Report and Recommendation of the President to the Board of Directors

Project Number: 42922-01
April 2009

Proposed Equity Investment Public–Private Partnership for Renewable Energy Development (India)

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 11 February 2009)

Currency Unit	–	Indian rupee/s (Re/Rs)
Re1.00	=	$0.021
$1.00	=	Rs48.8

ABBREVIATIONS

ADB	–	Asian Development Bank
CEO	–	chief executive officer
CER	–	certified emission reduction
CO_2	–	carbon dioxide
CSP	–	country strategy and program
C-WET	–	Center for Wind Energy Technology
DPR	–	detailed project report
FYP	–	five-year plan
IREDA	–	India Renewable Energy Development Agency
GDP	–	gross domestic product
IRR	–	internal rate of return
GE	–	General Electric
GHG	–	greenhouse gas
JVC	–	joint venture company
kWh	–	kilowatt-hour
MoEF	–	Ministry of Environment and Forests
MNES	–	Ministry of Non-Conventional Energy Sources
MNRE	–	Ministry of New and Renewable Energy
MW	–	megawatt
OEM	–	original equipment manufacturer
O&M	–	operation and maintenance
PPA	–	power purchase agreement
SERC	–	state electric regulatory commission

NOTES

(i) The fiscal year (FY) of the Government and its agencies begins on 1 April and ends on 31 March. "FY" before a calendar year denotes the year in which the fiscal year begins, e.g., FY2009 begins on 1 April 2009.

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

Vice-President	X. Zhao, Operations 1
Director General	P. Erquiaga, Private Sector Operations Department (PSOD)
Director	M. Barrow, Infrastructure Finance Division 1, PSOD
Team leader	D. Purka, Investment Specialist, PSOD
Team members	P. Bailet, Counsel, Office of the General Counsel
	S. Gupta, Senior Economist, PSOD
	T. Minnich, Investment Specialist, PSOD
	J. Munsayac, Senior Social Safeguards Officer, PSOD

CONTENTS

INVESTMENT SUMMARY

Investment Proposal

The Asian Development Bank (ADB) proposes to invest up to $40 million equivalent in a new public-private joint venture company (JVC) to be incorporated under the laws of India, which will develop, construct, and operate a portfolio of renewable energy projects in the country.

Classification

Targeting classification: General intervention
Sector (subsectors): Energy (Small hydro, wind)
Themes (subthemes): **Economic growth** (Promoting economic efficiency and enabling business environment), environmental sustainability (natural resources conservation), private sector development (public–private partnerships)
Climate change: Mitigation (high)
Location impact: Rural (high), urban (low), national (high)

Investment Description

The JVC intends to develop, construct, and operate a portfolio of 500 megawatts (MW) of renewable energy projects, initially focused on wind power and small hydroelectric power, in India. The company brings ADB together with the leading state-owned enterprise in power generation in India and two of the world's top diversified energy companies, General Electric of the United States and Kyushu Electric Power Company of Japan. ADB's role in the development phase of this JVC has been to facilitate the process and bridge the gaps between the parties' risk perceptions and their expectations from the investment in the renewable sector in India. As an honest broker, ADB provides direct comfort to both the local and foreign investors through its proposed equity participation in the JVC.

Use of Proceeds

Alongside those from other investors and debt, the proceeds of ADB's investment will be used to fund the development and construction of the renewable energy projects, as well as the incorporation and start-up expenses of the JVC.

Impact and Outcome

The proposed outcome of the investment will be 500 MW of additional renewable-power generation by 2012 by implementing projects through public-private partnership, thus catalyzing investment from the private sector. The investment will help diversify India's energy mix away from its dependence on fossil fuels, notably coal-fired thermal projects, toward more sustainable energy sources, and contribute to the national goal of achieving and maintaining 10% of total power generation from renewable sources by 2012.

Environment and Social Assessment

As an equity investment, this will be classified as environmental category FI. Given the nature and general location of projects to be financed by the JVC, the investment has been classified as B/C under the ADB *Involuntary Resettlement Policy* (1995) and B from the perspective of the ADB *Policy on Indigenous Peoples* (1998). The JVC will implement an environmental and social management system fully consistent with ADB's safeguard policies, and will screen, assess, and monitor projects at the appropriate stage of due diligence. The JVC will covenant not to finance activities on ADB's list of prohibited investments.

Development Impact

The investment will achieve the following:

(i) Accelerate the development and financing of renewable energy projects in India to reduce greenhouse gas emissions, such as carbon dioxide, in line with the Millennium Development Goals.

(ii) Help reduce India's dependence on fossil fuel sources to meet the growing power demand and use indigenous renewable sources to meet and maintain the policy objective of generating 10% of its power needs from renewable sources by 2012.

(iii) Catalyze foreign investment in the renewable-power sector in India by facilitating the formation of a new independent utility company in a joint venture between experienced global electric utility companies and NTPC Limited, the anchor of India's power sector. As indicated by both foreign investors, ADB's equity participation is a key factor in their decision to invest in the JVC.

Justification

The investment aligns with ADB's long-term strategic framework 2008–2020 (*Strategy 2020*) and Clean Energy and Environment Program, which calls for ADB investments in energy efficiency and renewable energy in Asia to reach about $1 billion a year and to sustain that level. It helps India diversify from fossil fuels for power generation and benefit from underused indigenous sources of energy. The proposed JVC, initiated by ADB, introduces the independent utility model for renewables, which will help bring down the overall cost of funding (and hence the average cost of generation) and attract other foreign investors to the renewable sector.

I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed equity investment of up to $40,000,000 equivalent in a Public–Private Partnership for Renewable Energy Development in India.

II. INTRODUCTION

2. India is endowed with abundant renewable energy sources—solar, wind, biomass, and small hydroelectric—and the Government is working proactively to develop them to reduce long-standing peak power and energy deficits sustainably. Under the "Power for All by 2012" initiative, the Government looks forward to universal electricity supply in India by 2012. The magnitude of the investment is vast: 78,700 MW of additional power generation capacity is needed to reach that goal. The Ministry of New and Renewable Energy (MNRE) (formerly the Ministry of Non-Conventional Energy Sources) has proposed exploiting the full potential of renewable energy sources to increase generation capacity in the country. The National Electric Policy, issued by the Ministry of Power in February 2005, also emphasized the development of renewable energy sources, and the Integrated Energy Policy of August 2006 provided the vision needed to reliably meet the demand for energy in a technically efficient, economically viable, and environmentally sustainable manner.

3. Since its inception, India's renewable energy program has been driven by policies and promotional measures framed initially by MNRE and subsequently by the state governments. The promotional measures available to renewable energy projects comprise a wide range of fiscal and financial incentives, including concessional loans, concessional customs duties, exemptions from excise duties, income tax holidays, and accelerated depreciation benefits. These policies have led to the development by January 2009 of 13,000 MW of renewable energy, 9% of total power generation in the country. To accelerate the promotion of renewable energy, most state electric regulatory commissions (SERCs) have imposed minimum amounts of renewable energy purchase obligations on licensed distributors in their states. The requirements are aligned with achieving the national renewable energy target of 10% of total power generation capacity—22,000 MW of renewable energy—by 2012, according to the Government's 11th Five Year Plan (FYP).[1]

4. NTPC Limited (established in 1975 as the National Thermal Power Corporation Limited) operates over 29,000 MW in thermal-power generating capacity in India and, with a 28% market share, is the industry anchor. The Asian Development Bank (ADB) has an existing relationship with NTPC through a nonsovereign loan facility signed in September 2006[2] to partially finance two supercritical thermal power plants in India. ADB has encouraged NTPC to continue diversifying its sources of power generation and improving the environmental aspects of future projects. NTPC has set a corporate goal of adding 1,000 MW of capacity through renewable energy sources.

5. ADB and NTPC have also discussed the establishment of a new joint venture company (JVC), with private sector entities as majority owners, to develop renewable power sources on a larger scale as a power utility would, instead of project by project. A memorandum of

[1] Planning Commission, Government of India. 2008. *Eleventh Five Year Plan 2007–12.* New Delhi.
[2] ADB. 2006. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan for the NTPC Capacity Expansion Financing Facility in India.* Manila.

understanding to this effect was signed in August 2008. The JVC would also include the energy financial services group of General Electric Energy of the United States (GE Energy) and Kyushu Electric Power Company of Japan (Kyushu), private sector power companies whose global expertise in renewable energy would be invaluable to the venture. The proposed equity investment received concept clearance in January 2008, and due diligence was completed in February 2009. If approved, the investment would be ADB's first in a public-private partnership to develop, construct, and operate renewable energy projects in India.

III. RATIONALE: SECTOR PERFORMANCE, PROBLEMS, AND OPPORTUNITIES

A. Sector Background, Performance Indicators, and Analysis

1. Demand for and Supply of Power

6. India is the third-largest electricity consumer in Asia behind the People's Republic of China and Japan. As of 31 January 2009, its installed power generation capacity was 147,452 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 63% of installed capacity. Hydropower accounts for 25% of the capacity, and renewable energy plants and nuclear plants, for the remaining 12%.[3] Industry buys about 35% of the electricity sold in India, followed by households at 25%, agriculture at 22%, and businesses and others at 18%.[4] Annual consumption per capita is relatively low, at slightly over 700 kilowatt-hours (kWh), despite the growing economy. 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 11.0% as of January 2009 (footnote 3).

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.[5] As the 10th FYP (2002–2007) achieved only 52% of the targeted increase in capacity, energy shortfalls will persist at least over the short to medium term. Target capacity has been expanded to 78,700 MW for the 11th FYP period (2007–2012), to keep the longer-term economic growth target within reach. This excludes the 11th FYP target for renewable energy generation capacity proposed by MNRE of 15,000 MW, including 14,000 MW of grid-interactive renewable power and 1,000 MW of off-grid renewable power. If these ambitious goals are attained, India should be able to achieve its national electricity policy goal of Power for All by 2012 and available power per capita should reach 1,000 kWh by FY2012.

8. The availability of electric power, and more broadly infrastructure, has indirect but strong links to poverty reduction and economic growth. In 2008, India's finance minister suggested that the country's lack of adequate infrastructure was holding back its economic growth by 1.5%–2% per year.[6] Empirical evidence presented by other comprehensive studies on the links between new electricity availability and economic growth suggest that increases in per capita gross

[3] Central Electricity Authority. 2009. *Monthly Review of Power Sector*. New Delhi (January).
[4] Central Electricity Authority. 2007. *Report on Seventeenth Electric Power Survey of India.* New Delhi.
[5] International Monetary Fund. *International Financial Statistics.* Washington, DC (various issues).
[6] ADB. Forthcoming. Infrastructure for Seamless Asia. Manila.

domestic product (GDP) of about 1% per year are possible,[7] and several broad studies demonstrate that better infrastructure, especially electricity, significantly reduces poverty in developing Asian countries (footnote 6).

2. Energy Mix and Environmental Impact in India

9. The burning of fossil fuels accounts for 66% of the total energy production in India and is responsible for a majority of greenhouse gas (GHG) emissions. During the 11th FYP period, utility-based generation is set to increase by 78,000 MW, with coal-fired thermal power making up the majority. Table 1 shows the energy mix for electricity generation in India as of the end of 2007 and the estimated generation of GHG emissions per unit of electricity.

Table 1: Energy Mix and Emission Intensity for Electricity Generation in India, 2007

Fuel Source	Proportion (%)	Weighted Average GHG Emissions[a] (tons CO_2 per MWh)
Coal	53	1.08
Hydropower	25	–
Oil / Diesel / Naphtha	1	0.62
Natural gas	10	0.47
Wind and solar power	8	–
Nuclear power	3	–

CO_2 = carbon dioxide, GHG = greenhouse gas, MWh = megawatt-hour.
[a] Values denoted by a hyphen are negligible or not measurable.
Source: Central Electricity Authority. 2008. *CO_2 Baseline Data for the Indian Power Sector*. New Delhi.

