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Barriers and opportunities for EU-India renewable energy collaboration

by

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TABLE OF CONTENTS

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Barriers and opportunities for EU-India renewable energy collaboration[1]

As India has become one of the world's fastest growing economies, the country's rapid economic growth has generated increasing asymmetries between the demand for energy and the country's capacity to generate it. Therefore, in order to ascertain the viability of India's long term growth potential and competitiveness, the security of India's energy supply has become an indispensable objective of the Indian government. Quite a lot of discussion has centred upon the need to secure India's energy needs by enhancing India's domestic energy capacity, by increasing the imports of oil and natural gas.

The Indian government has sought to address its energy security needs by reaching out in bilateral agreements, notably with the US and the EU. Based on the US-India Energy Dialogue and the India-EU Strategic Partnership Joint Action Plan, some suggestions have been made to gradually reorient the sectoral distribution of its fuel mix, particularly in terms of reaffirming the importance of nuclear energy and plan to expand its share in the Indian energy market. Less attention, however, has been paid to other sources of energy supply, such as environmentally-friendly renewable energy and alternative fuels.

1 This paper is co-authored by Dr Lawrence Sáez, Asia Research Centre, London School of Economics; and Mr Mahesh Vipradas, The Energy and Resources Institute (TERI), New Delhi, India. The authors would like to thank Gizem Gürson for invaluable research assistance to this report. Special thanks to Fatih Birol and Marion Schiller-Probst for their comments.

A. Introduction

Insofar as it provides India with a tangible range of options, the India-EU Strategic Partnership Joint Action Plan offers innovative ways to address India's energy security needs while at the same time achieving the targets set out in the Kyoto Protocol. For instance, the clauses pertaining to clean development and climate change in the India-EU Strategic Partnership Joint Action Plan stress the need "to encourage and promote sustainable patterns of consumption and production to lessen the causes and adverse impacts of climate change." To this effect, the India-EU Joint Action Plan calls for bilateral cooperation for the position of energy efficiency and energy conservation, the development of affordable and clean energy technologies, and the identification of new technologies in the field of new, renewable, conventional and non-conventional sources.

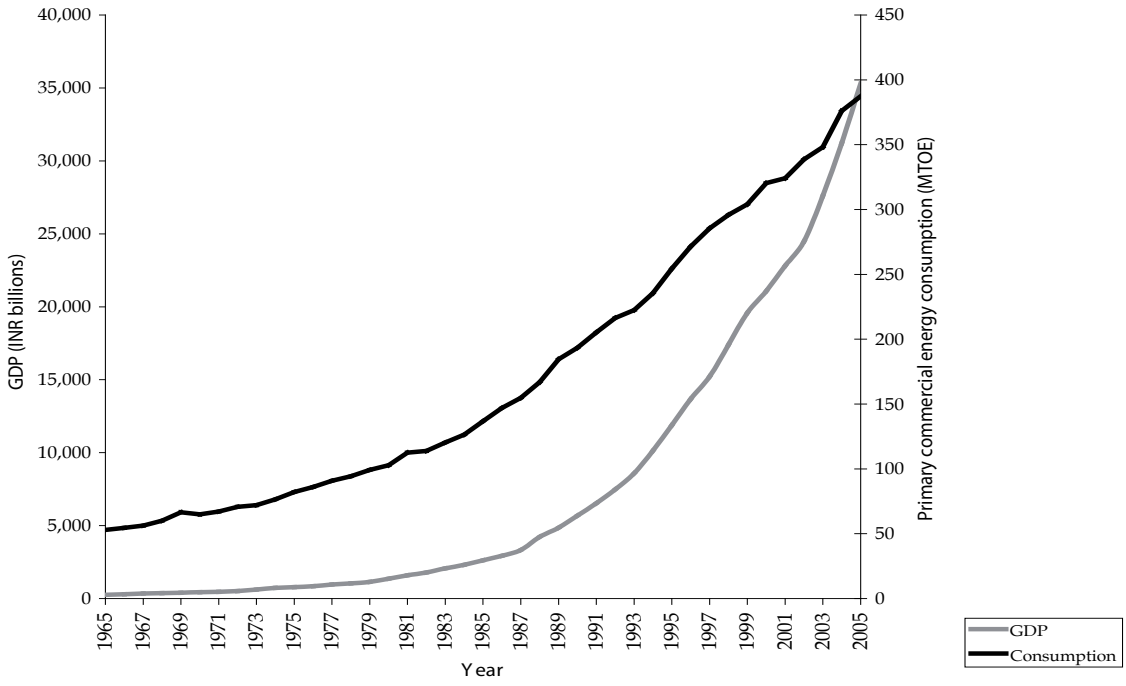
The 6th India-EU Summit endorsed the idea of utilizing the India-EU Energy panel as the vehicle from which to build on cooperation in the energy sector to develop more efficient, environmentally-friendly, and alternative energy chains. In this context, new and renewable energy —such as wind-generated power, solar kitchens, and biomass— are seen as extremely important energy options, both in terms of providing long-term sources of energy within India and assisting in the reduction of CO_2 (carbon dioxide) emissions and offsetting global warming. In this sense, the launch of the India-EU Initiative on Clean Development and Climate Change is very promising. Nevertheless, as will be discussed in this report, there are structural reasons why India-EU collaboration on this front may prove to be challenging.

This report will first highlight the critical challenges that face the Indian state as it attempts to secure its energy supply. A summary description of the institutional features of India's energy will follow. In this report, it will be shown that India's states will be key players in the implementation of energy policy relating to renewable energy, alternative fuels, and renewable energy technology. With an emphasis on legislative and regulatory barriers, the report will then identify some specific opportunities and challenges available to European firms operating in India. The report will then conclude with a set of potential policy recommendations in order to enhance the collaboration between the EU and India.

B. India's energy needs

India is one of the world's most dynamic economies. For a low-income economy, one of the unusual features of India's growth has been the dominance of the services sector, which account for nearly half of India's total output. Given the unique features of India's economic growth pattern, primary commercial energy consumption has been closely linked with macroeconomic growth [See Chart 1].

Chart 1. India's gross domestic product (GDP) growth and primary commercial energy consumption (1965-2005).



