GWEC
GLOBAL WIND ENERGY COUNCIL

INDIA WIND ENERGY OUTLOOK | 2012

NOVEMBER 2012

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सत्यमेव जयते

Minister
New and Renewable Energy
Government of India

Message

I am delighted to learn that the Global Wind Energy Council, World Institute of Sustainable Energy and Indian Wind Turbine Manufacturing Association are bringing out the 3rd Edition of the "India Wind Energy Outlook 2012" during 'Wind Power India 2012' - an international wind energy conference & exhibition being held at Chennai during November 28-30, 2012.

Wind Energy has been the fastest growing renewable energy sector in the country. With a cumulative installed capacity of over 18,000 MW, wind power currently accounts for almost 70 percent of the total installed capacity in the renewable energy sector. About 3,200 MW of new wind power capacity has been added during the last financial year (2011- 2012) alone which is the highest in a year, so far. The 12th Five Year Plan proposals envisage around 15,000 MW of grid-interactive renewable power capacity addition from wind energy alone.

Our Ministry has been at the forefront of providing the necessary policy support and a facilitative regulatory eco-system for the fast and orderly growth of the sector. We are equally conscious of the challenges and difficulties being faced by the sector. We are, however, confident that the potential of the sector is enormous. The target of 15 percent of total power capacity through renewable for India by 2020 envisaged under the National Action Plan on Climate Change cannot be achieved without a substantial contribution of wind energy.

I hope that the wind industry and the wind farm developers are working seriously to achieve these targets. I am told that the current compendium is a chronicle of our success in wind energy so far. I am sure that it will serve as a guidebook and motivate all the stakeholders in the sector. I compliment the publishers for their efforts and wish their endeavours all success.

(Farooq Abdullah)

India is the 3rd largest annual wind power market in the world, and provides great business opportunities for both domestic and foreign investors. The Indian wind power sector experienced record annual growth in 2011 with the addition of more than 3 GW of new installations. Diverse incentives supported by a long-term policy and regulatory framework at the central and state levels have played a crucial role in achieving this goal. Wind power is now increasingly accepted as a major complementary energy source for securing a sustainable and clean energy future for India.

It is with great pride that we announce the release of the 3rd Edition of the 'India Wind Energy Outlook', a joint publication by the Global Wind Energy Council (GWEC), the World Institute of Sustainable Energy (WISE), and the Indian Wind Turbine Manufacturers' Association (IWTMA), at 'Wind Power India 2012', being organized from 28-30 November 2012, in Chennai. The 'India Wind Energy Outlook 2012' is the wind industry stakeholders' contribution to the discourse on accelerating wind power development in India. Besides providing an overview of wind energy potential, manufacturing and investment prospects; the report provides insights into the challenges ahead, offering suggestions for overcoming hurdles to enable the domestic wind power sector to advance within a competitive, world-class and investor friendly environment. We further aim to enable all relevant stakeholders including the government, policy makers, regulators and the industry, to draw upon and make use of this publication to further strengthen the legal and regulatory framework for wind power in India.

Since the 1980s the Government has taken various initiatives for developing the country's vast indigenous renewable energy resources. This includes the National Action Plan on Climate Change (NAPCC), and the current 12th five-year plan, which set long-term targets, that help in evolving a better investment environment for the wind sector. But this effort would have been in vain, without the positive and proactive role of the Ministry of New and Renewable Energy and the electricity sector regulators. Their role in the development of wind power in India is undeniable and important. We look forward to working closely with all relevant stakeholders and supporting the Government towards achieving the goals set under the NAPCC and the 12th five-year plan. Our top priority is to support the development of a comprehensive renewable energy law and stable regulatory environment for wind power in India.

We look forward to taking this dialogue a step forward, in order to facilitate a quantum leap in the wind power sector and a transition to a renewable energy future. This transition can be achieved without sacrificing our economic development. It is our firm belief that the planned transition to a low-carbon economy through accelerated deployment of renewables over the next four decades is essential to solving the major crises of depleting fossil fuels reserves, climate change, and energy security, while ensuring sustainable development. This can be achieved without sacrificing developmental goals and wind power will play a major role in this transition.