10. While total emissions from the power sector have been increasing in the past 3 years (from 469 million tons of carbon dioxide [CO_2] in 2006 to 520 million tons of CO_2 in 2008), the weighted average operating emissions intensity rate (tons per CO_2 per megawatt-hour) has been declining slightly (from 0.82 to 0.80).[8]

11. In 2008, the Office of the Prime Minister issued the National Action Plan on Climate Change to raise the living standards of the majority of Indians and at the same time reduce their vulnerability to the impact of climate change. The action plan is guided by the principles of protecting the poor through inclusive and sustainable development, deploying technologies for the mitigation of GHG emissions, and engineering new and innovative market, regulatory, and voluntary mechanisms to promote sustainable development on an equitable basis.[9]

12. The action plan comprises eight national missions defining multipronged, long-term, integrated strategies for achieving climate-change objectives. These eight missions include, among other items, sustainable agriculture, enhanced energy efficiency, use of solar energy, and the "greening" of India. India's development agenda defined in the 11th FYP targets poverty eradication as a prerequisite for economic growth. As of 2005, 27.5% of the population lived in poverty and 44% had no access to power. India's goal of increasing access to power for all its citizens is based in part on the strong positive correlation between energy use and human development.[10]

[7] Esfahani, H. S., and M.T. Ramirez. 2003. Institutions, Infrastructure and Economic Growth. *Journal of Development Economics* 70: 443–477.
[8] Central Electricity Authority. 2008. *CO_2 Baseline Data for the Indian Power Sector*. New Delhi.
[9] Prime Minister's Council on Climate Change. 2008. *National Action Plan on Climate Change.* New Delhi.
[10] United Nations Development Programme. 2006. *Human Development Report 2006*. New York.

3. Renewable Energy Development and Policy Framework

13. As its power demand has escalated, India has depended more and more on fossil fuels. With oil and gas prices so volatile, global production declining, and fossil fuels expected to be in short supply in the future, energy security has become an increasing concern for India. Environmental concerns over excessive use and dependence on fossil fuels are also on the rise. India is therefore urgently exploring sustainable energy development, while reducing GHG intensity. Two major areas of renewable energy development, in view of their natural abundance, are wind power and small hydropower.

a. Wind Power in India

14. 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. A 2,200 MW increase in installed wind power capacity was targeted in the 10th FYP, but over 5,400 MW was actually installed.[11] As of September 2007, India, with over 7,700 MW of installed wind power capacity, ranked fourth in the world after Germany, the United States, and Spain.

15. 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 policies include permission to accelerate depreciation, concession or full exemption from customs duties, tax holidays, and soft loans available through government-owned agencies. Other policy and financial incentives are now being implemented by MNRE.

16. The wind power sector in India has been dominated by indigenous wind-turbine original equipment manufacturers (OEMs), such as Suzlon Energy, Enercon (India), RRB Energy, and Vestas Wind Technology, which collected wind resource data early on and obtained land-use rights for potential sites. These manufacturers-cum-developers can fully develop and operate commercial wind farms on their own behalf, sell the development rights to other developers through engineering, procurement, and construction contracts, or carve out portions of the planned wind farms for other investors. In all cases, project concessions require validation of wind resource data by the Center for Wind Energy Technology. While this process has led to an initial rise in wind power installations, it has also hindered the development of potential sites as returns to other investors are limited by the prices offered by the OEMs. Appendix 2 contains more information on the wind-power sector in India.

b. State Regulatory Environment for Wind Power

17. The SERCs control the approval of wind power projects for grid connectivity and the sale of electricity to the utilities. Most of the SERCs in states with high wind potential have standardized long-term power purchase agreements (PPAs) and declared feed-in tariffs as provided in the Electricity Act 2003 and the National Electricity Tariff Policy. These states include Maharashtra, Karnataka, Rajasthan, Madhya Pradesh, and Tamil Nadu. Offtake of power from wind and renewables is guaranteed via “must-run status” priority in the merit-order dispatch of total electricity from all utilities in each state.

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

18. A first-year accelerated-depreciation incentive at 80% is also offered; however, in light of the typically low profitability during the first year of operation, this incentive, in some cases, provides only a limited tax shield. Many developers of early wind projects were in fact investors in more diversified businesses not related to energy, so that the depreciation benefits and tax shield could be applied to consolidated profits. This process led to inefficient operation or maintenance of wind turbines, reducing availability and utilization. In response to this unintended consequence, MNRE in 2008 announced a generation-based incentive as an alternative to accelerated depreciation. The incentive is Rs0.50 per kWh paid on top of the feed-in tariffs set by SERCs for a period of 10 years after the commercial operation date. MNRE's initial target of 49 MW to qualify for the incentive is likely to increase to 5,000 MW by 2012.

c. Small Hydroelectric Power in India

19. The Central Electric Authority has estimated India's hydropower potential at 148,700 MW, with 28,000 MW in operation and 14,000 MW in various stages of development.[12] The potential installed capacity of small hydropower[13] is estimated at 15,000 MW; only about 2,000 MW is in operation. Hydropower generation is often the only means of providing electricity to low-income populations in remote hilly areas with limited access to grid connection. Small hydropower is also more predictable than solar or wind power: variations in water flow occur over longer periods, rather than hourly or daily.

20. MNRE oversees the development of small hydropower and has set a target of facilitating the development of about 2,000 MW through 2012. The focus of the small-hydropower program is commercialization through private sector participation with physical and financial incentives.[14] MNRE is providing the states with financial support for project development—for the identification of new potential sites, the conduct of detailed surveys, and the preparation of detailed project reports—and implementation incentives consisting of interest subsidies ranging from 1.50% to 5.00% for commercially developed 1–25 MW projects. The South Asia Department of ADB has also been working with state governments on the development of hydropower projects in the states of Uttarakhand[15] and Himachal Pradesh.[16] Further details on the small hydroelectric power market in India can be found in Appendix 3.

4. Constraints on Private Sector Participation

21. Despite the programs put in place by central and state agencies, foreign investment in the Indian renewable power sector remains limited. The sector continues to be dominated by wind-turbine OEMs, local investors, and existing power utilities, which seek to maximize the accelerated-depreciation benefits (or must now meet state-mandated renewable power purchase obligations). Participation tends to be project by project and without a coordinated strategic approach to meeting the Government's renewable energy standards efficiently.

---

[12] Prime Minister's Council on Climate Change. 2008. *National Action Plan on Climate Change.* New Delhi.
[13] Up to 25 MW, by general definition, with little or no storage of water.
[14] ADB. 2007. *Hydropower in India: A Sector Assessment.* Manila.
[15] ADB. 2006. *Report and Recommendation of the President to the Board of Directors on a Proposed Multitranche Financing Facility to India for the Uttaranchal Power Sector Investment Program*. Manila. This includes financing support for small hydroelectric power projects.
[16] ADB. 2008. *Report and Recommendation of the President to the Board of Directors on a Proposed Multitranche Financing Facility to India for the Himachal Pradesh Clean Energy Development Investment Program*. Manila.

22. The MNRE has established tax and generation incentives to encourage private sector participation in wind power, but significant barriers tend to put off some private sector investors. These barriers include (i) the absence of comparable economies of scale in renewable projects, (ii) marginal commercial viability, (iii) the inability to sustain regulatory incentives, and (iv) the collection and credit risk assumed by state offtakers who cannot negotiate additional payment-security or hypothecation provisions. Due diligence to determine the technical merits of projects, verify land ownership and approvals, and negotiate offtake contracts and power evacuation can also be cumbersome to less-experienced investors without access to local expertise.

23. Small hydropower developers with no experience in managing the development process, or those with limited access to capital required to complete the detailed studies, have difficulty overcoming the technical, procedural, and cost barriers. Typically, developers must obtain a project allotment from the state nodal agency, clearance from the Ministry of Environment and Forests (MoEF) if forest land is involved, and clearances from the irrigation, water resources, and state land-use departments to have their projects approved. In the absence of a streamlined, single-window clearance system, the process of obtaining approvals can set back organizations unfamiliar with the process. While local banks and financial institutions may be willing to lend long term to such projects, the development and time-sensitive construction risks usually necessitate recourse to financial resources from outside the project, such as a corporate guarantee. Hence, private investment in small hydropower projects have ironically been limited to the larger infrastructure and power project developers. In both the wind power and small hydropower subsectors, the JVC will implement a new business model that will leverage the partners' financial strength, technical expertise, and industry relationships (in India and worldwide) to pursue such projects on a much larger scale as an independent electric utility company focused solely on the renewable business.

B. ADB Operations, Strategy, and Sector Policy

1. Country Strategy

24. Mainstreaming poverty reduction is the central organizing theme of ADB's country strategy for India.[17] The 2009–2012 country partnership strategy is now in the advanced stages of development. The 2006–2008 country strategy and program (CSP) update draws on the three pillars of ADB's poverty reduction strategy: pro-poor growth, social development, and good governance. The strategy is aimed at supporting the achievement of the Government's high-growth agenda by assisting in fiscal consolidation, infrastructure development, and private sector development. Political and economic developments since the last approved CSP was finalized indicate that the assistance strategy remains valid, especially the core strategy of poverty reduction through infrastructure-led growth supported by social development and good governance. The CSP update suggests that, for GDP growth to accelerate to 8% as planned, infrastructure facilities must be upgraded and public services must be made more efficient. ADB's proposed assistance program reflects this priority: infrastructure accounts for nearly 77% of the 3-year pipeline (not including private sector and other nonsovereign operations).

[17] ADB. Forthcoming. Country Partnership Strategy (2008–2012): India. Manila; ADB. 2005. *Country Strategy and Program Update (2006–2008): India*. Manila.

2. ADB's Sector Strategy

25. ADB's strategy for the energy sector[18] 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 the environmental impact on the region and the rest of the world; 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.

26. ADB's assistance to 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 the reforms required under the Electricity Act of 2003, including the 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 FYP through the development of sustainable energy sources, particularly the promotion of renewable energy projects, and other means.

3. Strategy 2020

27. A core area of operation under ADB's long-term strategic framework 2008–2020 (Strategy 2020) is environmentally-sustainable growth for the region.[19] One of the key actions is mitigating climate change. ADB will assist the developing member countries in moving to low-carbon growth paths by (i) improving energy efficiency, (ii) expanding the use of clean energy sources, (iii) reducing fugitive GHG emissions, (iv) modernizing public transport systems, and (v) arresting deforestation.

28. The ADB 2009 Energy Policy[20] emphasizes, among other objectives, the development of indigenous energy sources and the creation of markets conducive to foreign investment in developing member countries. The 2009 policy updates the 1995 policy and its 2000 review, and aligns ADB's energy initiatives with Strategy 2020. One of the principles of the policy's implementation is the promotion of clean energy projects and the provision of energy to communities and groups with no access to its economic and social benefits. As part of the policy implementation, ADB is emphasizing public-private partnerships to enhance energy sector efficiency by increasing competition and investable resources. The objective is to create a framework that makes investing in renewable energy a commercially viable proposition. ADB is committed to facilitating direct private sector participation.

[18] ADB. 2000. *Energy 2000: Review of the Energy Policy of the Asian Development Bank*. Manila.
[19] ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank 2008–2020.* Manila.
[20] ADB. 2009. *Energy Policy*. Manila.

IV. THE PROPOSED JOINT-VENTURE COMPANY

A. Company Mission and Objectives

29. Investments in the renewable energy sector involve more risks than investments in conventional energy sources because of (i) the relatively higher cost per unit; (ii) the uncertainty of equipment life and long-term maintenance resources; (iii) technical issues such as voltage control and loss optimization in remotely connected generation; (iv) commercial issues, since renewable energy is not a substitute for firm capacity; and (v) the long gestation and breakeven period for investments. ADB's participation is needed, given the heightened risk perceptions and withdrawal of investors and lenders in the global liquidity and credit crisis. Thus, for the successful implementation of renewable energy projects, investors must not only have technical, project management, and procurement abilities but must also be skilled in the commercial aspects and in long-term financing and risk taking. A combination of financially strong electric power utilities, experienced renewable energy investors, and financial institutions that can provide long-term financing would be best equipped to succeed at this task.