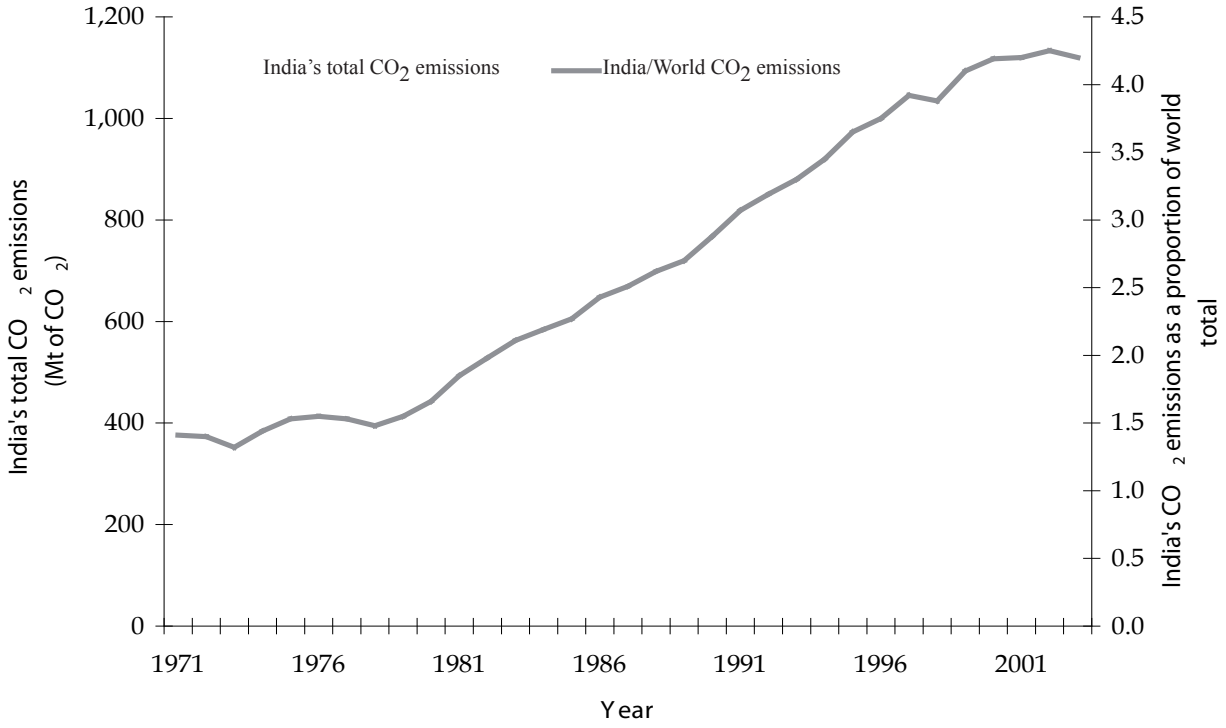
Source: GDP data from the International Monetary Fund (IMF), energy consumption data from the BP Statistical Review of World Energy (2006).

As Chart 1 shows, India's gross domestic product increased rapidly, particularly after 1991. Likewise, India's primary commercial energy consumption doubled from 1991 to 2005. At present, though, India's energy demand is increasing rapidly without corresponding energy efficiency improvements.

One of the gravest consequences of India's dual economic and energy consumption growth has been the increasing contribution of India to worldwide CO_2 emissions. As Chart 2 shows, India's

total CO_2 emissions have quintupled since data was collected by the International Energy Agency, increasing from 200 million tonnes of CO_2 in 1971 and exceeding 1 billion tonnes of CO_2 in 2005. Likewise, there has been a corresponding increase in India's contribution to world total CO_2 emissions. As Chart 2 shows, India's contributed 1.5 percent of world total CO_2 emissions in 1971. By 2005, India's contribution had exceeded 4 percent. [See Chart 2]

Chart 2. India's total CO_2 emissions and India's CO_2 emissions as a proportion of world total CO_2 emissions.



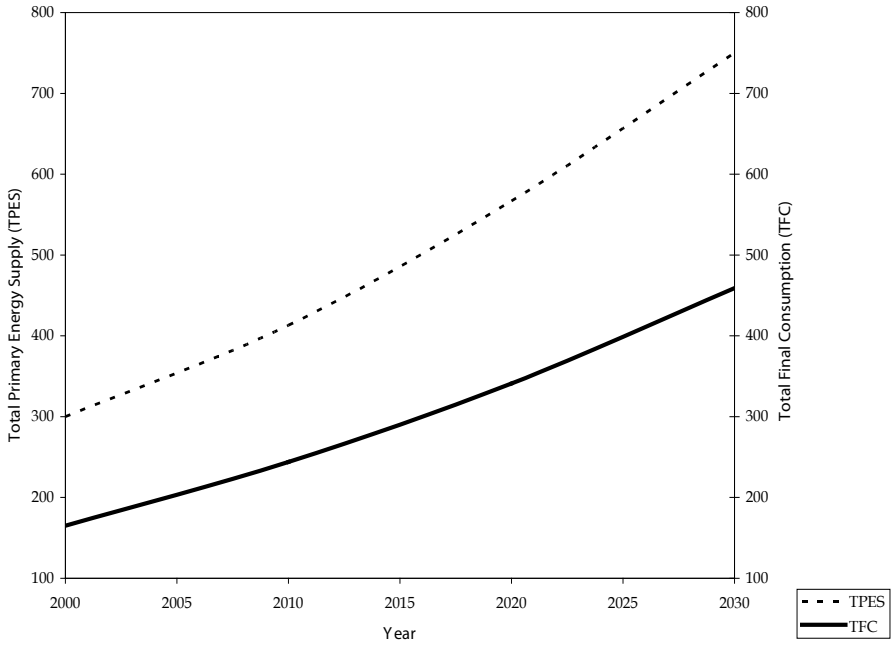
Source: International Energy Agency (2006).

It is worth highlighting that India's growing levels of CO_2 emissions have taken place against a backdrop of continuing gaps in energy provision. For instance, India's energy shortfalls have been well documented as they pertain to lingering problems with India's electricity generation. First and foremost is the inadequate installed capacity for energy generation and the lack of optimal utilization of existing installations. In some states there are high level of transmission and distribution (T&D) losses due to theft. Moreover, there are also severe transmission and distribution problems due to an inadequate inter-state network.

The sustainability of India's long-term economic growth is jeopardized by the fact that the demand for energy far outstrips the country's ability to produce it. India's installed energy capacity is

approximately 126,000 MW. India's electricity generation is approximately 558 BU. Electricity demand needs approximately 160,000 MW and it is forecast that by 2012, India's energy demand will grow to 200,000 MW. For instance, International Energy Agency forecasts of future total energy supply and total final consumption in India reveals a growing gap over a 30 year period [See Chart 3].

Chart 3. India's forecasted growth in total primary energy supply (TPES) and total final consumption (2000-2030).



Source: International Energy Agency (2006). Energy demand units represent Mtoe.

