Enercon 53 (E-53)	Enercon 53 (E-53)
No. of Blades	3 blades	3 blades
Rotor Diameter	53 m	53 m
Extreme Wind Velocity	57 m/sec	57 m/sec
Average Wind Velocity	7.5 m/sec	7.5 m/sec

MW = megawatt, m = meter, m/sec = meter per second.
Sources: Environmental impact study reports for Samana and Saundatti Wind Energy Project.

4. The E-53 model is designed and manufactured by Enercon GmbH of Germany. The salient features of E-53 are: (i) that each turbine is directly coupled with the generator and no gearbox is required, thus minimizing maintenance work; (ii) it has “cutout wind speed technology” that protects the wind turbine during storm conditions of wind speed of 28–34 m/sec; and (iii) it has high-efficiency blades with root spoilers and winglet tips to extract more energy from the same swept area and that reduces the noise from the blade tips.

[1] TCE Consulting Engineers Limited. 2008. *Environmental Impact Study Reports for Samana and Saundatti Wind Energy Project*. Mumbai (January).

5. For Samana wind farm, the power generated will be evacuated from the substation constructed by EIL near Sadodar village, which in turn is connected to the Gujarat Electric Transmission Co. (GETCO) substation through a 220 kV line. At Saundatti, the power generated will be evacuated by substation to be constructed by EIL near Goravanakolla village on the south ridge of the project site. Each wind farm development will include the following:

(i) construction of an unpaved access road from the highway to the wind farm,
(ii) construction of internal service roads branching out from the main access road to individual wind turbine generators (WTGs),
(iii) erection of WTG towers for Samana and Saundatti,
(iv) construction of substations at Samana and Saundatti, and
(v) installation of supervisory control and data acquisition (SCADA) system to serve all the proposed WTGs per wind farm. The SCADA system and the substation will be operated and maintained by EIL for GPEC.

C. Description of the Environment

1. Project Location and Topography

6. The Samana wind farm is located in Samana Taluka, 72 km from Jamnagar in Gujarat. The nearest airport is about 82 km from the proposed project site. The project site is 10 km from the National Highway (NH-8B) connecting Jamnagar to Rajkot. The site is located on a long and hilly ridge 150–215 meters above mean sea level. The area is dry, barren, and uninhabited with many rock outcrops. The soil is poor, mainly sand and silts, and thus has no agricultural value. The area has no natural water sources, and can sustain only desert thorny bushes and shrubs.

7. The Saundatti wind farm is located near Saundatti Taluka, about 80 km from Belgaum in Karnataka. The nearest airport is 85 km from the proposed project site. The site is located on a long and low hill ridge with heights varying from 210 to 240 meters above mean sea level. The area is barren and uninhabited with many rock outcrops. Soil is poor, yellow soil with gravel, and thus has no agricultural value. The area has no known historical or cultural sites. The area covers both forest land and privately owned land, although the land has no agricultural value and is not inhabited.

2. Physical Environment

8. The Samana wind farm is in the Saurashtra basin, Gujarat, which consists of mostly Mesozoic and Cenozoic rocks. The area has no known commercial deposits of mineral resources and supports only rock quarrying. The wind farm and its surrounding areas below the hill ridge are comprised of arid land with annual rainfall of 579 mm. The recorded relative humidity varies between a maximum of 75.4% and a minimum of 28.2%. The predominant wind directions during the study period were from the east, northeast, and east-northeast, accounting for about 45% of the total time with calm wind speed less than 2.0 m/sec for about 24.5% of the time. The recorded maximum and minimum wind speeds were 2.5 m/sec and 0.2 m/sec. Air temperatures range from 12.6^{o}C to 30.5^{o}C.[2] The area has poor soil with high sand and silt content (sand 31%–40% and silt 49%–58%). There are no natural water resources in the wind farm area. However, the surrounding areas below the wind farm have some surface and

[2] Meteorological station was established at proposed project site at Kalyanpur during December 2007 to record various meteorological parameters such as wind pattern (hourly basis), temperature variation, and relative humidity.

groundwater resources.

9. The existing ambient air quality status has been monitored at six locations for suspended particulate matter (SPM), respirable particulate matter (RPM), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO). Results show that all the parameters monitored are well within the National Ambient Air Quality Standards (NAAQS) for residential and rural areas.[3] Noise level monitoring was carried out at six locations and the results showed that all monitored noise levels at all locations were found to be within the prescribed limit of NAAQS in respect of noise.