30. NTPC, ADB, Kyushu, and GE Energy propose to combine their aligned objectives and management capabilities in a public–private JVC that will develop, construct, operate, and maintain renewable energy projects with maximum development impact on the people of India. Success in achieving India's renewable energy target of 10% of total power generation depends in large part on private sector participation in the selection, development, and implementation of projects in a timely and cost-effective manner. However, the present model, where private sector investors develop one project at a time, is not the most efficient path to renewable energy generation. Developing renewable projects in a portfolio allows the blending of credit, offtake, development, and technical risks, and potentially lowers the overall cost of financing. The JVC will endeavor to invest in a portfolio of 500 MW of renewable energy generation projects in India over a period of 3 years.

31. To start with, the JVC will concentrate on wind power and small hydroelectric power projects in India. But other renewable power generation resources, such as industrial cogeneration, waste-to-energy, solar, geothermal, biomass, biofuel, and tidal energy projects, may also be considered. In the future, the JVC could adopt a regional and global outlook as a major investor in, and facilitator of, renewable energy.

B. Organization and Management

1. Shareholders

32. The JVC will be established as a partnership between public and private shareholders. At incorporation, the largest shareholding (40%) will be held by NTPC, a state-owned enterprise. The rest of the shares will be held equally by ADB and two global power companies, Kyushu (Japan) and GE Energy (United States). The foreign partners were selected jointly by ADB and NTPC in a structured expression-of-interest process on the basis of their financial strength, global experience in carrying out renewable energy projects, and long-term interest in investing in the Indian power sector. At no point will the Government of India hold, directly or indirectly, more than 50% of the issued and outstanding shares. More information about the shareholders is in Appendix 4.

33. NTPC, 89% of which is owned by the Government, is the premier power generation company in India, with expertise and strength in such areas as establishing, operating, and maintaining large power projects, and selling power to various state power utilities and other bulk customers. It operates over 29,000 MW of power generation capacity. According to its audited statements for FY2008, NTPC has a turnover of Rs400.2 billion net profit after tax of Rs75.1 billon and net worth of Rs526 billion. It is rated BBB− by Standard & Poor's but was recently placed on negative watch because of the deterioration of the sovereign's fiscal position. NTPC has developed comprehensive in-house expertise in various facets of power generation, from concept to commissioning, efficient operation, and nurturing of ecology and the environment in accordance with the policies of the Government. Its corporate plan foresees about 1,000 MW in additional capacity up to 2017 from renewable energy sources.

34. Kyushu, the fourth-largest electric power company in Japan, operates 193 power generation facilities with a total capacity of 19,716 MW on Kyushu and surrounding islands. While a majority of this capacity is thermal and nuclear power, the company also has 138 hydroelectric power stations (2,676 MW), five geothermal power stations (207 MW), and two wind power stations (3.3 MW) in its renewable energy portfolio. Its overseas investments in Asia include the 1,200 MW Ilijan gas-fired power project in the Philippines and the 717 MW Phu My 3 gas-fired power project in Viet Nam, which was partially financed by ADB. In FY2008, Kyushu had a turnover of $14.8 billion, net profit after tax of $416.4 million, and net worth of $23.0 billion. That year, Kyushu began voluntarily reducing its CO_2 emissions, with the aim of achieving a 20% reduction in the 1990 levels by 2012. It plans to add substantial wind, biomass, and solar projects by 2017.

35. A business unit of General Electric (GE), GE Energy Financial Services provides long-term debt, mezzanine, and equity finance to the energy and water sectors around the world and has over $14 billion in assets, backed by GE's technical knowledge and financial strength. GE is rated AA+ by Standard & Poor's. It invests more than $5 billion each year in energy and water, two of the world's most capital-intensive industries. It adds more than 25 years of lending and investing experience in these industries to GE's 100 years in the energy business. GE Energy Financial Services' renewable energy portfolio of over $4 billion includes wind, biomass, biogas, solar, geothermal, and small hydro projects. The company currently owns equity interest in 51 wind farms worldwide, with the capacity to produce more than 2,550 MW of renewable electricity. Through its affiliated companies, GE Energy brings technical knowledge from its manufacturing of high-capacity wind-turbine generators and off-grid distributed-generation sets and experience operating and maintaining its renewable energy equipment worldwide.

2. Board of Directors and Chief Executive Officer

36. The shareholders will appoint 5–15 nominees to the board of directors of the JVC in a composition approximately proportional to the shareholding of each investor. Initially, there will be a maximum of five directors, two of whom will be nominated by NTPC and one each by ADB, Kyushu, and GE Energy. If ADB decides not to nominate a director, it will have the right to appoint an observer to the board. For the first 10 years after formation of the JVC and subject to the unanimous consent of the parties, the board will be chaired by a director nominated by NTPC, who will preside over the meetings of the board and the shareholders.

37. The JVC will form its own professional management team under a chief executive officer (CEO) and supported by executives in engineering, finance, human resources, and utility operations. The CEO will be responsible for the day-to-day operations of the JVC. The initial

activities will include proposing the organization structure of the JVC, delegating authority to various officials, creating initial staff positions, having budgets approved by the board of directors, and recruiting and managing the employees. The CEO will also be responsible for finalizing and updating the business plan of the company.

V. THE PROPOSED INVESTMENT

A. Development Impact and Outcome

50. The JVC will help diversify India's energy mix and wean the country away from its dependence on fossil fuels, notably coal-fired thermal projects, and toward more sustainable energy sources. In the process, 1.1 million tons per year of CO_2 emissions will be avoided,[21] and the national goal of generating 10% of the country's power needs from renewable sources by 2012 will become more attainable.

51. The JVC intends to commission 500 MW of additional renewable power generation by 2012[22] by implementing projects through public-private partnership, thus catalyzing investment from the private sector and delivering maximum value to the public sector. The additional capacity would provide about 1.2 gigawatt-hours of additional electricity per year, helping to bridge the persistent energy deficits and load shedding, which disproportionally affect India's poor with limited or no access to electricity.

B. Development Effectiveness

52. The development impact of the investment in the JVC will be assessed in terms of private sector development, business success, and economic sustainability according to the guidelines for implementing the *Good-Practice Standards for Evaluation of Private Sector Investment Operations*.[23] The JVC will incubate projects in a diversified portfolio that can attract private sector investment at the time of listing or sale and by introducing the independent utility model of collaboration between a state-owned utility and strategic foreign electric utilities. With a target of continuously developing private renewable energy generation, even beyond 500 MW, the JVC will demonstrate a model of renewable portfolio development for future private sector investments in alternative energy. Over the past 18 months, ADB has facilitated discussions and negotiations between the state-owned enterprise and foreign investors to reconcile the different risk perceptions and investment expectations. The success of the JVC may encourage further partnerships between the public sector and strategic foreign investors. The market assessment indicates that the portfolio of projects is financially and economically sustainable and will play a significant role in mitigating GHG emissions, thus leading to global environmental benefits. The JVC's development effectiveness framework is in Appendix 1.

C. Environmental Aspects and Social Considerations

53. The initial JVC investment is classified as environmental category FI (equity investment) because the specific subprojects have not yet fully been identified. An environmental and social

[21] Assuming 500 MW of renewable capacity in operation.
[22] At a conservative average plant load factor of 25%, typical for wind-power projects.
[23] Multilateral Development Banks Evaluation Cooperation Group. 2006. *Good-Practice Standards for Evaluation of Private Sector Investment Operations.* Washington D.C. 3rd ed.

management system will be put in place by the JVC after incorporation. For those projects envisioned by the JVC, the subprojects are likely to be classified as environmental category B because renewable energy projects are unlikely to create any significant negative environmental impact during construction and operation. The JVC will covenant not to finance activities that are on ADB's list of prohibited investment activities. As laid out in the environmental and social management system framework (Appendix 6), each project will be properly classified and assessed in line with ADB's environmental safeguard policies before subprojects are approved by ADB.

54. The perceptible environmental impact of wind power projects is noise and visual impact, but both may be considered insignificant depending on the setback of turbines from settlements and the landscape values of the sites. Bird kill may be a nonissue since locations in the flight paths of endangered migratory birds will be avoided. Small hydroelectric projects could result in changes in waterway ecosystems, in the migration of some aquatic species, and in terrestrial areas affected by inundation where small amounts of pondage may be required. The JVC will therefore prioritize the development of run-of-the-river configurations that require minimal or no pondage to maintain flooding of the penstock, and will avoid locating in environmentally sensitive areas such as national parks or wildlife reserves. Any environmental disturbance associated with construction (i.e., land disturbance, vegetation clearance, erosion and sedimentation, construction noise and traffic, and waste generation) is considered temporary, by virtue of the limited extent and significance of the consequences. The implementation of the environmental management plan for each project will minimize or mitigate the impact during project operations, and will also include monitoring arrangements.

55. The project sites may be on government or private land or forestland. Sites on government-owned land or forestland could first be leased by the Government to the JVC or developer, and then transferred to the utility on commissioning. For privately owned land, the land is likely to be purchased by the JVC or the developer and later transferred to the utility after legal due diligence by the utility. The physical assets of wind farms have relatively small footprints. Wind-turbine generators will be sited on uninhabited land to avoid displacement of communities or loss of livelihoods. It is anticipated that the amount of land to be permanently acquired or purchased will be limited, and effects on grazing or agricultural activities, if not avoided, will be only minimal or temporary. Wind power projects are likely to be developed in states where there are tribal populations (Karnataka, Gujarat, Tamil Nadu, Maharashtra and Rajasthan), but the impact on scheduled tribes is expected to be limited since only small parcels of land will be required and tribal community life as a whole is unlikely to be disrupted. Given the nature and general location of projects to be financed by the JVC, the investment has been classified as B/C under the ADB *Involuntary Resettlement Policy* (1995) and B from the perspective of the ADB *Policy on Indigenous Peoples* (1998). The summary poverty reduction and social strategy is in Appendix 7.

D. Economic Evaluation

59. The economic analysis conducted to measure the viability of the JVC from the perspective of India's economy (Appendix 9) shows all costs and benefits in domestic 2009 constant values, with all estimated taxes and duties excluded. The value of electricity generated, the major economic benefit from the implementation of the JVC business plan, will be fully absorbed at present levels of electricity demand in the identified states, all of which face power shortages. The energy and power shortages of the past decade were mainly due to the significant lag in capacity additions behind demand growth. Hence, the electricity to be

generated by the JVC will answer unmet demand, i.e., it will not be a substitute for power from existing generation capacity. The entire output from the JVC will be incremental and will increase the supply of clean energy. Although the projects are not registered for CERs, the investments will lead to reductions in GHG emissions, a global environmental benefit. The economic analysis incorporates the value of this benefit, using a reasonable international market price for CERs.

60. The base-case economic internal rate of return for the JVC that will develop and operate 500 MW of renewable energy capacity is 21.1%, above the social discount rate of 12%. Sensitivity testing against four adverse scenarios demonstrates that the investment is economically robust and viable.

E. Justification

64. The investment is aligned with ADB's *Strategy 2020* (footnote 19) and Clean Energy and Environment Program, which calls for ADB to invest up to $1 billion per year in energy efficiency and renewable energy in Asia and to sustain that level of investment.[24] Significant additions will be made in India's generation capacity for thermal power to help meet the country's rapid growth in electricity demand. Total GHG emissions will, however, also increase as a result. ADB's investment in the JVC will enable India to reduce emission intensity in the power sector and to bring down incremental increases in GHG emissions by 1.1 million tons of CO_2 per year, while pursuing its poverty reduction strategies and economic development.

65. The proposed investment is consistent with the CSP update (2006–2008) and with the 2009–2012 country partnership strategy, now being prepared, to sustain ADB's support for inclusive and environmentally sustainable growth in India (footnote 17). It affirms the strategic pillars of (i) supporting the development of a low-carbon infrastructure, particularly in hydropower and other forms of renewable energy; and (ii) catalyzing investment through the use of innovative business and financing modalities such as public-private partnerships, nonsovereign operations, and the carbon credit market.

66. The proposed investment will increase power generation from renewable energy sources in India, in line with the Government's objectives stated in the Electricity Act of 2003 and the Integrated Energy Policy. India has been trying to reduce its dependence on price-sensitive fossil fuels and to develop renewable energy sources, which are abundant and mostly underused, for energy security and environmentally sustainable economic development. Outflows of foreign exchange for imports of fossil fuels, such as coal from Indonesia, Australia, and South Africa, will also be reduced.