As Chart 3 shows, India's total primary energy supply exceeds total final consumption. The IEA estimates that over a 30-year period, the gap between energy demanded (represented by total primary energy supply, TPES) and energy actually consumed (as represented by total final consumption, TFC) will continue to grow.

The Indian government has identified the security of its energy supply as one of the most important security needs. For instance, the impending issue of energy shortages figures prominently in the Government of India's most important document relating to government planning, the Tenth Five-Year Plan (2002-2007). The Report claims that "despite the resource potential and the significant rate of growth in energy supply over the last few decades, India faces serious energy shortages."[2] Moreover, the election manifesto of the current coalition government, the National Common Minimum Programme of the Government of India, devotes an entire section to the subject of India's

2 Planning Commission, Government of India, *Tenth Five-Year Plan*. Chapter 7.3, section 2.

energy security. The government's aim is to "put in place policies to enhance the country's energy security particularly in the area of oil."[3]

The perspective that India's energy security is of primary importance to the Indian government has also been highlighted in the Planning Commission's expert committee report on an integrated energy policy. According to the report, energy security "is an important concern for India's energy policy."[4] The report identifies several problems associated with sustaining India's energy security, but principally considers that the growing dependence on imported sources of energy is the most pressing issue. In the expert committee's opinion, "any disruption in access to energy can be very expensive in welfare terms as energy is critical not only for economic growth but also for human survival and well-being."[5]

India's efforts to satisfy its current and future energy demands needs is constrained by several factors, some which are structural and others which are institutional. Nearly 89 percent of energy generated in India is produced domestically. At the aggregate level, over 68 percent of India's gross energy output is dominated by coal and lignite. India produces some oil and natural gas. India produces about 34 million tonnes of crude oil and 120 million tonnes of petroleum products. Nevertheless, India's domestically produced oil and natural gas is costly in terms of exploration and production costs, primarily because nearly 66 percent of India's domestic oil production and over 72 percent of its natural gas is produced offshore. For that reason, India imports over seventy percent of its oil.

India's existing fuel mix, combined with the uneconomical domestic exploitation of its oil and gas resources, has prompted the Indian government to devote growing shares of revenue to import oil and gas. In 2005-2006, for instance, India imported 99.4 million metric tonnes of crude oil for $38.7 billion. In addition, India imported 11.7 million metric tonnes of petroleum products for $5.86 billion. Therefore, India is vulnerable to both supply risks —associated with the maintenance of reliable oil supply— as well as market risks, namely relating to sudden increases in oil prices caused by a disruption. As past trends in sudden change in crude oil prices have shown, they can pose a severe strain on India's fiscal stability. For that reason, the expert committee report concluded that "it is thus of utmost importance that alternatives to oil which are based on domestic resources are pushed."[6]

3 *National Common Minimum Programme of the Government of India* (May 2004). Available at http://pmindia.nic.in/cmp.pdf.

4 Planning Commission, Government of India, *Integrated Energy Policy* (August 2006), Chapter IV, p. 55. Available at http://planningcommission.nic.in/reports/genrep/rep_intengy.pdf.

5 Ibid.

6 Ibid, p. 71.

C. India's renewable energy capacity

The concerns about the sources of India's energy mix are enhanced by fears about the long-term sustainability of India's electricity generation. As India's gross electricity generation is dominated by thermal power energy, which encompasses about 83 percent of India's total utilities electricity generation. Hydroelectric power amounts to 14.3 percent and nuclear energy the remaining 2.7.

There is a discrepancy between installed energy capacity and gross electricity generation. As Table 1 shows, India's installed energy capacity is concentrated in thermal sources of energy. Although the Indian government has been quite receptive to the idea of securing its energy needs through conventional sources of energy, it has also explored the potential for alternative sources of energy. However, as Table 1 shows, renewable energy only amounts to 4.9 percent of India's total installed energy capacity [See Table 1].

Table 1. India's installed energy capacity

Source of energy	MW	Percentage
Thermal	83,272	66.1
Coal	*68,488*	54.3
Gas	*13,582*	10.7
Oil	*1,202*	1.0
Hydro	32,726	25.9
Nuclear	3,900	3.1
Renewable	6,191	4.9
Total	126,089	100

Source: Government of India, Ministry of Power (2005).

Faced with the prospect of long-term energy shortages, the Indian government has taken decisive steps to exploit the potential from renewable energy. At the institutional level, the Indian government has several central government ministries devoted directly to various facets of India's energy provision. They include the Ministry of Coal, the Ministry of Petroleum and Natural Gas, and the Ministry of Power. The Department of Atomic Energy, although not an Indian central government ministry, also exercises considerable influence on India's energy policy. Other ministries have indirect impact on the formulation of India's energy policy, whether it be in the area of energy conservation (the Ministry of Environment and Forests) or the approval of foreign direct investment projects (the Ministry of Commerce and Industry). It is worth highlighting that these ministries *do not always act in unison* and *can limit an understanding of India's energy policy on any given policy area*. Nevertheless, since 1992, India has become a world leader in the regulation and development

of renewable energy by having a separate ministry devoted to this particular sector (the Ministry of Non-Conventional Energy Sources, MNES). The chief function of the MNES is to promote the utilization and research and development (R&D) into alternative sources of energy, including solar, wind, small hydro, biomass, geothermal, and tidal energy sources. In addition to its regulatory scope, the MNES also provides financing to renewable energy projects. Operating under the administrative control of the MNES, the India Renewable Energy Development Agency (IREDA) provides loans for setting up projects relating to renewable energy. In conjunction with IREDA, the MNES also provides fiscal and financial incentives. The Ministry also has jurisdiction over energy sources such as chemical sources of energy, fuel cells, alternative fuel for surface transportation, and hydrogen energy.

India's institutional affinity for renewable energy has translated into growing installed energy capacity. According to the MNES, India ranks fourth in the world in wind power installed capacity. As Table 2 shows, the proportion of installed renewable energy generating capacity is heavily dominated by wind.

Table 2. India's installed renewable energy capacity (2006).

Renewable energy source	MW	Percentage
Wind	5,340	65.1
Small hydro	1,826	22.2
Biomass cogeneration and power	912	11.1
Biomass gasification	70	0.8
Energy from residues	45	0.5
Solar photovoltaic	3	0.03
Total	**8,196**	**100**

Source: Government of India, Ministry of Non-Conventional Energy Sources (2006).

Table 2 also shows that small hydroelectric power (involving individual capacity of less than 25 MW) and biomass are also an important source of renewable energy in India. In contrast, energy from residues and solar photovoltaic energy are disappointingly low contributors to India's renewable energy mix.