10. The Saundatti wind farm is in Belgaum district, which is rich in mineral resources such as iron, manganese, bauxite, clay, limestone, sand, building stones, etc. The wind farm area is barren land with no significant vegetation and is characterized by its poor yellowish soil with embedded rocks and gravels. At the district level, the climate is tropical with air temperatures varying from 11^{o}C to 38^{o}C and an average total rainfall of 1,476 millimeters. However, the wind farm area is on the dry side of Belgaum district with low rainfall. As the wind farm is on hilly terrain, it has no natural surface water resources. However, the surrounding areas below the wind farm have some surface and groundwater resources.

11. The predominant wind directions during the study period were from the west, south-west, south-southwest, and west-southwest, accounting for about 71.4% of the total time with calm wind more than 2.0 m/sec for about 2.8% of the time. The recorded maximum and minimum wind speeds were 3.0 and 0.2 m/sec. Air temperature varies between minimum of 14.0^{o}C and a maximum 31.2^{o}C.[4] The existing ambient air quality (AAQ) status has been monitored at five locations for SPM, RPM, SO_2, NO_x and CO. Results showed that all the parameters monitored are well within the NAAQS for residential and rural areas. Noise level monitoring was carried out at five locations and the results showed that all monitored noise levels at all locations were found to be within the prescribed NAAQS.

3. Biological Environment

12. The Samana wind farm area is poor in biological resources. The areas classified as forest land in the surrounding areas immediately below the hill ridge are covered with degraded forest, thorny bushes, and shrubs. No large trees are visible apart from trees planted in villages in the surrounding areas. There are no wildlife sanctuaries, reserve forests, or bird sanctuaries within the vicinity of the wind farm area.

13. The vegetation of Belgaum district is of two types. The moist type occurs in the southwestern portion where the district touches the crest line of the Western Ghats. The second is the dry type found towards the east of Belgaum city and stretches from the northern areas around Athani, Chikodi, and Gokak right down to Sampagaon and Saundatti in the south. The moist vegetation is sustained by heavy seasonal precipitation from the southwest monsoon, which is active from June to October. There are no wildlife sanctuaries, reserve forests, or bird sanctuaries within the immediate vicinity of the study area.

14. According to the Zoological Survey of India, there is no specific domestic migration path of birds in Gujarat. The Khijadia bird sanctuary is 83 km from the proposed Samana wind farm

[3] The ambient air quality results also meet the World Bank standards for ambient air emissions.
[4] Meteorological station was established at proposed project site at Saundatti in January 2008 to record various meteorological parameters such as wind pattern (hourly basis), temperature variation and relative humidity.

site.

4. Socioeconomic Environment

15. Human resettlements are found only in the surrounding areas below the hilly range where the wind farms will be located. There are 30 and 18 villages found in and around Samana and Saundatti project sites, respectively. In Samana, most of the population is dependent on raising groundnuts, cotton, and livestock. In Saundatti, most of the total population depends on agriculture and raising livestock.

16. **Land Acquisition and Resettlement.** The total land to be acquired for the Samana Project will be about 234 acres. The land will be acquired in about 126 locations, of which 63 locations are degraded forest land and the balance 63 locations will be predominantly government land. Private land, if required for setting WTGs, will be acquired on willing-buyer-to-willing-seller basis through negotiations between the owners and EIL. As the private land is not inhabited and not used for economic and social activities, its use for the erection of WTG towers will not create adverse social impacts or economic losses.

17. The total land to be acquired for the Saundatti Project will be about 135 acres. Of the 103 WTGs under the Saundatti Project, 64 WTGs are on forest land and 39 WTGs on private land. EIL will seek approval from the government of Karnataka under the Forest Conservation Act 1980 to use the required forest land under a lease agreement. The use of degraded forest land will not restrict access to forest resources, if any, of any communities living in the vicinity of the wind farm area. Private lands will be acquired through private negotiations between EIL and the owners based on willing-buyer-to-willing-seller basis. If negotiations with any particular land owners are not successful, alternative locations will be considered.

18. **Indigenous Peoples.** There are no indigenous peoples (scheduled tribes) living close to or within the sites identified for the Samana and Saundatti wind farms. No restrictions in access will be imposed on degraded forest land. The sites are vacant, and there are no archeological, historical, or religious sites in the project areas.