67. The proposed JVC will attract private foreign investors who were previously reluctant to invest directly in the renewable energy sector because of the perceived risks and the dominance of local firms. Private investment has been project by project at best. Domestic investment in wind power was initially encouraging, but most of it was undertaken purely for the accelerated-depreciation benefits, or by captive power supply or distribution utilities seeking to comply with renewable energy purchase obligations. The proposed joint venture introduces the independent utility model for renewables, which will help bring down the overall cost of funding (and hence the average cost of generation) and prove that this business concept is viable and

[24] The Energy Efficiency Initiative as described and endorsed in ADB. 2007. *Clean Energy Financing Partnership Facility: Establishment of the Clean Energy Fund and Clean Energy Trust Funds.* Manila.

sustainable. This proof of concept may change risk perceptions and attract other foreign investors to the renewable sector in India.

F. Anticorruption Policy and Policy of Combating Money Laundering and the Financing of Terrorism

69. The investors were advised of ADB's *Anticorruption Policy* (1998, as amended to date) and policy relating to the *Combating of Money Laundering and the Financing of Terrorism* (2003). Consistent with its commitment to good governance, accountability, and transparency, ADB will require the JVC to institute, 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 investment documentation among ADB, the other shareholders, and the JVC will further allow ADB to investigate any violation or potential violation of these undertaking.

VI. INVESTMENT LIMITATIONS

70. The proposed financing will be within approved country, industry, project, and group exposure limits for nonsovereign operations.

VII. ASSURANCES

71. **No-Objection Letter.** Consistent with the Agreement Establishing the Asian Development Bank, the Government of India will be requested to confirm that it has no objection to the proposed assistance to the JVC. No funding will be disbursed until ADB receives such confirmation.

72. **Documentation.** Following the approval of the proposed investment by the ADB Board of Directors, ADB will enter into suitable investment documentation. The documentation will be on terms and conditions consistent with this document, acceptable to ADB, and consistent with all relevant ADB policies.

VIII. RECOMMENDATION

73. I am satisfied that the proposed equity investment would comply with the Articles of Agreement of the Asian Development Bank (ADB) and recommend that the Board approve the equity investment of up to $40,000,000 equivalent in the Public–Private Partnership for Renewable Energy Development in India from ADB's ordinary capital resources, on 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

6 April 2009

DESIGN AND MONITORING AND DEVELOPMENT EFFECTIVENESS FRAMEWORKS

Table A1.1: Design and Monitoring Framework

Design Summary	Performance Targets and/or Indicators	Data Sources and/or Reporting Mechanisms	Assumptions and Risks
Impact Diversify India's energy mix and reduce dependence on power generation from fossil fuel resources	10% renewable power in India's total generation by 2012 and that same ratio at least maintained through 2020 Electricity generation from coal reduced to 50% by 2020	Power sector statistics as published or announced by Ministry of Power MNRE annual reports Company annual reports	**Assumptions** There is continued macroeconomic and political stability Power demand is in line with projections Regulatory incentives for renewable projects remain in place **Risks** Market price for coal and other fossil fuels dramatically decreases CDM mechanism and carbon market is substantially revised after 2012
Outcome 500 MW of additional renewable power generation projects implemented by a public-private joint venture in India	Additional power generation of 1,214 GWh by 2013 1.1 million tons of CO_2 per year avoided by 2013	Power sector statistics as published or announced by Ministry of Power Quarterly and annual financial statements of the company Quarterly progress reports of the company ADB annual reviews	**Assumptions** Business plan is successfully executed in a timely fashion There is continuity of qualified company management **Risks** Identified projects are not commercially viable because of external factors Current financial crisis inhibits projects from moving forward or getting financed
Outputs 1. Development of a diversified portfolio of renewable energy projects (wind, small hydro, others) 2. Implementation of an environmental and social management system	At least three separate projects in operation from at least two different types of renewable projects by 2013 All related policies put in place by company management by 2010	Quarterly and annual financial statements of the company Quarterly progress or construction reports to the board ADB annual reviews	**Assumptions** Company has access to adequate development funds and working capital Construction contracts are successfully negotiated and risks adequately mitigated **Risks** Projects are delayed In-country political risks

Design Summary	Performance Targets and/or Indicators	Data Sources and/or Reporting Mechanisms	Assumptions and Risks
3. Successful management of project construction 4. Efficient operation and maintenance of facilities	Capital expenditures within 10% of estimates made at board approval O&M costs in line with estimates		result in non-project-specific delays
Activities with Milestones 1.1 Investment agreement signed by May 2009 1.2 Company incorporated under Indian law by June 2009 1.3 Managing director and senior management recruited by July 2009 2.0 Detailed project reports or feasibility studies prepared for at least three renewable projects in accordance with the signed investment documentation, by July 2010 2.1 Additional renewable energy projects developed in accordance with the business plan, by 2012 3.0 Capital expenditures for renewable energy projects by 2012 4.0 CER credits sold on a spot or forward basis at market prices at appropriate time			**Inputs** **Equity** Shareholders TBD **Debt** Commercial lenders TBD

ADB = Asian Development Bank, CDM = Clean Development Mechanism, CER = certified emission reduction, CO_2 = carbon dioxide, DMC = developing member country, GE = General Electric, GWh = gigawatt-hour, MNRE = Ministry of New and Renewable Power, MW = megawatt, O&M = operation and maintenance.

Table A1.2: Development Effectiveness Framework

Objective	Impact	Performance Targets	Measurements
Private Sector Development	**Company Impact** Company business plan implemented on a commercially sustainable basis New sources of foreign investment from experienced foreign utilities catalyzed **Impact beyond Company** Demonstration effect of pursuing renewable energy projects through a diversified portfolio approach Demonstration effect of a public-private joint venture company to leverage strengths and experience of investors	500 MW of projects implemented or in advanced stage of development by the end of 2013 JVC able to raise recourse financing to company balance sheet at a cost of borrowing lower than that for nonrecourse financing Average cost per kWh of renewable power competitive with that of power from traditional sources More long-term partnerships established between foreign investors and local investors or state-owned enterprises in the renewables market	JVC's success in implementing a majority of the projects as stated in its business plan JVC operating and financial performance reports Reports on electricity generation prices from state electricity regulators based on merit-order dispatch MNRE reports on foreign investment in the sector
Business Success	Financially profitable and sustainable operations	Satisfactory return on invested capital 500 MW of projects implemented or in advanced stage of development by the end of 2013	Internal rate of return of free cash flow available to investors Dividend yield from JVC IPO valuation and earnings multiple relative to market standard Audited JVC financial reports
Economic Sustainability	Economic growth through more reliable power supply with less-frequent shortages Low-carbon energy projects developed CO_2 emissions reduced in line with MDG targets for India	Share of renewable energy in India's power generation increased to 10% and maintained at that level Emission intensity reduced from 0.80 tons CO_2 per MWh in India CERs generated of 1.1 million tons of CO_2 per year Economic rate of return greater than 12%	Ministry of Power reports on electricity production and other energy sources CEA report on baseline emissions for India MNRE reports on renewable energy development, incentives, etc. UN or other international reports on carbon intensity in India

CEA = Central Electricity Authority, CER = certified emission reduction, CO_2 = carbon dioxide, IPO = initial public offering, JVC = joint venture company, kWh = kilowatt-hour, MDG = Millennium Development Goal, MNRE = Ministry of New and Renewable Energy, MW = megawatt, UN = United Nations.

WIND POWER SECTOR IN INDIA

A. Growth of Generation Capacity

10. As the Indian power sector has grown, India has become more and more dependent on fossil fuels. With the recent volatility in oil and gas prices, and the expected shortage of fossil fuels in the future, there has been increasing concern about the security of India's energy supply, as well as the environmental effects of excessive use of fossil fuels. India therefore urgently needs to explore sustainable energy development, and the Government has been working proactively to promote the use of renewable energy.

11. Among the renewable power resources available in India, wind energy shows promise. India has 45,000 megawatts (MW) of gross potential if 1% of land in the potential areas is assumed to be available for wind-power generation. Sites with annual mean wind density exceeding 200 watts per square meter are considered suitable for wind power projects. The Center for Wind Energy Technology (C-WET) identified 216 such sites in India. The states with the most sites are Tamil Nadu (41), Gujarat (38), Andhra Pradesh (32), Maharashtra (31), and Karnataka (26). India's technical potential is only about 13,000 MW with 20% grid penetration, but this figure should rise as grid capacity in the potential states increases. As of December 2007, India had installed wind power capacity of over 7,800 MW and ranked fourth in the world in this regard, after Germany, Spain, and the United States. A 2,200 MW increase in installed wind power capacity was targeted in the 10th Five Year Plan; over 5,500 MW has been installed.[25] The installed wind power capacity and gross potential in India, by state, is shown in Table A2.1.

Table A2.1: Installed Wind Power Capacity and Potential in India, by State

(MW)

State	As of 31 March 2005	As of 31 March 2006	As of 31 December 2007	Gross Potential
Andhra Pradesh	120.5	121.0	122.5	8,275
Gujarat	253.5	338.1	874.8	9,675
Karnataka	410.8	584.6	917.2	6,620
Kerala	2.0	2.0	2.0	875
Madhya Pradesh	28.9	40.3	70.3	5,500
Maharashtra	456.2	1,001.3	1,646.3	3,650
Rajasthan	284.8	358.1	495.7	1,700
Tamil Nadu	2,034.9	2,892.5	3,711.6	5,400
West Bengal	1.1	1.1	1.6	3,050
Others	1.6	1.6	2.7	450
Total	**3,594.3**	**5,340.6**	**7,844.5**	**45,195**

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

12. While the joint venture company (JVC) has no geographic restrictions, it has targeted certain states on the basis of a market assessment and discussions with investors. The states targeted for new wind-turbine installation are Karnataka, Maharashtra, Rajasthan, and Madhya Pradesh. All are leading states in wind resource availability (gross potential is 6,620 MW in Karnataka, 3,650 MW in Maharashtra, 1,700 MW in Rajasthan, and 5,500 MW in Madhya Pradesh) and in wind generation capacity (Karnataka has 917 MW of installations, Maharashtra 1,646 MW, Rajasthan 496 MW, and Madhya Pradesh 70 MW). Wind power potential is already well developed in Tamil Nadu, with 5,400 MW available and 3,712 MW

[25] Ministry of New and Renewable Energy. 2008. *Annual Report 2007–2008*. New Delhi.

installed. But since the state is in an advanced state of development, many installed turbines are older, and thus less efficient and undersized. Some existing sites can be retrofitted with newer and larger turbines. All of the targeted states actively promote wind power generation and have declared 20-year fixed feed-in tariffs.

B. Regulatory Framework for Wind Power in India

13. The Government is proactively encouraging the development of renewable energy sources. It started promoting renewable energy in the early 1980s, after the first and second global oil price shocks. The Commission for Additional Sources of Energy was created in 1981, and the Department of Non-Conventional Energy Sources in 1982. The latter became 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 development of renewable energy sources is a major goal of the National Electricity Policy, issued by the Ministry of Power in 2005. MNRE is the nodal ministry for all matters relating to new and renewable energy. Its main functions are (i) policy making 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.

14. MNES (now MNRE) established C-WET 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.

15. Technological advances are gradually producing more commercially viable wind power projects. Wind power has become a more attractive investment with the replacement of the old 250-kilowatt wind turbines 30 meters (m) high with 1–2 MW units 50–80 m high. Greater wind power density due to the increased height, lower installation cost per MW, and reduced land requirement make a good case for choosing a larger unit size of wind turbines. India's advantage is that it manufactures wind turbines 1 MW and above.