D. Constitutional, legislative, and regulatory landscape dealing with renewable energy

The opportunities and challenges for EU-India collaboration in climate-friendly renewable energy takes various forms. The primary source of challenges is linked to regulatory and legal barriers. The Indian government, both at the national and the subnational level, has provided fiscal and financial incentives towards the development of renewable energy technology. As will be discussed in the forthcoming sections of this report, the opportunities for EU-India collaboration are technical in nature and pertain to demand for specific types of renewable energy technology based on geographic potential.

Constitutional provisions. India's energy market is heavily controlled by the state, both at the national level and subnational level. India is a federal country composed of 28 states and 7 union territories. As a country with a federal administrative structure, India's Constitution allocates substantive constitutional duties to the central government and to the individual state governments. An annex to the Constitution, the Seventh Schedule, outlines the jurisdiction of the central government (List I, Union List), the states (List II, States List), and those cases of concurrent jurisdiction between the central government and the states (List III, Concurrent List).

In reference to energy provision clauses, the Indian Constitution grants the central government exclusive jurisdiction over the regulation and development of oilfields and mineral oil resources. It also grants the central government exclusive jurisdiction over the development of atomic energy and the mineral resources necessary for its production. In turn, the Indian Constitution grants the states exclusive jurisdiction over gas, gas works, and water supplies. It also grants exclusive jurisdiction to state governments for the taxation on the consumption and sale of electricity.

Subjects under which the central government and the states have concurrent jurisdiction include the generation, transmission, and distribution of electricity. Although not explicitly mentioned in the Indian Constitution, renewable energy and electrical power is considered to be a subject of concurrent jurisdiction.

Legislative and policy provisions. India does not have a comprehensive energy policy. As was discussed in the previous section, several central government ministries (Coal, Petroleum and Natural Gas, and Power) have a direct impact on energy regulation in India. In order to provide some clarity to India's overall energy policy, the central government has most recently enacted the 2003 Electricity Act. The chief aim of the Act is to provide transparency in the energy sector, principally by consolidating existing laws pertaining to transmission, distribution, and commercialization and consumption of energy.

Prior to the enactment of the Electricity Act of 2003, the power sector in India was governed by three important items of legislation: The Indian Electricity Act, 1910; The Electricity (Supply) Act, 1948, and The Electricity Regulatory Commission (ERC) Act, 1998. Prior to the enactment of the Electricity Regulatory Act, 1998, the regulatory function at the central level was performed by the Central Electricity Authority (CEA). At the provincial level, the main regulatory duties were undertaken by the state electricity boards (SEBs). Under this dual regulatory mechanism, the authority of the CEA was exercised through the process of granting of techno-economic clearances and the interpretation of various norms. The central government was also responsible for the setting of tariffs from electricity generated in central generating stations. At the state level, the state governments and the SEBs were responsible for the regulatory function of the sector.

In order to formulate a comprehensive legislation imparting renewed thrust to coordinated development of the power sector in the country, the Electricity Act, 2003 was enacted. The Electricity Act of 2003 provides the most comprehensive —yet flexible— legislative framework for the development of the power sector. The legislation envisions a sector characterized by a competitive market in power where the regulators and the power utilities play increasingly significant roles.

The key objectives of the Electricity Act of 2003 are as follows:

i) To consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of the entire electricity industry;
ii) Promoting competition in the industry;
iii) Protecting the interest of consumers and supply of electricity to all areas;
iv) Rationalization of electricity tariff;
v) Ensuring transparent policies regarding subsidies;
vi) Promotion of efficient and environmentally benign policies;
vii) Constitution of CEA, Regulatory Commissions and establishment of an Appellate Tribunal; and
viii) For other related matters

The effort to secure India's energy needs via renewable energy has not been ignored by the 2003 Electricity Act. One of the aims of the 2003 Electricity Act is to provide energy inefficiency and environmental protection. Likewise, the Act aims to foster rural electrification. To this end, the Act calls for specific measures, including the preparation and notification of a national policy "permitting stand alone systems (including those based on renewable sources of energy and non-conventional sources of energy) for rural areas."[7]

The Electricity Act of 2003 is likely to have a significant impact on the renewable power sector because it recognized the role of renewable energy technologies in the National Electricity Policy and in stand-alone systems. Some of the important provisions in the Act with regard to the promo-

7 Ministry of Power, Government of India, *Electricity Act, 2003*. Available at http://powermin.nic.in.

tion of renewable energy concern the promotion of a tariff policy as a key strategy in providing incentives to producers of renewable energy. According to Section 3 (1) of the Electricity Act of 2003, the central government "shall from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy."[8]

The Electricity Act of 2003 has made the state electricity regulatory commissions (SERCs) crucial players in the context of state level policies for renewable energy." Under the Section 86(1) of the Act, it is mandatory for the SERCs to "promote co–generation and generation of electricity through renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any persons, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee."[9]

In order to provide some clarity relating to elements of its overall energy policy, the Indian government is —at present— in the process of coordinating its renewable energy policy. The draft of this policy, the New and Renewable Energy Policy Statement 2005, provides a degree of clarification as to the Indian central government's likely approach to dealing with issues relating to the scope of private sector involvement and sources of financing of renewable energy. In its draft policy statement, the Indian government views that it must provide incentives to domestic consumers. It suggests that "with regard to new and renewable energy systems/choices for individual, commercial and urban applications, financial and fiscal investors will be provided on a case by case basis." In the case of household systems and appliances, affordability and desirability "will be the criteria for determining the need and level of incentives provided the deployment leads to fuel-switching in furtherance of the aim of fossil-fuel energy conservation."[10]

The New and Renewable Energy Policy Statement 2005 suggests that in order to improve the cost-effectiveness of grid renewable electricity, "fiscal incentives, in the interim period, will have to be given to attract investment." However, the Indian government also suggests that government policy will aim to move away from a subsidy-driven policy towards commercialization. In this sense, the interim period, as the projects themselves are expected to be more self-sustainable, will not be a permanent one. According to the Policy Statement, financial incentives will "be discontinued with the closure of the 10th Plan as they have more or less met their obligations." The Policy Statement suggests that "were the need to arise, renewable electricity projects in special category states might continue to receive fiscal incentives."[11] Likewise, the Policy Statement suggests that financial

8 Electricity Act, 2003, section 3.1.
9 *Electricity Act 2003*, section 86.1.
10 *New and Renewable Energy Policy Statement 2005*, section 5.6.2.1.
11 *New and Renewable Energy Policy Statement 2005*, section 5.6.3.

incentives will continue to be given beyond the 10th Plan period, primarily municipal solid waste management and a few energy projects "not only for sub-serving a larger public purpose but also because most MSW systems continue to remain uncompetitive in terms of cost."[12]