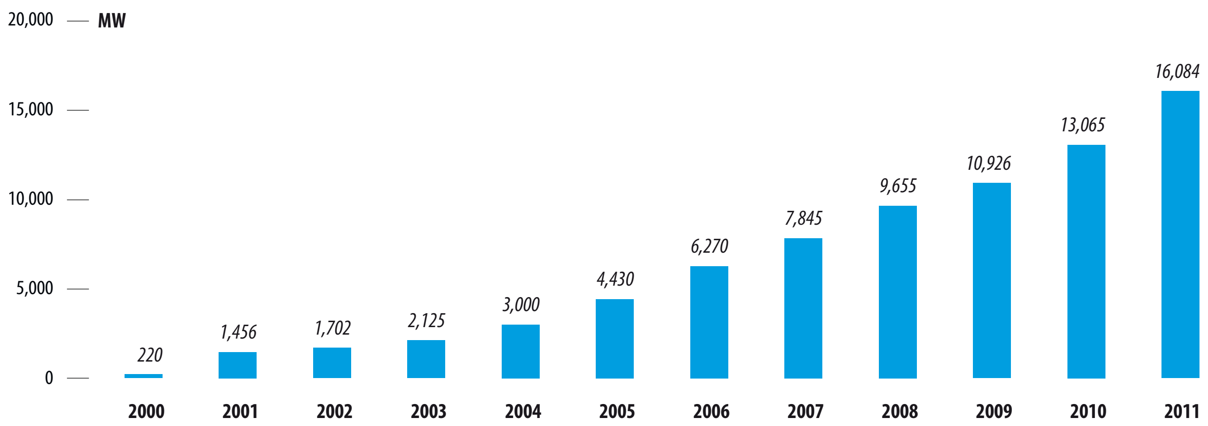
Steve Sawyer
Secretary General –
Global Wind Energy Council

G M Pillai
Founder/Director General
World Institute of Sustainable Energy

Ramesh Kymal
Chairman
Indian Wind Turbine Manufacturers' Association

1 | STATUS OF WIND ENERGY IN INDIA

INDIA: CUMULATIVE WIND INSTALLATION (MW)



Source: GWEC,2012[2]

WIND ENERGY IN INDIA

In 2012, despite a slowing global economy, India's electricity demand continued to rise. Electricity shortages are common, and over 40% of the population has no access to modern energy services. India's electricity demand is projected to more than triple between 2005 and 2030. In the recently released National Electricity Plan (2012) the Central Electricity Authority projected the need for 350-360 GW of total generation capacity by 2022. Despite major capacity additions over recent decades, power supply struggles to keep up with demand.

India had another record year of new wind energy installations between January and December 2011, installing more than 3 GW of new capacity for the first time to reach a total of 16,084 MW. As of March 2012, renewable energy accounted for 12.2 percent of total installed capacity, up from 2 percent in 1995. Wind power accounts for about 70 percent of this installed capacity. By the end of August 2012, wind power installations in India had reached 17.9 GW[1].

Under the New Policies Scenario of the World Energy Outlook (2011), total power capacity in India would reach 779 GW in 2035. To reach 779 GW in 2035, capacity must grow at a CAGR of 5.9 percent, or over 20 GW per year from 2009 through 2035. The largest addition per year up to now was nearly 18 GW during fiscal year 2011-2012[3]; this scale of expansion could pose a challenge for the government [IEA, 2012[4]] without a significant role for renewables. During fiscal year 2011-2012 wind energy alone delivered over 3GW to India's new installed capacity, accounting for over 16.5 percent of total new installed capacity.