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

17. Recently, the focus of the regulatory framework for the renewable energy sector has shifted from being supply-driven to being demand-driven. The Electricity Act of 2003 requires all state energy regulatory commissions to ensure that electricity distributors procure a specified minimum percentage of power generation from renewable energy sources.[26] In its midterm

[26] Section 86 of the Electricity Act of 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;…"

appraisal of the 10th Five Year Plan, the Planning Commission (footnote 1) made the following recommendations regarding the renewable energy sector:

(i) switch incentives and support from supply-driven programs to demand-driven programs and technologies;
(ii) explore alternative subsidy structures that encourage utilities to use wind, small hydroelectric, cogeneration, and other nontraditional energy sources;
(iii) phase out capital subsidies linked to the creation of renewable capacity in favor of subsidies linked to renewable energy generated;
(iv) require electricity distributors, through the state electricity regulatory commissions, to purchase energy from renewable sources, as provided in the Electricity Act; and
(v) improve coordination and synergy between the programs of MNES (now MNRE) and similar programs of other central ministries and state governments.

C. Wind Power in Target States

18. The target states of Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu are among India's leading states in wind energy generation, with a gross potential of about 22,870 MW. As of 31 December 2007, these states had an installed wind generation capacity of 6,841 MW. Their potential for further wind generation is therefore significant.

19. Each of the target states has passed regulations to encourage wind power generation. In accordance with the tariff policies of the Government, the states have issued renewable energy purchase obligations requiring distribution licensees to purchase a minimum quantity of total electricity consumption from renewable sources (Table A2.2).

20. Each of the target states has declared power purchase agreement (PPA) conditions and approved standard PPAs to be executed between the generator and the distribution licensee according to the terms indicated in Table A2.2. All states have "take-and-pay" provisions for power offtake, with "must-run" status in the merit-order dispatch.

Table A2.2: Wind Power Policies, by State

Policy Item	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan	Tamil Nadu
Renewable energy purchase obligation	5% minimum, 10% maximum	0.5% minimum	6.0% minimum for 2009–2010	6.0% minimum for 2009–2010; increasing to 7.5% for 2011–2012	Obligations set for each distribution licensee from 0.95% to 3.8%
Tariff order duration (years)	10	20	13	20	20
Feed-in tariff (Rs/kWh)	3.40	4.03	3.50	3.78	3.40
Escalation	None	Declines gradually to Rs3.36/kWh by year 20	Above rate + Rs0.15/kWh per year	None	None
Share of CDM revenue with distribution licensee(s)	0%	0%	0%	25%	50% proposed
Other incentives	No electricity duty for 5 years	No electricity duty for 5 years	Support for infrastructure and evacuation costs	50% duty exemption for 7 years	–

CDM = Clean Development Mechanism, kWh = kilowatt-hour.
Source: Wind Power India. Available:http://www.windpowerindia.com

SMALL HYDROELECTRIC POWER SECTOR IN INDIA

A. Growth of Generation Capacity

1. Among the renewable power resources available in India, a promising source for further development is small hydropower. This consists of hydroelectric generation stations with a capacity of up to 25 megawatts (MW), typically run-of-river or small pondage installations with minimal inundation zones for storage or none. India ranks fifth in the world in usable potential, distributed across six major river systems—the Indus, the Brahmaputra, the Ganga, the central Indian river systems, and the east- and west-flowing river systems of south India.[1] The economically exploitable potential from these river systems has been assessed at just over 84,000 MW in delivered capacity, accounting for load factor, topographic features, and watershed hydrology. So far only 32,325 MW has been established. Included in the assessment is nearly 10,000 MW in small hydroelectric power development potential distributed over 4,000 sites with an estimated unidentified potential of an additional 5,000 MW.

2. The hydroelectric power sector was opened to private sector participation in 1991, but only about 910 MW, or less than 3% of the total installed hydropower capacity, has been commissioned so far. The hydro-rich states of Himachal Pradesh, Sikkim, and Uttarakhand have adopted several measures in recent years to promote the balanced growth of public and private sector projects. They are the initial target development states of the joint venture company (JVC). These states have an estimated potential capacity of just over 3,450 MW, distributed among 874 remaining sites.[2] Table A3.1 shows the installed small hydropower capacity and gross potential in the three target states.

Table A3.1: Installed Small Hydropower Capacity and Potential in Himachal Pradesh, Sikkim, and Uttarakhand

State	Installed Capacity (MW)	Capacity under Development (MW)	Gross Potential Capacity (MW)	Number of Sites Remaining
Himachal Pradesh	146.6	71.8	2,268.4	469
Sikkim	39.1	13.2	265.5	73
Uttarakhand	410.8	584.6	917.2	332
Total	**596.5**	**669.6**	**3,451.1**	**874**

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

B. Regulatory Framework for Small Hydropower in India

3. The Government is proactively encouraging the development of renewable energy sources. Its efforts to promote renewable energy started in the early 1980s after the first and second global oil price shocks. The Commission for Additional Sources of Energy was created in 1981 and the Department of Non-Conventional Energy Sources in 1982. The Department of Non-Conventional Energy Sources became 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 development of renewable energy sources is a major goal of the National Electricity Policy, issued by the Ministry of Power in 2005. MNRE is the nodal ministry for all matters

[1] Asian Development Bank (ADB). 2007. *Hydropower Development in India: A Sector Assessment.* Manila.
[2] Ministry of New and Renewable Energy. 2008. *Annual Report 2007–2008*. New Delhi.

relating to new and renewable energy. Its main functions are (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.

4. Recently, the focus of the regulatory framework for the renewable energy sector has shifted from being supply-driven to being demand-driven. The Electricity Act of 2003 requires all state energy regulatory commissions to ensure that electricity distributors procure a specified minimum percentage of power generation from renewable energy sources.[3] In its midterm appraisal of the 10th Five Year Plan, the Planning Commission (footnote 1) made the following recommendations regarding the renewable energy sector:

(i) switch incentives and support from supply-driven programs to demand-driven programs and technologies;
(ii) explore alternative subsidy structures that encourage utilities to use wind, small hydroelectric, cogeneration, and other nontraditional energy sources;
(iii) phase out capital subsidies linked to the creation of renewable capacity in favor of subsidies linked to renewable energy generated;
(iv) require electricity distributors, through the state electricity regulatory commissions, to purchase energy from renewable sources, as provided in the Electricity Act; and
(v) improve coordination and synergy between the programs of MNES (now MNRE) and similar programs of other central ministries and state governments.

5. The National Tariff Policy 2005 requires distribution companies to procure their future hydropower requirements from the generation companies through competitive bidding. Central and state public utilities have a 5-year window within which to implement the bidding framework. The terms and conditions laid down by the Central Electricity Regulatory Commission (CERC) for tariff setting include 0.2%–0.7% auxiliary energy consumption, based on generator configuration, and recovery of full capacity charges based on the capacity indexes indicated in Table A3.2.

Table A3.2: Norms of Operation for Recovery of Capacity Charges

(%)

Power Station Type	Capacity Index in Year 1 of Commercial Operation	Capacity Index after Year 1 of Commercial Operation
Purely run-of-river	85	90
Storage-type or run-of-river with pondage	80	85

Source: Asian Development Bank.

6. CERC has set the debt-equity ratio as of the start of commercial operation at 70:30 for tariff setting. A developer may contribute additional equity, but the amount for tariff setting is

[3] Section 86 of the Electricity Act of 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;…"

capped at 30% and the balance is considered as quasi-equity debt. For structures at less than 30% equity, the tariff may be determined at the actual debt and equity.

7. The tariff is a two-part structure, comprising recovery of annual capacity charges and primary energy charges. Project capital is recovered through the annual capacity charge, and variable costs through the energy charges. The rate of primary energy charge is equal to the lowest variable charge of the central sector thermal power station in the region. Generation performance incentives are payable when the capacity index[4] exceeds the values indicated in Table A3.2, accrued up to a maximum of 100%. Additionally, an incentive for early commissioning is payable for an amount of pro rata reduction in interest during construction recovered through the tariff in 12 equal monthly installments for the first 12 months of operation.

8. Despite this regulatory framework and progress made in the sector, the development of small hydropower projects has been impeded by various factors. Barriers specific to private sector small hydropower development include (i) long project gestation periods, (ii) high capital costs, (iii) statutory clearances, (iv) geologic uncertainties, (v) land acquisition difficulties, and (vi) resettlement and rehabilitation problems (in some cases). In addition, the absence of a streamlined single-window clearance system can delay the approval process and be a setback for organizations not familiar with the process. To assist developers in overcoming these barriers, MNRE provides financial and technical support to state hydropower development initiatives. Three states in particular have adopted initiatives to promote the growth of private sector projects, as discussed below.[5]

9. **Himachal Pradesh.** The key features of the state's policy are (i) developers are selected through the memorandum of understanding route for projects of up to 100 MW; (ii) no CEA clearances are required for projects of up to Rs25 billion, selected through competitive bidding; (iii) a premium is paid on peak power; and (iv) 100% foreign equity is permitted on the automatic approval route for projects of up to Rs15 billion. Through a multitranche financing facility to Himachal Pradesh Power Corporation, ADB is supporting four hydroelectric power projects (111 MW, 195 MW, 100 MW, and 402 MW).

10. **Sikkim.** The Sikkim Power Development Corporation Limited (SPDCL) facilitates joint venture projects between private power developers and the Government. SPDCL-sponsored projects have the following key features: (i) 12% free power is made available to the state, (ii) the project may sell the balance directly to states or power trading agencies on a merchant basis, and (iii) the Government has equity participation of 10%–49%.

11. **Uttarakhand.** The key features of the state's policy for private sector development are as follows: (i) potential projects are advertised for international competitive bidding, (ii) projects are awarded on the basis of the highest bid over the up-front minimum premium, (iii) concessions are granted through 45-year build-own-operate-transfer contracts, (iv) developers may sell the power outside the state, and (v) up to 12% of the power generated can be captured by the state's free power program. Through a multitranche financing facility, ADB is funding four small hydropower projects in Uttarakhand (10 MW Madhyamaheshwar, 4 MW Kaliganga-I, 6 MW Kaliganga-II, and 9 MW Kaldigad).

---

[4] Capacity index—the ratio of declared capacity to the maximum available capacity—has been adopted by the Central Electricity Regulatory Commission as a standard parameter for hydropower in lieu of plant load factor. Capacity index is essentially a declaration of machine availability independent of water availability; therefore, hydrological risk is passed on directly to beneficiaries.

[5] ADB. 2007. *Hydropower in India: A Sector Assessment.* Manila.

DESCRIPTION OF SHAREHOLDERS

A. NTPC Limited

1. Overview and History

1. NTPC Limited (formerly known as National Thermal Power Generation Limited) is a government-owned entity with 89.5% of its paid-up capital contributed by the Government and the balance of 10.5% being held by foreign institutional investors, financial institutions, banks, and the general public. NTPC is India's largest producer of thermal power.[1] Although the Government is the majority owner, NTPC is considered a *navratna* company, that is, it operates under the Companies Act like a private company and its management can make operating decisions without interference from the Government. As of 31 December 2008, the total installed capacity of NTPC was 29,894 megawatts (MW), through 15 coal-fired power stations (23,895 MW), seven gas-fired power stations (3,955 MW), and three joint venture projects (2,044 MW). NTPC had a 19.6% share of the total installed capacity in India as of that date, and it contributed 27.1% of total power generation in the country in FY2005.

2. NTPC is expanding its business into hydroelectric power generation, coal mining, gas exploration, and the liquefied natural gas value chain, to supplement and support its core power generation activities. Through its wholly owned subsidiaries, NTPC proposes to implement and operate small to medium-sized hydroelectric power plants and engage in power trading and distribution. It is also involved in several joint ventures, including one with Alstom, Germany, for the renovation and modernization of third-party power plants in India and other member countries of the South Asian Association for Regional Cooperation.

2. Assets and Operations

3. NTPC has a current installed capacity of 29,894 MW. It plans to become a generation company with power generation of more than 46,000 MW by the end of the 11th Plan period (end of 2012) and more than 66,000 MW by the end of the 12th Plan period (end of 2017). NTPC is adopting a multipronged growth strategy for capacity addition through greenfield projects, expansion of existing stations, acquisitions and takeovers, and joint ventures and subsidiaries. Aside from the 4,000 MW already commissioned during the 10th Plan period and 8,970 MW under implementation during the 10th and 11th plan periods, the new generation projects identified for implementation include both greenfield projects and the expansion of existing power plants.