Under the banners of the Electricity Act of 2003 and the New and Renewable Energy Policy Statement 2005, the central government has outlined a set of guiding principles as it pertains to renewable energy policy.[13] To date, the Electricity Act of 2003 has generated more subsidiary legislation, largely dealing with tariff setting. For instance, in pursuance of the provisions of the Electricity Act of 2003, the Government of India, through the Ministry of Power, has adapted the National Electricity Policy to stress the need for the promotion of non-conventional energy sources. Under the provisions of the National Electricity Policy, the "co-generation and generation of electricity from non-conventional sources would be promoted by the SERCs by providing suitable measures for connectivity with grid and sale of electricity to any person and also by specifying, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee." According to the National Electricity Policy, "such percentage for purchase of power from non-conventional sources should be made applicable for the tariffs to be determined by the SERCs at the earliest."[14]

Likewise, the 2003 Electricity Act has altered the provisions of the Ministry of Power's National Tariff Policy. In compliance with Section 3 of the Electricity Act of 2003, the National Tariff Policy provides that the appropriate commission shall "fix a minimum percentage for purchase" of non-conventional sources of energy generation "taking into account availability of such resources in the region and its impact on retail tariffs. Such percentage for purchase of energy should be made applicable for the tariffs to be determined by the SERCs."[15]

At present, the implementation of the relevant provisions of the 2003 Electricity Act and the National Tariff Policy are underway. In this scheme, different SERCs are in the process of issuing tariff orders for renewable energy based electricity generation and specifying quota/share for power from renewable energy. However, as will discussed in greater detail later, the most important actors in the implementation of India's renewable energy will be India's states. The heterogeneity of India's federal units makes it difficult to coordinate public policy. In some instances, the central government has attempted to co-opt Indian states to be participants in the promotion of environmentally-friendly renewable energy technology, primarily policy planning tools such as the central

12 Ibid.

13 Chapter VII of the Planning Commission's *Integrated Energy Policy* report provides concrete recommendations on a unified renewable energy policy, including provisions for capital subsidies, incentive structures for power regulators, and outcomes-based price subsidies.

14 Ministry of Power, Government of India, *National Electricity Policy*, section 5.12.2. Available at http://powermin.nic.in.

15 Ministry of Power, Government of India, *Tariff Policy*, section 6.4.1.

government's Five Year plans. The central government has, through the issuance of the latest Five Year Plan, provided a critical anchor to the financing of renewable energy projects. The 10th Five Year Plan (which runs from 2002 through 2007), creates incentives for the promotion of renewable energy technology. However, the perception from the central government is that it has not been fiscally prudent to continue to subsidise these technology projects.

Foreign investment promotion provisions. The Government of India has a sector-specific policy for the approval of foreign direct investment (FDI). In some sectors, FDI is permitted automatically subject to specific sectoral regulations and regulations applicable. The Ministry of Commerce and Industry is responsible for identifying the level of foreign equity participation and the method of approval of foreign direct investment projects. From time to time, the Ministry of Commerce and Industry issues an updated list of industries eligible for automatic approval of foreign investment. The Ministry of Commerce and Industry is also responsible for determining the upper level of foreign ownership, in most cases ranging from 51 to 74 percent. In special cases, the Ministry allows 100 percent equity participation by foreign investors.

The foreign investment regime from energy provisions is straight forward. Beginning in 1998, projects for electricity generation, transmission, and distribution, with foreign equity up to 100 percent, were made eligible to automatic approval provided that the foreign equity in any given project did not exceed 15,000 million Indian rupees (approximately 250 million euros). Starting in 2000, the Indian government decided to remove the upper limit for foreign direct investment, so foreign equity participation in energy projects (with the exception of atomic energy) could reach up to 100 percent. The Indian government explicitly specified that 100 percent equity participation by foreign investors and automatic approval would include projects relating to hydroelectric power plants, coal, lignite-based thermal power plants, oil-based thermal power plants, and gas-based thermal power plants. Therefore, under the present policy, the power sector (with the sole exception of atomic energy), including generation, transmission, and distribution of energy and power trading, receives automatic approval and allows 100 percent foreign equity participation.[16]

Renewable energy has not been explicitly identified by the Ministry of Commerce and Industry as a category that was included in those energy projects that were authorised to receive automatic approval and were 100 percent equity participation by foreign investors was allowed. In terms of external sources of financing, the New and Renewable Energy Policy Statement 2005 suggests that there will be no limitations to investment in renewable energy through FDI. According to the draft document, renewable energy technologies projects "will be allowed 100 per cent equity through automatic approval route to attract FDI to this sector."[17] The Policy Statement, though, offers a

16 Ministry of Commerce and Industry, Government of India, *Foreign Direct Investment Policy 2006*. Available at http://dipp.gov.in/publications/fdi_policy_2006.pdf.

17 *New and Renewable Energy Policy Statement 2005*, section 5.9.1.

pessimistic assessment as to the likely inflows of FDI relating directly to renewable energy technology. It notes that there is a wide gap —as there is on other foreign investment arenas— between actual and projected FDI flows. It suggests that the gap "remains large mainly because renewables are a high risk low return business, to which FDI is naturally not attracted."[18]

Although the central government remains a critical actor in the regulation and implementation of India's energy policy, to date, the involvement of the private sector has been pivotal in the financing of renewable energy projects. The 2005 Policy Statement reiterates the expected participation of the private sector in this capacity. For instance, the Statement suggests that "renewable electricity prospects are expected to be set up mainly through private investment."[19]