RENEWABLE ENERGY IN THE 12TH FIVE-YEAR PLAN [2012-2017]

Historically, wind energy has met and often exceeded the targets set for it under both the 10th Plan (2002-2007) and 11th Plan (2007-2012) periods. During the 10th Plan period the target set was of 1,500 MW whereas the actual installations were 5,427 MW. Similarly during the 11th Plan period the revised target was for 9,000 MW and the actual installations were much higher at 10,260 MW.

The report of the sub-group for wind power development appointed by the Ministry of New and Renewable Energy to develop the approach paper for the 12th Plan period (April 2012 to March 2017) fixed a reference target of 15,000 MW in new capacity additions, and an aspirational target of 25,000 MW. Importantly the report recommends the continuation of the Generation Based Incentive scheme during the 12th Plan period. The report also prioritized the issue of transmission, which was a weak link in the value chain until now. A joint working group of the MNRE, the Ministry of Power, the Central Electricity Authority and the Power Grid Corporation of India is looking at this issue.

However, for India to reach its potential and to boost the necessary investment in renewable energy it will be essential to introduce comprehensive, stable and long-term support policies, carefully designed to ensure that they operate in harmony with existing state level mechanisms so as to avoid reducing their effectiveness.

1 *Website accessed on 20-10-12 www.mnre.gov.in.*
2 *GWEC Annual Market Update 2012, the installations are between January and December of each year. The MNRE publishes data for Indian fiscal year that runs from 1st April to 31st March of the following calendar year.*
3 *India's economic policy is based on its Five Year Plans, and India's Fiscal Year runs from April 1st to March 31st of the following year.*
4 *Understanding Energy Challenges in India: Policies, Players and Issues Published by OECD/IEA in September 2012 under the Partner Country Series.*

WIND POWER RESOURCE ASSESSMENT

Presently, India has an installed power generation capacity of a little over 207.8 GW[5], of which renewables account for about 25 GW, and wind makes up a majority of this installed capacity. In 2011 the state-run Centre for Wind Energy Technology reassessed India's wind power potential as 102,778 MW at 80 metres height at 2% land availability[6], up from the earlier estimate of approximate 49,130 MW at 50 metres, also at 2% land availability[7]. If the estimated potential of 102 GW were fully developed, wind would provide only about 8 percent of the projected electricity demand in 2022 and 5 percent in 2032 [LBNL 2012][8].

Over the past year other research organizations have estimated wind potential using differing models for mapping the wind resource[9]. In one such study conducted by the Lawrence Berkeley National Laboratory, assuming a turbine density of 9 MW/km^2, the total wind potential in India with a minimum capacity factor of 20 percent ranges from 2,006 GW at 80-meter hub-height to 3,121 GW at 120-meter hub-height[10] [LBNL 2012].

These research studies need ground level validation through long-term wind measurements at 80 and 120-meter hub height. Nevertheless their findings may have a significant impact on India's renewable energy strategy as it attempts to cope with a substantial and chronic shortage of electricity.

In a positive development the Ministry of New and Renewable Energy (MNRE), has now signed a Memorandum of Understanding with the Lawrence Berkeley Lab to collaborate on several issues related to the estimation of wind resource potential and grid integration.

WIND POWER INSTALLATIONS BY STATE

Historically, the States of Tamil Nadu, Karnataka, Maharashtra and Gujarat have been the leaders in terms of total wind installations. The States of Rajasthan, Madhya Pradesh and Kerala are quickly catching up. By the end of the 11th Plan period in March of 2012, the total installed capacity had reached a total of 17,351.6 MW.

Interestingly more than 95 percent of the nation's wind energy development to date is concentrated in just five states in southern and western India – Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, and Gujarat [LBNL, 2012]. These five states accounted for over 85% of the total installed capacity at the end of the last plan period. Rajasthan is another emerging State with rising wind turbine installations.