4. The engineering, construction, and operation of power plants for thermal power generation is the core business of NTPC. Sales of energy accounted for 93% of its operating income in FY2008. NTPC's facilities are located throughout India, but mostly in the central and eastern states. The company is also looking to invest in power generation facilities in neighboring countries like Sri Lanka.

[1] Ministry of Power. 2005. *Annual Report for Fiscal Year 2005*. New Delhi.

3. Financial Performance

5. NTPC pays dividends annually to the Government and its other shareholders. The dividend paid for FY2007 was Rs28,859 million, or 38.9% of profits after tax, not far different from the Rs26,385 million paid for the previous fiscal year. NTPC's dividend target is 30% of profit after tax, but NTPC is allowed to use its internal resources to fund capacity expansion. Dividends are declared and paid at the board's recommendation and with the approval of the shareholders.

6. The operating performance of NTPC has been considerably above the national average. The increase in the availability factor for coal stations, from 85.03% in FY1997 to 92.12% in FY2007, compares favorably with international standards. The plant load factor increased from 75.2% in FY1997 to 92.24% in FY2007, its highest level since the start. Table A4.1 summarizes NTPC's financial results for the most recent 3 years.

Table A4.1: Financial Performance Summary for NTPC Limited
(Rs million)

Performance Indicator	FY2005	FY2006	FY2007
Energy sold (GWh)	159,019	176,530	187,988
Total revenue from energy	266,564	325,344	369,462
Earnings	66,087	89,074	102,549
Profit after tax	58,202	68,647	74,148
Net worth	449,587	485,968	526,386
Loans	201,973	271,906	244,844
Total assets	651,560	757,874	771,230
Operating cash flow	59,720	80,653	101,711

GWh = gigawatt-hour.
Source: NTPC. 2008 and 2007. *NTPC Annual Report 2007–2008 and 2006–2007*. New Delhi.

4. Focus on Renewable Energy

7. NTPC has gone into renewable energy development, first into hydropower and then into wind power, to establish a sustainably balanced power portfolio. As of July 2007, the company had 1,920 MW of run-of-river hydropower projects under implementation at three different locations. NTPC is also looking separately into wind power projects in conjunction with state governments.

B. Kyushu Electric Power

1. Overview and History

8. Kyushu Electric Power Company Incorporated was established in 1951 and today is an integrated generation, transmission, and distribution company serving the island of Kyushu and

surrounding small islands. Since the deregulation of Japan's electric power industry, Kyushu Electric Power has diversified into information technology and telecommunications, environment and recycling, and lifestyle-oriented services.

2. Assets and Operations

9. Kyushu Electric Power supplies electricity to 8.42 million people and operates 194 generation facilities with a total capacity of 19.42 gigawatts, including thermal, nuclear, hydroelectric, gas, and wind-power projects. Nuclear power facilities account for 41% of the electricity that the company produces. Carbon dioxide (CO_2) emissions per unit of electricity used are among the lowest in Japan's electric power sector, at 0.375 kilograms of CO_2 per kilowatt-hour.

4. Financial Performance

10. Table A4.2 presents a summary of the financial performance of Kyushu Electric Power. On 18 July 2008, Moody's Investors Service assigned an Aa2 rating with a stable outlook to the company's ¥470 billion shelf registration, in view of Kyushu Electric Power's solid franchise in its operating area on Kyushu Island, the effectively limited competition in the industry, and the importance of the company's public utility service, backed by a favorable regulatory framework and the Japanese Government's energy policy.[2]

Table A4.2: Financial Performance Summary for Kyushu Electric Power Company
(¥ billion)

Performance Indicator	FY2005	FY2006	FY2007
Energy sold (GWh)	58,982	60,765	60,706
Operating revenue	1,408.7	1,401.7	1,408.3
Net income	89.2	76.8	65.9
Profit after tax (%)	6.3	5.5	4.7
Net worth	1,910.3	1,997.4	2,007.1
Long-term debt	2,139.4	2,104.9	2,031.7
Total assets	4,049.7	4,102.3	4,038.8
Operating cash flow	—	270.9	304.5

— = not available
GWh = gigawatt-hour.
Note: $1 = ¥97.87 as of 30 March 2009
Source: Kyushu Electric Power Co. Inc. 2007. *Annual Report 2007*. Fukuoka.

4. Focus on Renewable Energy

11. Kyushu Electric Power is operating or developing three wind power generation facilities on Kyushu Island with a total output of 54 MW.[3] The company has considerable experience in hydropower generation: it operates 138 hydropower stations in various forms, from a 50 kW

[2] Reuters. 18 July 2008.
[3] Kyushu Electric Power Co. Inc. 2007. *Overview of Kyushu Electric Power*. Fukuoka.

mini-hydro to a 180 MW reservoir type, and a 600 MW pumped storage. Its total hydropower output is 2,378 MW. Small hydroelectric power installations (up to 25 MW) make up 124 of the total of 138, and produce 463 MW of power.

C. GE Energy Financial Services

1. Overview and History

21. GE Energy Financial Services (GE EFS), a business unit of GE with $19 billion in assets, provides structured project finance, construction loans, lease financing, funding for late-stage project development efforts, and venture capital for promising energy projects globally. Under GE's "ecomagination" initiative, the company is expanding its participation in clean- and renewable energy projects to reduce greenhouse gas emissions. GE EFS is headquartered in Connecticut, USA, and will interface with the JVC from its office in Gurgaon, India, from which it operates its global growth business unit.

2. Assets and Operations

22. Projects supported by GE EFS generate a total of 26 gigawatts and the company has invested in more than 30,000 miles of natural gas pipelines. Considerable equity investments and loan products have put over $4 billion into wind, solar, biomass, hydroelectric power, geothermal, and other renewable power projects. In emerging markets, the core business of GE EFS is in power, water, gas, and renewables. Outside North America, it has invested more than $1.6 billion in 24 projects, including projects in India, and plans to increase the investment total to $5 billion by 2010. It has recently taken equity positions in a power and water project holding company in Turkey and a captive power developer in India, and is establishing a renewable energy trust in Singapore to pursue renewable opportunities in Southeast Asia. The parent company, GE Energy, has supplied over 10,000 wind-turbine installations worldwide with more than 15,000 MW of capacity in over 20 years. Its product and service portfolio includes wind turbines with rated capacities of up to 3.6 MW and support services ranging from development assistance to operation and maintenance.

5. Financial Performance

23. GE EFS is a wholly owned subsidiary of GE under its capital finance operating segment and therefore does not publish financial statements aside from GE's consolidated statements. Total revenue and profit after tax are indicated specifically for GE EFS (Table A4.3) and the company enjoys access to the capital markets under GE's AA+ credit rating.

Table A4.3: Summary Financial Key Indicators for GE Energy Financial Services

($ million)

Performance Indicator	FY2006	FY2007	FY2008
Total revenue	1,664	2,405	3,707
Profit after tax	648	677	825

Source: GE 2008. *Annual Report 2008.* Stamford.

4. Focus on Renewable Energy

24. GE EFS has been growing rapidly at an average annual rate of 32% by revenue since 2005 and diversifying its portfolio of more than $4 billion in renewable energy assets. As an anchor investor, it has launched the Renewable Energy Trust Asia to build a portfolio of 200 MW in renewable energy projects in Southeast Asia. GE has a long track record of investing in wind, solar, biomass, hydro, and geothermal power assets. In addition to renewable power assets, GE's renewables finance experts are examining growth opportunities in biofuels, greenhouse-gas offsets, energy efficiency, and many other sectors.

25. GE EFS has equity positions in over 30 wind farms totaling more than 2,000 MW, including a $51 million equity investment in the Kumeyaay wind farm, which was the largest wind farm in India in 2005. The equity investments have demonstrated a transparent commercial approach, as evidenced by the selection of seven turbine vendors, six of them from outside GE, to supply more than 50% of the turbines.

DRAFT ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM FRAMEWORK

A. Guiding Principles

1. After incorporation, the joint venture company (JVC) will formulate a corporate policy for environmental and social management and establish an environmental and social management system (ESMS) consistent with the safeguard policy principles and requirements of the Asian Development Bank (ADB). The guiding principles are as follows:

(i) compliance by the JVC with ADB's applicable environmental and social safeguard policies,[1] and the environmental and social laws and policies (on labor,[2] land acquisition, and resettlement) of India;

(ii) integration of an assessment of compliance with environmental and social safeguards in the due diligence and risk assessment by the JVC;

(iii) establishment of a process or system for screening, categorization and classification, and assessment, to identify and monitor the adverse environmental and social impact of the JVC's projects;

(iv) identification of appropriate mitigation and compensation measures to minimize adverse impact in line with international best practices and applicable environmental and social safeguards;

(v) public disclosure of information about the projects' environmental and social impact;

(vi) promotion of compliance by the investee with applicable environmental and social safeguards, including India's resettlement laws and standards, through appropriate documentation of environmental and social impact studies, approvals, and site visits as appropriate;

(vii) where applicable, in case of breach of the environmental and social policy requirements of ADB, or the laws and standards of the Government of India, prompt collaboration in the preparation of an action plan; and

(viii) appropriate staffing of the JVC to enable it to implement the ESMS.

B. Environmental and Social Management System

2. The JVC will establish and adopt an ESMS consistent with ADB's environmental and social safeguard policies. The ESMS will comprise (i) the environmental and social safeguard policy, signed by senior management; (ii) environmental management capability; (iii) procedures for the environmental assessment and review of subprojects; and (iv) environmental monitoring and reporting procedures.

---

[1] ADB has three safeguard policies: the *Environment Policy* (2002), the *Policy on Indigenous Peoples* (1998), and the *Involuntary Resettlement Policy* (1995). ADB investees are legally obligated to comply with these policies.

[2] In addition to the three policies mentioned in footnote 1, ADB has a Social Protection Strategy, which recommends best practices with regard to labor markets, social insurance, social assistance, micro- and area-based schemes, and child protection. Although compliance with the Social Protection Strategy is not a legal requirement, it is a desirable extension of the JVC's approach to environmental and social protection. Additional guidance on the Social Protection Strategy is available at http://www.adb.org/SocialProtection.

1. Environmental and Social Management System Policy

3. As part of the process of establishing an ESMS, the JVC will prepare and adopt an environmental and social safeguard policy statement signed by its senior management, which stipulates, among other things, that

(i) the JVC's projects should be consistent with its policies on the environment, involuntary resettlement, and indigenous peoples and scheduled tribes,[3] as well as other social and disclosure policy requirements;

(ii) the JVC should actively observe all applicable environmental and social requirements of the national and local governments of India, particularly those governing land acquisition, compensation, involuntary resettlement, and indigenous peoples;

(iii) the JVC should also follow internationally recognized labor practices consistent with national labor laws and regulations; and

(iv) if the JVC contravenes applicable environmental and social safeguard requirements, ADB will take action to understand the reasons for noncompliance and will discuss corrective actions acceptable to the relevant authorities.

4. Wherever the relevant projects of the JVC involve involuntary resettlement[4] impact, the JVC will satisfy itself that it has (i) avoided involuntary resettlement wherever feasible; (ii) minimized resettlement where population displacement is unavoidable; and (iii) ensured that affected persons[5] have been compensated and assisted through replacement of land, housing, infrastructure, resources, income sources, and services, in cash or in kind, so that their economic and social circumstances will be at least restored to the pre-project level. All compensation will be based on the principle of replacement cost.

5. Wherever the projects of the JVC affect indigenous peoples or scheduled tribes, the JVC will satisfy itself that it has (i) avoided negative impact on indigenous peoples or scheduled tribes, where possible; (ii) provided adequate and appropriate compensation where negative impact is unavoidable; and (iii) ensured that development initiatives affecting indigenous peoples are effective and sustainable, and are compatible in substance and structure with their cultures and social and economic institutions, and commensurate with their needs, aspirations, and demands.

---

[3] Scheduled tribes or indigenous people are those with a social or cultural identity distinct from that of the dominant or mainstream society, making them vulnerable to being disadvantaged in the process of development.