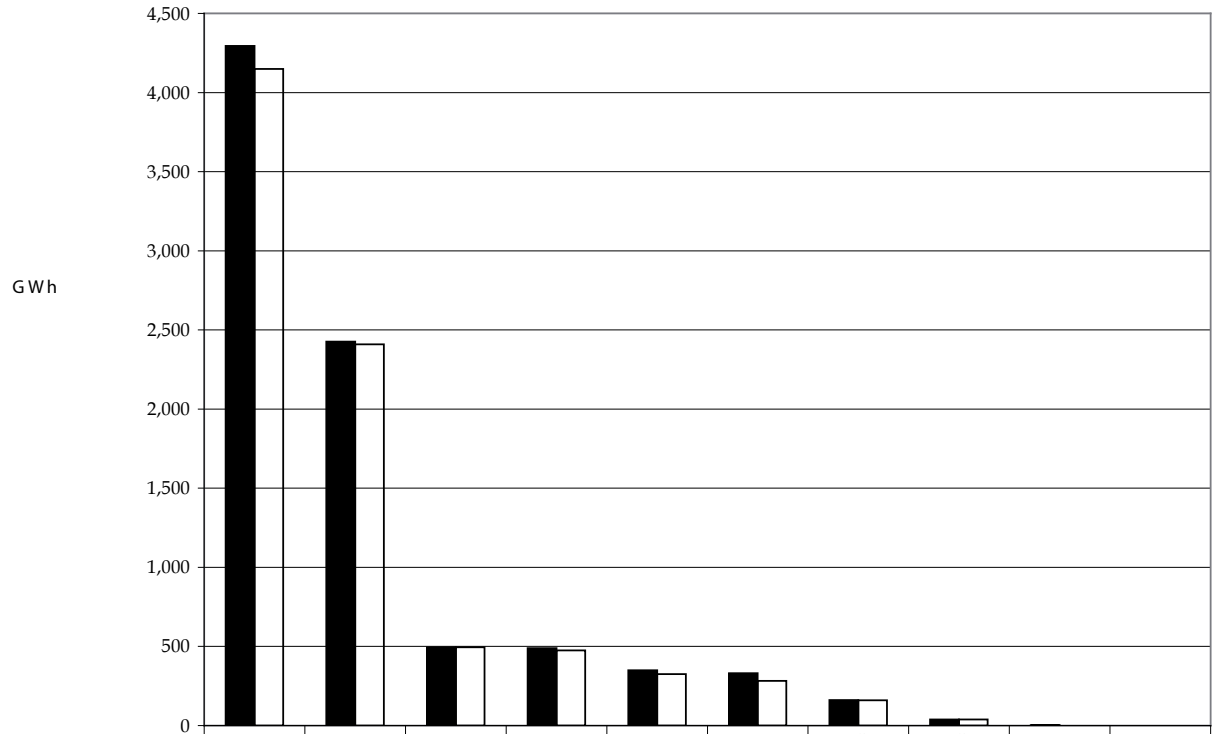
E. Promoting renewable energy in India's states

The configuration of India's renewable energy market is underdeveloped in some areas, partially as a result of the comparative geographic advantages of some states. For instance, the states of Rajasthan, Gujarat, Maharashtra, and Tamil Nadu exhibit the greatest potential for the development of wind power because they have high levels of wind density and low rainfall compared to other states in India. The states of Andhra Pradesh and Karnataka have shown some potential for the dual use of wind power and hydroelectric generation. Similarly, the states of Himachal Pradesh, Jammu and Kashmir, Uttaranchal, and Arunachal Pradesh appear to be ideal sources for the generation of electricity through small hydroelectric projects (up to 25 MW capacity).

The mapping of India's renewable energy usage reveals two trends. First, the generation of electricity through renewable energy sources is highly concentrated into a few states. Moreover, the private sector has been instrumental towards the provision of energy through renewable energy sources [See Chart 4].

18 Ibid, section 6.5.1.
19 Ibid, section 5.6.3.

Chart 4. Gross energy generated by wind power in India's states (2005) and proportion financed by the private sector.



	India Total	Tamil Nadu	Maharashtra	Karnataka	Gujarat	Rajasthan	Andhra Pradesh	Madhya Pradesh	Kerala	West Bengal
■ Gross energy generated (GWh)	4,295.2	2,426.3	495.4	489.5	350.0	331.5	160.8	38.8	2.5	0.5
□ Private sector funded	4,148.7	2,408.7	495.4	474.5	325.0	282.8	159.4	38.8	0.3	0.0

Source: Central Electricity Authority (CEA), Government of India.

As Chart 4 shows, only 9 states (Tamil Nadu, Maharashtra, Karnataka, Gujarat, Rajasthan, Andhra Pradesh, Madhya Pradesh, Kerala, and West Bengal) generated any electricity from wind power. Out of these states, over 56 percent of gross energy generated by wind power came from one state (Tamil Nadu). Chart 4 also shows that nearly 96 percent of India's gross energy generated by wind power was financed by the private sector.

F. Statewise analysis of fiscal and financial incentives to renewable energy

At the state level, most states and union territories have an individual State Nodal Agency (or SNA). These institutions are state government agencies which undertake the promotion of renewables through provision of fiscal and financial incentives. State nodal agencies also serve to facilitate in terms of infrastructure development in a given state and provide assistance with interaction with the state utility.

Central and state taxes on various forms of energy are one of the most important consideration of pricing of such energy sources. According to the report of the expert committee on an integrated energy policy, taxes "are not applied consistently, thereby resulting in significant price distortions."[20] In the past, the fiscal incentives given at the state level were primarily in the form of sales tax exemptions for the investors in the renewable energy projects. Likewise, the financial incentives were mainly in terms of capital subsidies. With the progress achieved in different renewables energy technologies, the import of these incentives has been replaced with a new generation of regulatory interventions. As a result of specific provisions in the Electricity Act of 2003 —particularly those pertaining to renewable energy— the role of state regulatory commissions have became very crucial.

Different state regulatory commissions, in accordance to the provisions of the Electricity Act 2003, have issued tariff orders for power procurement from renewable energy sources. The main incentive, through the regulatory interventions, is the *preferential tariff* offered for renewable energy projects. These tariffs are estimated by the state regulatory commission to provide attractive returns for the investors. Further, as guided by the Electricity Act of 2003, the state regulatory commissions are also critical players in deciding the percentage quota for renewables; thus creating a market for power generated from renewable energy projects.

There is an asymmetry in the level of state-level incentives for renewable energy. Only a handful of states have taken the lead in providing these incentives, in the form of tariffs and fixed quotas for power generation from renewable energy. Appendix 1 provides consolidated information on tariffs being provided in those states which already have issued tariff orders. Below is a summary analysis of the most salient incentives provided by different states.

Maharashtra

The fiscal incentive of a sales tax exemption was introduced in Maharashtra in 1998. This sales tax exemption was valid until March 2003. Subsequently, the Maharashtra Electricity Regulatory Commission (MERC) has issued tariff orders for wind, cogeneration, biomass, and small hydro projects. In addition to the tariff incentives, the MREC has also fixed quota for power generation from renewable energy sources. The quota of renewable energy sources in the total power distributed during the 2006-07 would be 3 percent. The MREC has gradually increased this quota to 6 percent in 2009-10.

Tamil Nadu

In case of the state of Tamil Nadu, no fiscal or financial incentives are presently being provided. However, the state's current renewable energy policy —for power purchase and wheeling and banking of power— provides sufficient incentives which have resulted in very high levels of growth,

20 Planning Commission, Government of India, *Integrated Energy Policy*, Chapter V, p. 78.

especially in case of wind energy sector. The Tamil Nadu Electricity Regulatory Commission (TNERC) has recently issued a tariff order for power purchase from renewable energy sources. Furthermore, the Tamil Nadu Electricity Board (the state utility) proactively works with project developers for infrastructure development, especially for wind projects. Realising that the pace of growth, especially in wind sector, being very high and the TNEB alone can not develop the infrastructure, TNEB works with project developers for faster development of power evacuation infrastructure.