D. Environmental Impacts and Mitigation Measures

1. Impacts During Construction

19. The construction of the two wind farms involve only minor civil, mechanical, and electrical works taking place on several small areas scattered over a wide area. The construction activities, particularly road construction, will create some small and transient environmental disturbances such as noise, gaseous emissions, and dust from trucks and heavy equipment. No groundwater will be tapped for domestic and construction work. The water required for construction will be purchased from municipal sources and the reverse osmosis plant at the EIL concrete tower fabrication (CTF) factory in Sadodar. Solid waste generated during road construction and excavation will be used for embankment of the road and minor leveling of site during site restoration after construction. However, these environmental disturbances will not create significant social or ecological impacts.

2. Impacts During Operation

20. During operation, the WTGs do not generate gaseous and dust emissions. Therefore, air pollution is not an issue. The WTG towers erected thus far have not created adverse visual

impacts since the hill ridge on which the wind farms are located is not known for its natural beauty. Noise contribution to background noise will be the bare minimum, and will not have significant impact on either surrounding ambient noise quality or ecology. The wind turbines will also not endanger migratory birds or bats as there are few in the wind farm areas. The turbine design minimizes flickering effects of turbine rotation.

21. Transformers used at each WTG tower and the substation will be of forced-oil and forced air cool design, which do not use polychlorinated biphenyl (PCB). EIL will strictly adhere to regulations regarding air traffic and safety relevant to tall WTG towers. As per air navigational marking regulations, the upper section of the towers and turbine blades are marked with red bands of a specific width for visibility. Blinking lights have been provided as per the navigational marking regulations for visibility and clear identification at night. Hence, no impact is expected on air traffic or safety. The region in which the wind farms are located has experienced seismic tremors ranging from 2.0 to 6.8 Richter scale. Therefore, the WTGs and towers as well as other buildings will be designed with appropriate safety factors to withstand the lateral ground movement caused by seismic shocks.

22. Both direct and indirect temporary employment, for both casual and skilled labor, will be generated during construction period. The existing culture and health of the local populations will not be affected as the construction period will be very short.

E. Institutional Requirements and Environmental Management Plan

1. Organizational Structure, Roles, and Responsibilities

23. As EIL is responsible for the construction, operation, and maintenance of the WTGs, substation and SCADA system, it will be responsible for environmental management and monitoring of the Project. GPEC will ensure that EIL will comply with all regulations and conditions for the various operating permits. The environmental management plan (EMP) presents the potential impacts, the corresponding mitigating measures, timeframe and the responsible parties to implement the EMP.

F. Public Consultation and Disclosure

24. Formal consultation sessions have been held by GPEC and were attended by selected stakeholders, including representatives from local *gram panchayats* (mostly village heads, *sarpanches*), local residents, and representatives of equipment suppliers to solicit their views on the Project and its environmental and social aspects. EIL has conducted many awareness camps on the wind energy projects covering various settlements in the vicinity of the project area to inform local communities about the wind energy project. Local communities have demonstrated good understanding of the nature and scope of wind energy projects. They have been assured that the wind farms would have no significant environmental and social impacts. However, they hoped the wind farm would create economic opportunities for the communities, and that the project sponsor would provide assistance in community development, particularly drinking water, health, and education.

G. Findings and Recommendations

25. The IEE findings lead to the conclusion that the Project, being a wind energy project on marginal land with no economic and ecological value, is unlikely to cause any significant, lasting environmental or social impacts. The perceptible environmental impacts are noise and visual impacts, but both are considered to be moderate at most given the considerable setback of turbines to the nearest settlements and the landscape values of the site. The environmental disturbance normally associated with construction activities will be minimized through an EMP, implementation of which will continue during project operation and which includes monitoring arrangements.

H. Conclusions

26. It is concluded that the IEE is adequate to justify environmental and social clearance of the Project. There is no need for further analysis and the environmental and social assessment of the Project is considered complete.