[4] ADB defines "involuntary resettlement" as social and economic impact that is permanent or temporary and is caused by (i) the acquisition of land and other fixed assets, (ii) a change in the use of land, or (iii) restrictions imposed on land as a result of an ADB operation.

[5] The term "affected person" includes any people, households, firms, or private institutions that, on account of changes resulting from the project, will have their (i) standard of living adversely affected; (ii) right, title, or interest in any house, land (residential, commercial, agricultural, forest, or grazing land), water resources, or any other movable or fixed assets acquired, possessed, restricted, or otherwise adversely affected, in full or in part, permanently or temporarily; or (iii) business, occupation, place of work or residence, or habitat adversely affected, with or without displacement.

2. Environmental and Social Management System Procedures

6. **Screening.** Before making any specific investment, the JVC will verify to ADB that the proposed project is not on ADB's list of prohibited investments. The JVC will undertake an initial assessment of whether the project, in its reasonable opinion, has the potential to have adverse environmental or social impact or may involve land acquisition or involuntary resettlement, or affect indigenous peoples or scheduled tribes. These issues will continue to be assessed during due diligence, to ensure that the project complies with the environmental and social requirements of India. The JVC will develop and implement a rigorous screening system to assess whether the proposed projects have adequately addressed the environmental and social safeguards.

7. Projects are categorized according to the significance of their impact on the environment, involuntary resettlement, and indigenous peoples. The significance of the impact is measured by its type, location, scale, nature, and magnitude. ADB has several categories of projects, depending on their environmental and social impact, as follows.

a. Environmental

8. **Category A.** Category A projects are those with anticipated significant adverse impact on the environment. In this category are the following types of projects: thermal power and hydropower plants; irrigation systems; roads, bridges, tunnels, railways, and airports; forestry; farming; general construction; waste processing and disposal facilities (landfill, transfer station, and incineration); mining, oil extraction, and refinery; iron, steel, and metal production; chemical plant installation; skin and hide processing, and tanneries; sawdust processing, and pulp and paper production; and establishment of artificial lakes or reservoirs. Category A projects will require an adequately prepared environmental impact assessment (EIA) with an environmental management plan and an environmental monitoring program.

9. **Category B.** Projects with anticipated insignificant adverse impact on the environment are in category B.[6] Included here are transmission lines and substations; wind power projects; rehabilitation of power plants, factories, or roads within the same corridor or footprint; and other developments where the anticipated adverse impact is insignificant. Category B projects will require the preparation of an initial environmental examination (IEE) with an environmental mitigation and monitoring program. A project listed (by type) as category B but deemed to be of significant anticipated environmental impact can be determined to be a category A project by the JVC.

10. **Category C.** In this category are projects with no anticipated adverse impact on the environment. Category C projects require no impact assessment studies.

b. Social

11. **Category A.** Projects where 200 or more people will experience major impact from involuntary resettlement—physical displacement from housing or loss of 10% or more of their productive (income-generating) assets—are in category A. A full resettlement plan is required for such projects. A project's impact is also considered significant if it positively or negatively

[6] Under ADB's *Environment Policy* (2002), a project is classified as category B if its potential environmental and social impact is less adverse than that of category A projects. Typically, the impact is site-specific, rarely irreversible, and can readily be mitigated.

(i) affects indigenous peoples' or scheduled tribes' customary rights of use and access to land and natural resources; (ii) changes indigenous peoples' or scheduled tribes' socioeconomic status; (iii) affects indigenous peoples' or scheduled tribes' cultural and communal integrity; (iv) affects indigenous peoples' or scheduled tribes' health, education, livelihood, or social security; or (v) alters or undermines the recognition of indigenous knowledge. For projects that significantly affect indigenous peoples or scheduled tribes, an indigenous peoples development plan (IPDP) or a scheduled tribes development plan (STDP) is prepared.

12. **Category B.** Projects where fewer than 200 people will experience major impact from involuntary resettlement are in category B. These projects require a short resettlement plan. Projects that are expected to have limited impact on indigenous peoples and scheduled tribes require a specific action favorable to indigenous peoples in the project design or in related plans (e.g., a resettlement plan).

13. **Category C.** Projects in this category are not expected to have any impact on indigenous peoples or to lead to involuntary resettlement. Category C projects do not require any plans to be prepared.

14. **Impact Assessment and Safeguards Planning.** If the JVC determines that a project could have significant adverse environmental or social impact, or could involve involuntary resettlement or affect indigenous people, it will, before providing any financial assistance,

(i) consult with and assist in providing advisory or other services related to the safeguards to the client; and

(ii) where the project has significant impact on the environment, prepare a feasibility study (or review the existing study), to include an environmental and social assessment, which addresses the following key environmental and social issues:

(a) environmental and socioeconomic impact of the investment, including careful consideration of gender issues in the conduct of social analysis or consultation with women's groups during preparation, to ensure that women participate and receive benefits;

(b) requirements under relevant Indian laws and regulations, and applicable international agreements, including but not limited to laws and regulations governing land acquisition, compensation, resettlement, and indigenous peoples;

(c) sustainable development and use of renewable natural resources;

(d) protection of human health, cultural properties, and biodiversity, including endangered species and sensitive ecosystems;

(e) land acquisition and land use;

(f) impact on indigenous peoples, scheduled tribes, and communities;

(g) cumulative environmental and social impact of existing, proposed, and anticipated future investments;

(h) disclosure of impact and mitigation measures to affected parties and the participation of those parties in the design and review of mitigation and rehabilitation measures;

(i) consideration of environmentally, socially, and economically feasible alternatives; and

(j) pollution prevention and waste minimization, pollution (liquid effluents and air emissions) control, and solid and chemical waste management.

15. For greenfield development or the rehabilitation or expansion of existing facilities, the JVC will conduct screening, categorization, and environmental due diligence to determine the required level of environmental assessment for each subproject. During the implementation of the subproject, the JVC will be required to comply with the environmental management plan and the environmental monitoring program indicated in the EIA or IEE. Wherever an EIA is required, a summary EIA must be prepared and posted on ADB's website for a specific period of time before ADB may approve the project.[7]

16. If greenfield development is involved, the JVC will determine whether indigenous peoples will be affected, and land acquisition and involuntary resettlement may be involved. If the JVC cannot reasonably satisfy itself that the project complies with all applicable environmental and social requirements of the Indian national and local governments, and that indigenous peoples and scheduled tribes will not be affected and the project will involve no involuntary resettlement, the JVC will

(i) decline to invest in such project; or
(ii) implement an agreed corrective action plan within a specified period of time; or
(iii) if involuntary resettlement or impact on indigenous peoples or scheduled tribes cannot be avoided, the JVC will prepare and submit a resettlement plan or an IPDP or STDP, according to the policy outlined in section 3 of the SPRSS (Appendix 7). The plans must satisfy the JVC that impact on indigenous peoples or scheduled tribes will be mitigated and involuntary resettlement will be minimized, and that the affected people will receive compensation at replacement cost. During the implementation of the investment, the JVC will monitor the implementation of resettlement plans and IPDPs or STDPs, and ensure that such plans are made available to the public.

17. If the project involves rehabilitation or expansion of existing facilities, the JVC manager will conduct due diligence to determine if there are any outstanding compensation or involuntary resettlement issues, unaddressed adverse impact on ethnic minorities, unresolved grievances, or related areas of reputational risk to the JVC and to ADB. If there are any outstanding involuntary resettlement and ethnic minority issues, the JVC will inform ADB and prepare corrective measures in the form of a retrofit plan to comply with ADB's social safeguard policy requirements. The retrofit plan should be disclosed to the affected persons and submitted to ADB for review and approval.

18. Wherever a resettlement plan is required, the affected persons will be fully informed and consulted on compensation and resettlement options, including relocation sites, and socioeconomic rehabilitation. Pertinent resettlement information[8] will be disclosed to the affected persons at key points, and specific opportunities will be provided for them to participate in choosing, planning, and implementing options. The information will be disclosed in a manner that is accessible to the affected people where there are differing levels of literacy. Grievance redress mechanisms for affected persons, with adequate representation of affected people and

[7] This time limit is stipulated in the ADB *Operations Manual* as 120 days. ADB. 2006. *Operations Manual.* Section F1: Environmental Considerations in ADB Operations. Manila (25 September).

[8] In accordance with ADB's *Public Communications Policy* (2005), resettlement information should include measurement of losses, detailed asset valuations, entitlements and special provisions, grievance procedures, timing of payments, and displacement schedule.

with adequate multi-gender presence, will be established in each resettlement plan. The plan will be made available to the affected persons in their own language(s), with details on their entitlements, before it is implemented.

19. Wherever an IPDP or STDP is required, adequate consultations will be held with indigenous peoples or ethnic minorities during its preparation. They will be informed of the mitigation measures proposed and their views will be taken into account when the plan is finalized. The IPDP or STDP will be translated into the language of the indigenous peoples or ethnic minorities and made available to them before implementation. The disclosure will be in a manner accessible to the affected people where there are differing levels of literacy. Indigenous people or ethnic minority institutions and organizations in the affected area will also be involved in implementing the IPDP or STDP and in resolving any disputes that arise.

20. The draft resettlement plans, IPDPs, and STDPs will be made available to the public. ADB will review and approve the necessary resettlement plans as they are prepared, and, once they are finalized, will disclose these on its website before implementation. Plans may be revised after submission in response to (i) requests for revision during the review process, or (ii) changes in design during implementation. Such revised plans will also be made available to the affected people, in a form and language they can understand, and in English on ADB's website.

21. **Reporting.** The JVC will report on the environmental and social impact in a manner commensurate with the significance (e.g., semiannual reports in case of significant impact). The JVC will prepare and submit to ADB an annual environmental and social performance report[9] on investments made by the JVC, summarizing

(i) the environmental and social impact of projects undertaken by the JVC, including the progress and performance of each project under its environmental management plan, resettlement plan, and IPDP or STDP;
(ii) any areas of noncompliance or other issues arising from the environmental and social safeguards, including resettlement (for each individual investment), and a description of any prospective investments where such policies may be triggered; and
(iii) periodic reviews of the ESMS, with a view to continual improvement.

C. Environmental and Social Management System Capacity

22. The ESMS will be established through

(i) integration of environmental and social safeguard aspects in the appraisal, approval, and monitoring process; and
(ii) adequate staffing of the JVC with personnel appropriately qualified to undertake the functions associated with the ESMS.

23. An appropriate number of qualified staff members of the JVC will be assigned to operate the ESMS. The JVC will ensure that at least one of its senior representatives receives environmental and social safeguard training under a recognized program.

[9] A sample report is provided in the full ESMS framework.

SUMMARY POVERTY REDUCTION AND SOCIAL STRATEGY

Country/Project Title: India: Public–Private Partnership for Renewable Energy Development			
Lending/Financing Modality:	Equity Investment	Department/ Division:	Private Sector Operations Department Infrastructure Finance Division 1

I. POVERTY ANALYSIS AND STRATEGY

A. Linkages to the National Poverty Reduction Strategy and Country Partnership Strategy

1. Based on the country poverty assessment, the country partnership strategy, and the sector analysis, describe how the project would directly or indirectly contribute to poverty reduction and how it is linked to the poverty reduction strategy of the partner country.

The equity investment will increase the number of renewable energy projects in India and help meet the demand for energy in a sustainable manner. Availability of clean and reliable sources of energy is expected to improve the local economy, and thereby create more work opportunities for the population including the poor. The investment is aligned with ADB's Strategy 2020 and Clean Energy and Environment Program, which calls for ADB investments in energy efficiency and renewable energy in Asia to reach about $1 billion per year. It is also expected to increase power generation from renewable energy sources in India, in line with the Government's objectives in the Electricity Act of 2003 and the Power for All by 2012 initiative. The investment is consistent with the CSP update (2006–2008) and with the CPS (2009–2012) now being prepared to sustain ADB's support for inclusive and environmentally sustainable growth in India. It is consistent with the strategic pillars of (i) supporting the development of a low-carbon infrastructure, explicitly in hydropower and other renewable energy forms; and (ii) catalyzing investment through the use of innovative business and financing modalities such as public-private partnerships, nonsovereign operations, and the carbon credit market.