Karnataka

The incentives for renewable energy in Karnataka also are mainly through targeted regulatory interventions. The Karnataka Electricity Regulatory Commission (KERC) has issued regulations providing specific tariffs for power purchase from different renewable energy sources. The KERC has also specified the renewable energy quota of minimum of 5 percent and a maximum of 10 percent. The Karnataka Renewable Energy Development Agency Ltd. (KREDL), though, does not provide any direct financial or fiscal incentives. Instead it acts as facilitator for development of renewable energy projects. KREDL also interacts with the regulators and utilities on behalf of project developers.

Rajasthan

In case of Rajasthan, presently a renewable energy policy is in place which, though does not provide the fiscal or financial incentives but provides attractive power purchase tariffs for power purchase from renewable energy sources. The Rajasthan Electricity Regulatory Commission (RERC) is in the process of developing the tariff and quota regulation for renewable energy.

Gujarat

Even though it is one of the leading states for attracting foreign direct investment, the development in the renewable energy sector was hampered in Gujarat in recent past as result of lack of clear policy as well as any incentives. The Gujarat Electricity Regulatory Commission (GERC) has recently issued the order for purchase of power from renewable energy sources and related issues filling the policy gap.

Other Indian states, through the state regulatory commission, have either tariff orders for purchase of power from renewable energy sources or are in the process of preparing the same. Thus, in case of Indian states, fiscal and financial incentives have gradually been replaced with regulatory interventions. These regulatory interventions have been created, primarily, for the purpose of creating markets through fixed quota for renewables, while at the same time ensuring returns to the investors by providing ‘preferential tariffs’.

G. Indian renewable energy manufacturing and opportunities for European firms.

The Indian government has sponsored the development and experimentation various types of alternative sources of energy. At present, India is one of the world leaders in wind power generation, ranking fifth in the world (behind Germany, Spain, the USA, and Denmark) in total installed wind power capacity. Moreover, India is a world leader in the manufacturing of certain types of equipment for the use of photovoltaic energy conversion. For instance, India is the world's fifth largest manufacturer of silicon solar modules. Other sources of renewable energy (notably biogas burners, improved chulhas, solar panels, solar thermal water heaters based on flat plate collectors, solar water heaters based on evacuated tube collectors, solar cookers) are manufactured by small Indian producers.

The Indian government has also adopted an innovative approach to the sale and distribution of solar energy equipment. The most notable example of this innovation is the effort by the MNES to promote the establishment of Aditya Solar Shops throughout the country. These solar shops, operated by state government agencies or private firms, are geared to provide sales of different renewable energy and energy efficient devices as well as the servicing and repair of such devices. In order to promote financial self-sufficiency, Aditya shops are also allowed to sell energy efficient items (such as compact fluorescent lamps (CFL), lighting accessories, high efficiency kerosene stoves) as well as other types of conservation devices. Moreover, these solar shops serve another purpose, which is to provide a venue for dissemination of information on various renewable energy devices and systems.

In this environment, Indian firms enjoy a comparative advantage over their European counterparts in the manufacture of small scale solar equipment. Nevertheless, the facilitation of technology from Europe to India will be central to the development of second generation sources of renewable energy and for the production of large-scale renewable energy sources. So far, though, the positioning of European firms in Indian renewable energy market has been largely limited to the provision of wind turbines and biomass conversion technology. European manufacturers, principally German and Danish companies, have provided a range of wind power equipment through Indian subsidiaries. For instance, German (Enercon GmbH, GE Wind Energy GmbH, NEG Micon, and Wincon West Wind), Danish (Vestas Wind Systems A/s), Spanish (Gamesa Eolica) and Belgian (Turbowinds) manufacturers have assisted in the domestic production of wind turbines with a generating capacity of 230 kW to 900 kW.

Large European energy and petrochemicals companies, such as British Petroleum and Royal Dutch Shell, have been active in the development of alternative sources of energy (especially

solar thermal systems and biomass). British Petroleum has been involved in a joint venture with India's Tata Group for the manufacture of solar cells, solar PV modules and systems. According to British Petroleum, over 60 percent of its production is exported to Europe (primarily to Germany). Likewise, Royal Dutch Shell have been active in the development of biomass cogeneration and gasification.

Given that coal will continue to play a prominent role in India's energy mix, a second generation of India-EU collaboration is likely to emerge in coal gasification and carbon sequestration technologies. However, given the high economies of scale needed to undertake this process, it is likely that only major industry players may be able to participate in this process.

Based on interviews with European renewable industry analysts and representatives of European industry associations, there are several types of industry specific concerns that face European firms operating in India. There is a broad consensus that the formal institutional framework, at least at the central government level, is not hostile to EU-India collaboration on renewable energy. Nevertheless, some expressed a concern about the competence and technical expertise in some of the staff in key central government ministries dealing with renewable energy. These issues, in their view, were not insurmountable and were no different than those that European firms are likely to face in some challenging emerging markets, such as Eastern Europe. The Confederation of Indian Industry (CII), however, was repeatedly praised for its high level of professionalism and capacity in providing a great deal of assistance to potential entrants to the Indian renewable energy market.

Some interviewees expressed a concern about the low level of awareness about renewable energy in India. These individuals highlighted that the contrast with China, for instance, was stark. Primarily they attributed these differences to the generally higher levels of pollution in China and to the country's relative economic strength. Subjects believed that a critical area of opportunity for European and Indian firms concerned the area of research and development. Some interviewees, for instance, lamented the absence of an undergraduate course on renewable energy. They believed that the sharing of technical expertise, as early as the undergraduate level, would help raise awareness about the importance of renewable energy as a solution to energy problems. The view was also expressed that this scientific collaboration ought to extend to other spheres of research. At present, there is only one research institute that deals with R&D in wind testing and certification, the Centre for Wind Electricity Technology (CWET) in Chennai. European firms specialising in testing and certification of different types of wind turbine could be very successful in India.

Those interviewees who projected an optimistic outlook for renewable energy in India praised the technical expertise available in India and expressed the view that EU-India collaboration was already taking place in some areas of R&D. For instance, several interviewees noted that some

European firms, notably Enercon GmbH, manufactured some of the wind technology components in for export to Europe. In their estimation, up to 60 percent of their production was currently exported to Europe, primarily Germany.