Table A4.2: Environmental Management Plan

Environmental Issue	Mitigation Measures	Time Frame	Implementing Party
Construction vehicle on unpaved roads	Sprinkling of water to control fugitive dust emissions.	During construction	Contractor
Traffic control and safety	Drivers to be trained to park vehicle safely and retain the key during non-use of vehicle.	During site clearance and construction	Contractor
	Vehicle used for delivery of materials to be well maintained and approved by the authority concerned.		
	Temporary traffic control during transportation of wind turbines, and construction of roads, etc.		
	Idling of vehicle to be avoided, especially near habitation.		
Land use outside project site	Restriction on construction related activities.	During site clearance and construction	Contractor
Material spill	Delivery vehicles and/or trucks to be covered to avoid spillage.	During construction	Contractor
Storage of construction materials	Store construction materials containing fine particles in an enclosure such that sediment-laden water does not drain into nearby water drains.	During construction	Contractor
Soil erosion	Stabilize slopes on road or elsewhere any embankments (through measures such as re-applying the top soil removed during construction to retain spores of grass and shrub species) to control sedimentation, erosion, and water pollution. Also consider the use of geotextiles to prevent soil erosion during construction.	During construction	Contractor
Blockage and change in drainage pattern	If channel drains are blocked, ensure that they are cleaned before onset of monsoon season.	During construction	Contractor
	Daily inspection of site for debris should be carried out to ensure removal of construction material, debris, or surplus earth material.		
Noise from construction related equipment	Construction equipment should be equipped with exhaust silencer. Regular maintenance and service of equipment to adhere to applicable noise standards.	During construction	Contractor
	Ensure that workers wear earplugs or earmuffs to avoid noise impacts.		

Environmental Issue	Mitigation Measures	Time Frame	Implementing Party
Ecological issues	Identify trees that may be felled for wind farm areas and road alignment in forestland and follow the condition in forest clearance letter. Compensatory plantation using local plant species and encourage mixed culture as suggested by the Gujarat and Karnataka forest departments.	Before start of construction	Contractor
Labor camps and construction facilities	Ensure that contract conditions are followed for maintaining hygienic conditions at work site. Ensure availability of first-aid kits as required under the Factory Act. Train at least one person for effective use of first aid facilities in case of any injury.	During construction, erection and commissioning	Contractor
Occupational health and safety	Ensure compliance of all safety and health rules and uses of necessary safety equipment through out the construction period. Barricade the site with adequate marking flags, reflectors etc. to the extent possible for safety of general traffic.	During construction	Contractor
Public health and safety	• Take proper care during loading and unloading to avoid any mechanical injury. • Provide necessary and sufficient illumination to avoid glare. • Provide the necessary safety equipment such as safety nets, helmets, safety belt, etc. • Prevent unauthorized personnel from accessing the towers and other hazardous or restricted areas. • Provide temporary shade in the nearby area so that workers can rest at different intervals and avoid sunstroke. • Provide sufficient and hygienic drinking water at work areas. • Retain the nearby available medical services' contact number and address for emergency use. • Sharp edges should be covered properly to avoid cut injury. • Follow standard safety toolbox before starting the job. • Arrange periodic training and awareness program for site workers and nearby community.	During erection and commissioning of wind turbine	Contractor
Impact on visual resources	Minimize new road construction. Paint wind turbines, blades, towers and structures with a neutral non-reflective color, so that	During construction	Contractor

Environmental Issue	Mitigation Measures	Time Frame	Implementing Party
	they will blend with the surroundings.		
Noise pollution	Monitor the noise levels at sensitive receptors as per monitoring plan. Regular maintenance of wind energy converter.	Routinely during operations	Developer
Land pollution	Ensure proper and contained disposal of enamel and paint drums and other wastes at sites.	Routinely during operations	Developer
Traffic and safety	Enforce traffic control measures, including speed limits of delivery trucks and service vehicles of engineers and/or other staff personnel.	During operation	Developer
Public health and safety	• Provide minimum safety setback of 150 m or 3 times the turbine height, whichever is greater, from any property line. • Design site plan to comply with the requirement of aviation authorities to avoid electromagnetic interference. • Provide national speed control to ensure the safe operation of wind turbine rotors. Prevent unauthorized personnel from accessing the towers and other hazardous or restricted areas. • Develop an operational and emergency response program for fire and major accidents including emergency equipment. • Check road embankment for erosion and rutting, any sign of instability to be taken care before every monsoon. Identify the personnel for monitoring and mitigating the effect of project on environmental and sociocultural resources. • Provide all safety measures and sanitary facilities as per the Factory Act 1948 and other legislative enactments. • Tower entrance door should be kept under lock and key.	During operation	Developer
Electromagnetic interference (EMI)	Compliance with guidelines and other requirements to avoid EMI with aviation equipment. Fiberglass blades are partially transparent to electromagnetic waves, and therefore do not generally cause EMI.	During operation	Developer
Training and awareness	Train the employees and contractor and arrange for awareness program in nearby community (including awareness on preventive measures for HIV/AIDS) through contractor.	Periodically	Developer
Environment, Health and Safety (EHS) Assessment	Periodically evaluate and assess the EHS function.	Periodically	Developer

Sources: TCE Consulting Engineers Limited. Environmental Impact Study Reports for Samana and Saundatti Wind Power Projects. January 2008.