B. Poverty Analysis Targeting Classification: General intervention

1. Key Issues. The availability of electric power, and more broadly infrastructure, has an indirect but strong link with poverty reduction and economic growth. The availability of reliable power supply from renewable sources will encourage the growth of local enterprises, the development of good transport and communications systems, and the improvement of health and other social services, ultimately resulting in more employment and improved living conditions for the poor in the areas where renewable energy projects will be developed.

2. Design Features. The investment will achieve an outcome of 500 MW of additional renewable power generation by 2012 by implementing projects through public-private partnership, thus catalyzing investment from the private sector and delivering maximum value to the public sector. The addition of 500 MW in renewable energy capacity would provide about 1.1 GWh of additional electricity per year and thus help to bridge the persistent energy deficits and load shedding disproportionately affecting India's poor, who have little or no access to electricity.

C. Poverty Impact Analysis for Policy-Based Lending *Not applicable*.

II. SOCIAL ANALYSIS AND STRATEGY

A. Findings of the Social Analysis

Key Issues. Social impact assessments will be undertaken as part of the feasibility studies to be conducted for each project to be developed by the JVC. Given the nature and general location of projects, the investment has been classified as B/C under ADB's *Involuntary Resettlement Policy* (1995), and B from the perspective of ADB's *Policy on Indigenous Peoples* (1998). The JVC will be required to adopt and maintain an environment and social management system (ESMS) approved in form and substance by ADB. The ESMS will include principles, policies, and procedures for addressing the involuntary resettlement and indigenous people impact of projects. Each project will be classified for involuntary resettlement and indigenous people impact; wherever potential impact is identified, the JVC will prepare the necessary social safeguard plans and actions and submit these to ADB for review and approval.

B. Consultation and Participation

1. Provide a summary of the consultation and participation process during the project preparation.

For future projects to be developed by the JVC, consultation and participation activities will be undertaken in accordance with ADB's safeguard policy requirements and the ESMS approved in form and substance by ADB.

2. What level of consultation and participation (C&P) is envisaged during the project implementation and monitoring?
☒ Information sharing ☒ Consultation ☐ Collaborative decision making ☐ Empowerment

3. Was a C&P plan prepared? ☐ Yes ☒ No

C. Gender and Development

1. Key Issues. This is an equity investment and no specific infrastructure projects have been identified for financing. The JVC will carefully consider gender issues in the conduct of social analysis or consultation with women's groups during preparation, and ensure that women participate and receive benefits.

2. Key Actions. Measures included in the design to promote gender equality and women's empowerment—access to and use of relevant services, resources, assets, or opportunities and participation in decision-making process:
☐ Gender plan ☐ Other actions/measures ☒ No action/measure

III. SOCIAL SAFEGUARD ISSUES AND OTHER SOCIAL RISKS

Issue	Significant/Limited/ No Impact	Strategy to Address Issue	Plan or Other Measures Included in Design
Involuntary Resettlement	Limited. It is anticipated that the amount of land to be permanently acquired or purchased will be limited and the economic impact, if not avoided, will be only minimal or temporary.	Wherever potential resettlement impact are identified, the JVC will prepare a resettlement plan and submit it to ADB for review and approval.	☐ Full Plan ☐ Short Plan ☒ Resettlement Framework/ Environment and Social Management System ☐ No Action
Indigenous Peoples	Limited. Wind farms are likely to be developed in states where there are tribal populations. But these projects require small parcels of land and are unlikely to disrupt tribal community life as a whole.	Impact on tribal populations will be avoided to the extent possible. If impact is unavoidable, a specific plan or actions to address any impact will be developed according to the ESMS agreed on with ADB.	☐ Plan ☐ Other Action ☒ Indigenous Peoples Framework / Environment and Social Management System ☐ No Action
Labor ☒ Employment opportunities ☐ Labor retrenchment ☐ Core labor standards	Employment opportunities indirectly generated during the construction of renewable energy projects.	None.	☐ Plan ☐ Other Action ☒ No Action
Affordability	No impact. Power will be sold to the grid.	None.	☐ Action ☒ No Action
Other Risks and/or Vulnerabilities ☐HIV/AIDS ☐Human trafficking ☐Others	No impact.	None.	☐ Plan ☐ Other Action ☒ No Action

IV. MONITORING AND EVALUATION

Are social indicators included in the design and monitoring framework to facilitate monitoring of social development activities and/or social impacts during project implementation? ☐ Yes ☒ No

ADB = Asian Development Bank, CSP = country strategy and program, CPS = country partnership strategy, ESMS = environmental and social management system, GWh = gigawatt-hour, JVC = joint venture company, MW = megawatt.

ECONOMIC EVALUATION

A. Assumptions

1. General

1. The economic analysis for the investment has been carried out in line with a standard cost-benefit analysis framework, and in accordance with the Asian Development Bank (ADB) *Guidelines for the Economic Analysis of Projects*.[1] All economic costs and benefits are expressed in constant 2009 domestic prices.

2. Demand and Supply of Power

2. India suffers from chronic energy and power shortages. The main reason for this has been that capacity additions have lagged significantly behind demand growth. For example, during the 10th Five Year Plan period (FY2003–FY2007) only 52% of the targeted capacity additions were achieved. Though there has been an absolute increase in capacity and in the per capita consumption of electricity, the per capita consumption is a fraction of that in developed countries and also much lower than in some developing countries like the People's Republic of China. The current per capita electricity consumption in India is 700 kWh, compared with 1,200 kWh in the People's Republic of China and 13,000 kWh in the United States. The Government of India has highlighted a vision of "Power for All" by 2012 when currently only 55.8% of the households have access to electricity. The Planning Commission has estimated an electricity-GDP elasticity of 1 and projected GDP to grow at 8% over the medium term. Even with the current global economic downturn and with the lowering of GDP growth rates for FY2010, GDP is expected to grow at 5%–6%.

3. The Central Electricity Authority (CEA) undertakes periodic electric power surveys to project the energy requirement of the country and guide the planning process for capacity addition. CEA released its 17th electric power survey in March 2007 with detailed estimates of the growth in power demand, region-wise and for the country as a whole. Table A9.1 shows the long-term projected energy requirement across various regions in the country.

Table A9.1: Project Energy Requirements

	Energy Requirement (GWh)			Peak Load (MW)		
Region/States	**FY2011**	**FY2016**	**FY2021**	**FY2011**	**FY2016**	**FY2021**
Northern	294,841	411,513	556,768	48,137	66,583	89,913
Western	294,841	409,805	550,022	47,108	64,349	84,778
Gujarat	85,445	119,083	156,842	14,374	19,670	25,447
Southern	253,443	380,068	511,659	40,367	60,433	80,485
Karnataka	53,540	79,996	107,471	8,826	13,092	17,464
Eastern	111,802	168,942	258,216	19,088	28,401	42,712
Northeastern	13,329	21,143	36,997	2,537	3,760	6,180
Islands	384	595	847	88	136	151
All India	**968,659**	**1,392,006**	**1,914,508**	**152,746**	**218,209**	**298,253**

GWh = gigawatt-hour, MW = megawatt.
Source: Central Electricity Authority. 2007. *Report on the Seventeenth Electric Power Survey of India*. New Delhi.

[1] ADB. 1997. *Guidelines for the Economic Analysis of Projects.* Manila.

4. The investment would develop and operate wind-power projects in Maharashtra, Karnataka, Rajasthan, Tamil Nadu, and Madhya Pradesh, and small hydroelectric projects in Himachal Pradesh. In the hilly and mountainous terrains of Himachal Pradesh, off-grid hydro may be the only source of electricity in the foreseeable future.

5. The major economic benefit from the investment is the electricity generated, which is fully absorbed at current levels of electricity demand in the states identified. These states face peak and energy shortages, which are projected to persist in the future. Lack of adequate electricity will adversely affect economic growth and development.

3. Economic Costs

6. Capital costs include the cost of developing 500 MW of wind and small hydroelectric projects, as detailed in the main text, and a conservative adjustment of 10% tax to exclude taxes in the calculation of the economic internal rate of return (EIRR). O&M costs for generation have been adjusted to remove the escalation factor.

4. Economic Benefits

7. Given the shortages in meeting energy and peak demand in the offtaking states, all the electricity generated by the investment will meet unmet demand, that is, it would not substitute power from any existing generation capacity. The entire output from the projects is considered incremental. The economic value of the incremental electricity generated is the cost paid by each state for power purchased. The energy charge paid is linked to the cost of supply of the lowest-cost thermal plant. This is taken to reflect the willingness to pay for the incremental supply of electricity in that state.

8. As the investment develops renewable energy technologies, another benefit will be the reduction of greenhouse gas (GHG) emissions. The investment is likely to generate certified emission reductions (CERs) of GHGs, the sale of which will generate additional revenue. Even in the absence of CER registration and revenue, the investment continues to contribute to the overall reduction of GHGs. The investment generates a benefit (with or without the CER revenue), which is the lowering of GHG emissions. The estimated reductions in emissions are based on the carbon emissions reduction factor determined by the Central Electricity Authority. The carbon emissions reduction is valued at a price of €8 per ton of CO_2 (about $10 per ton of CO_2)[2] for 20 years, as this is a global benefit that will accrue over the entire life of the investment. For illustrative purposes, the analysis was done with and without the benefit of the GHG reductions. The inclusion of the benefit of GHG abatement increases the EIRR by 2.4% in the base case. Other local environmental benefits like lower suspended particulate matter and the related health benefits are not included in the quantitative analysis. As these would have a net positive contribution to benefits, the current analysis of economic return is conservative.

5. Economic Internal Rate of Return

9. A consolidated EIRR is calculated for all the subprojects to determine the economic viability of the total investment. The base case EIRR is estimated at 21.1%. The results of the economic analysis for the base case have been summarized in Table A9.2. The sensitivity of the EIRR was tested under four adverse scenarios: (i) a 10% decrease in output, (ii) a 20%

[2] As of 06 March 2009, €1 = $1.27.

increase in O&M costs, (iii) a 10% increase in capital costs, and (iv) the simultaneous occurrence of cases (i) to (iii). The results of sensitivity analysis are summarized in Table A9.3. The results of the economic analysis indicate that the investment is economically viable under all stress scenarios.

Table A9.2: Economic Internal Rate of Return
(Rs million)

Year	Capex	O&M	Generation (million kWh)	Revenue	Net Benefits (including CER revenue)
2010	(10,035)	(134)	430	1,488	(8,537)
2011	(8,078)	(221)	710	2,461	(5,599)
2012	(5,720)	(331)	1,173	4,289	(1,367)
2013	(180)	(331)	1,173	4,334	4,218
2014	(360)	(337)	1,208	4,480	4,189
2015		(337)	1,208	4,525	4,594
2016		(337)	1,208	4,573	4,642
2017		(337)	1,208	4,648	4,717
2018		(337)	1,208	4,723	4,792
2019		(337)	1,208	4,798	4,867
2020		(337)	1,208	4,874	4,943
2021		(337)	1,208	4,949	5,018
2022		(337)	1,208	5,015	5,084
2023		(337)	1,208	4,585	4,654
2024		(337)	1,208	4,282	4,351
2025		(337)	1,208	4,285	4,354
2026		(337)	1,208	4,287	4,356
2027		(337)	1,208	4,290	4,359
2028		(337)	1,208	4,293	4,362
2029		(337)	1,208	4,296	4,365
				EIRR	**21.12%**

( ) = negative, capex = capital expenditures, EIRR = economic internal rate of return, O&M = operation and maintenance.
Source: Asian Development Bank estimates.

Table A9.3: Sensitivity Analysis

Scenario	EIRR without CER benefits	EIRR including CER benefits
Base Case	**18.74**	**21.12**
(i) 10% lower power sales	16.30	18.45
(ii) 20% O&M cost increase	18.33	20.71
(iii) 10% higher capital costs	14.31	16.49
(iv) Combination of (i) to (iii)	13.94	15.91

CER = certified emission reduction, EIRR = economic internal rate of return.
Source: Asian Development Bank estimates.