Of greater concern, however, are actual impediments that European firms face once they have entered the market. Most of these critical challenges are informal in nature and they relate to several types of market distortions, primarily in the areas of product development, project finance, and the protection of property rights. In this front, there were several specific issues that were raised:

- Concern about the stability of payment pricing, particularly in the area of preferential tariffs;
- Administrative access to land, namely in terms of uncertainty about long term access to land;
- Security of power supply, especially in terms of protection against theft.

Although serious, these are issues that can be resolved with the adequate regulatory resolve. In terms of the policy behaviour of some states, it appears that a functional regulatory structure at the state level is key to providing adequate protection to both consumers and stakeholders. Some states in India, principally Tamil Nadu, had developed a reputation as a public policy innovator in the energy field. For instance, Tamil Nadu's state electricity regulator has a reputation for efficient delivery of payments to its customers.

H. Conclusions.

As has been emphasized in this report, the security of supply, sustainability, and competitiveness are likely to be the key drivers of EU-India energy cooperation. The Indian government faces an imminent energy crunch and has the principal debate on how to alleviate this gap is via the alteration of India's energy mix, either by increasing India's oil imports or by moving towards the provision of energy through nuclear technology.

Insofar as it pertains directly to the promotion of climate-friendly renewable energy technology, EU-India collaboration is likely to be constrained by several factors.

First, the Indian central government has just come to terms with a unified energy policy. The 2003 Electricity Act is a step in the direction of providing greater policy integration and coordination for the electricity sector. The Planning Commission's report of the expert committee on integrated energy policy suggests concrete measures for achieving an unified government policy on relative prices, consistent tax structures, uniform treatment of externalities, public infrastructure, and consistent regulation. The Planning Commission's report contains an outline of concrete provisions in relation to regionally balanced development and renewable energy. Likewise, the New and Renewable Energy Policy Statement 2005 is also a step in the right direction, although so far it remains in draft form. It is worth noting, however, that subsidies of conventional sources of energy, especially for

electricity, remain quite high. As shown in the discussion on this report, the central government aims to reduce subsidies for renewable energy to a bare minimum. In this sense, renewable energy will have difficulties remaining competitive in the overall Indian energy market.

Second, the key sources of India's renewable energy are highly concentrated into a few sectors, primarily wind, small hydro, and biomass. Installed renewable energy capacity in other sectors (particularly energy from residues and solar photovoltaic energy) is miniscule. Given that states will be the primary players in the implementation of India's renewable energy policy, it is of concern that so few states have legislative or regulatory institutions for the promotion of the underutilised sources of renewable energy.

Third**,** most of the renewable energy in India is financed with private sector involvement and unlike conventional sources of electricity, does not receive widespread subsidies. At one level, the central government has encouraged foreign investors to get involved in renewable energy projects. To that effect it provides no foreign direct investment restrictions in this area. However, the cost effectiveness of small renewable energy projects has been identified as critical source for the shortfall of actual foreign direct investment in this area. The central government has hinted that it will not provide fiscal incentives for most renewable energy projects beyond the 10th Five Year Plan. Instead, the majority of current incentives focus on preferential tariffs, rather than other forms of fiscal and financial incentives.

Fourth**,** the provision of renewable sources of energy is highly concentrated to a few regions of India. For instance, 100 percent of India's wind power energy is located in nine out of India's twenty-seven states. As this report has hinted, some of the reason for this level of renewable energy concentration is a result of optimal conditions for certain types of renewable energy. For instance, wind generation can only take place in those areas where there is sufficient wind density to make wind generation sustainable. Nevertheless, it is also apparent that some states have taken a more forward approach to attempting to generate electricity through renewable energy sources. Some have achieved these goals by having simplified tariff structures, an operational state regulatory framework, and functional state electricity agencies. Most states, however, have been less forthcoming in this area.

Finally, the experience of European renewable energy firms operating in India suggests that there are many lingering challenges that will be difficult to overcome in the short term. Based on interviews with some of these firms, there was a consensus that unpredictable market distortions, uncertain project financing, and the asymmetrical protection of property rights were some of the critical challenges that European renewable energy firms had to face and which often made the generation of renewable energy in India an unsound investment.

Appendix 1. The power purchase determined by the state electricity regulatory commission in different states tariffs for different renewable energy sources.

State	Wind	Small hydropower	Bagasse based cogeneration	Biomass
Andhra Pradesh	Rs. 3.37 per unit with 5 percent simple escalation.	Rs. 2.60 per unit for the first year with gradual reduction to Rs. 1.88 per unit in the tenth year.	Fixed cost of Rs. 1.72 per unit in the first year, gradually reducing to Rs. 0.90 in the tenth year and afterwards. Variable cost Rs. 1.02 in 2005-06, escalating to Rs. 1.24 in 2008-09.	Fixed cost of Rs. 1.61 per unit during the first year, decreasing to Rs. 0.87 in the tenth year. The variable cost for 2004-05 was Rs. 1.27, escalating to Rs. 1.54 in 2008-09.
Maharashtra	Rs. 3.50 per unit with annual increase of Rs. 0.15 per unit.	Rs. 2.84 per unit in the first year, which increases by Rs. 0.03 per unit every year until the tenth year. Fixed tariff of Rs 3.11 per unit from the tenth until the fifteenth year. Annually, with an escalation of Rs. 0.03 per unit subsequently.	Rs. 3.05 per unit with 2 percent escalation.	Rs. 3.04 per unit in first year, escalating to Rs. 3.34 in the tenth year.
Madhya Pradesh	First year Rs. 3.97 per unit drops to Rs. 2.43 per unit in the eleventh year, and gradually increasing to Rs. 2.60 per unit in the twentieth year	Not available	Not available	Not available
Karnataka	Rs 3.40 per unit for first ten years.	Rs. 2.80 per unit for first ten years.	Rs. 2.80 per unit in the first year with 2 percent escalation until tenth year.	Rs. 2.85 per unit in the first year, with 2 percent escalation until tenth year.
Tamil Nadu	Rs. 2.75 per unit (for old projects) and Rs. 2.90 per unit (for new projects).	Not available	Rs. 3.15 per unit.	Rs. 3.15 per unit.
Uttar Pradesh	Not available	Rs. 3.39 per unit in the first year, reduced by Rs. 0.10 per unit until tenth year, then reduced by Rs. 0.03 from tenth year until twentieth year.	Variable tariff rate (namely fixed cost, non escalating and escalating components, and variable cost depend on year of commissioning).	Not available
Gujarat	Rs. 3.37 per unit.	Not available	Not available	Not available

Source: The Energy and Resources Institute (TERI).

Note: 1 Euro is approximately equivalent to 59 Indian rupees (Rs.).