INSTALLED WIND POWER CAPACITY BETWEEN 01.04.2011 AND 31.03.2012

States	Annual Installations (MW)	Cumulative Installations (MW)
Andhra Pradesh	54.1	245.5
Gujarat	789.9	2,966.3
Karnataka	206.7	1,933.5
Kerala	0	35.1
Madhya radesh	100.5	376.4
Maharashtra	416.75	2,733.3
Rajasthan	545.7	2,070.7
Tamil Nadu	1,083.5	6,987.6
Others	0	3.2
Total	**3,197.15**	**17,351.6**

Source: C-WET, MNRE 2012[12]

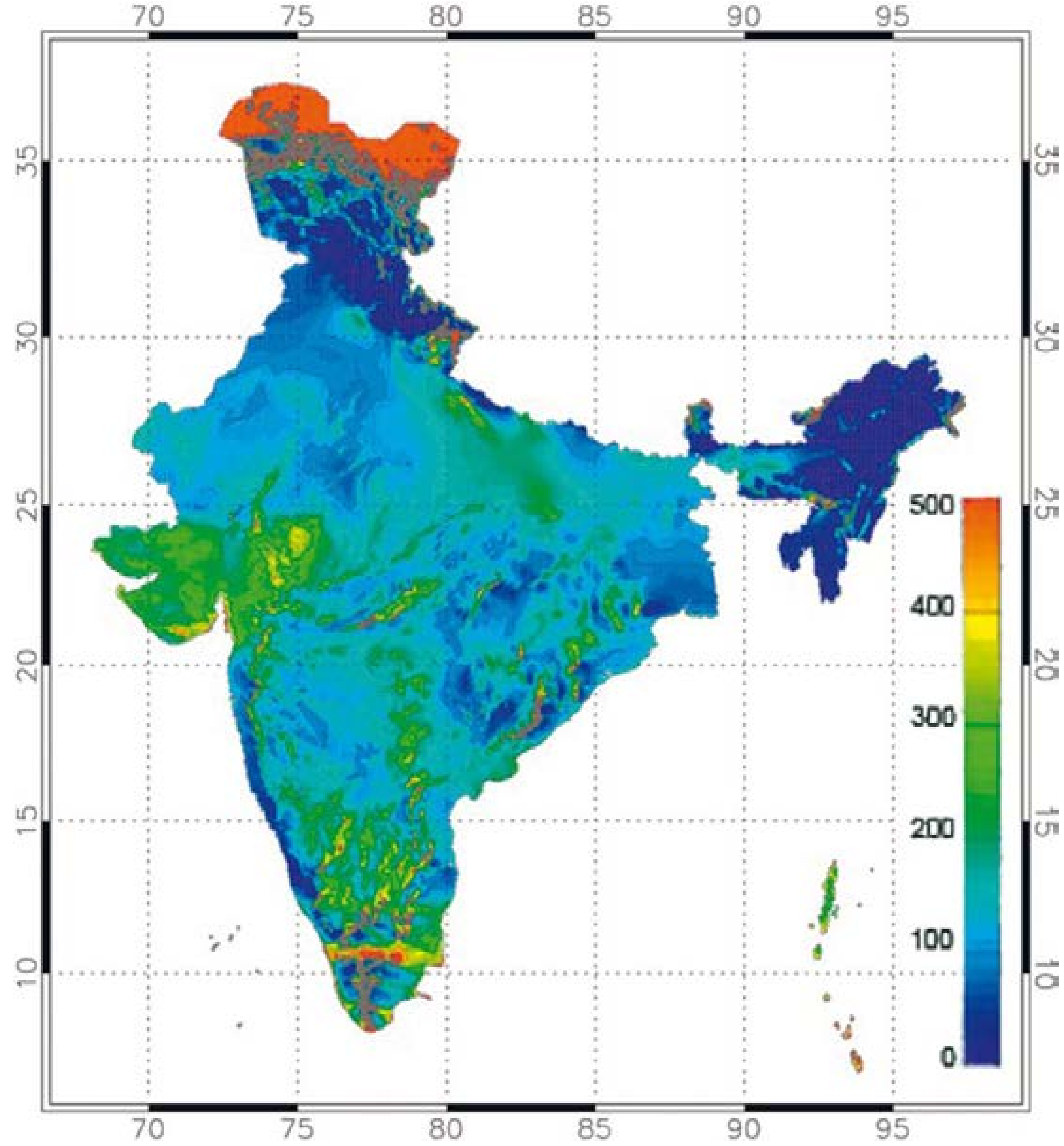
OFFSHORE WIND POWER DEVELOPMENT

India has a long coastline of over 7500 kilometers. In April 2012, the Ministry for New and Renewable Energy constituted an Offshore Wind Energy Steering Committee[13] under the chairmanship of the Secretary, MNRE, to drive offshore wind power development in India in a planned manner.

The Government is looking to prepare a time-bound action plan for development of offshore wind energy, especially in the coastal states of Andhra Pradesh, Gujarat, Maharashtra, Odisha, Kerala, Karnataka, West Bengal and Tamil Nadu. A policy and guidelines for offshore wind are likely to be announced by the Ministry of New and Renewable Energy in the near future.

The State of Tamil Nadu is likely to take a lead in harnessing its offshore wind resources and is in the process of installing a 100-metre mast for wind measurements in Dhanushkodi. According to C-WET, as per the preliminary assessment conducted by the Scottish Development International[14] (SCI), Tamil Nadu has a potential of about 1 GW in the north of Rameswaram and another 1 GW in the south of Kanyakumari. SCI, under the guidance of Centre for Wind Energy Technology conducted a detailed survey of the region to assess various parameters required for installing offshore wind farms. The technical feasibility study looked at offshore wind energy potential in favourable areas in the southern Peninsula and Kutch region in Gujarat. In a recent study conducted by WISE, the offshore wind potential of Tamil Nadu has been estimated as 127 GW at 80 m height[15], which will need further validation.

WIND POWER DENSITY MAP AT 80 METRES (W/M^2)



Source: Centre for Wind Energy Technology, India[11] (2012)

5 *www.cea.nic.inWebsite Accessed on 20-10-12*

6 *The revised figure of 102,778 MW remains to be validated with real time data. Website Accessed on 20-10-12 http://www.cwet.tn.nic.in/html/departments_ewpp.html*

7 *Website Accessed on 20-10-12 http://www.cwet.tn.nic.in/html/departments_wra.html*

8 *Reassessing Wind Potential Estimates for India: Economic and Policy Implications by Amol Phadke, Ranjit Bharvirkar and Jagmeet Khangura; Lawrence Berkeley National Lab (2012)*

9 *Note: Another of such studies 'A GIS based assessment of potential for wind farms in India' by Jami Hossain, Vinay Sinha, V.V.N. Kishore, was published in Renewable Energy (2011, vol. 36, no12, pp. 3257-3267) and assessed the wind power potential in India to be 4250 GW; other similar studies were undertaken by The Energy and Research Institute for the State of Gujarat (2011) and World Institute for Sustainable Energy for the State of Tamil Nadu (2012). WISE's GIS based study on wind potential reassessment for Tamil Nadu has estimated onshore wind potential of 197 GW at 80 m height with 15% and above Capacity Utilization Factor. A higher quality onshore potential is estimated at 51 GW at 80 m height. Overall it is interesting to note that all of these studies find significantly higher wind potential than acknowledged officially.*

10 *The study also finds that the total footprint required to develop high-quality wind energy (that is, wind turbines at 80 meters with a capacity factor greater than 25 percent, which would yield a potential of about 543 GW in India) is approximately 1,629 square kilometers, or 0.05 percent of the total land area in India. The footprint is not large because, typically, the wind turbines occupy only about 3 percent of a wind-farm and related infrastructure; the rest of the land can be used for other purposes.*

11 *http://www.cwet.tn.nic.in/html/departments_ewpp.html Website Accessed on 20-10-12*

12 *Website Accessed on 20-10-12 http://www.cwet.tn.nic.in/html/information_yw.html*

13 *The Offshore Wind Energy Steering Committee will focus on issues related to allotment of offshore wind sites that require multilayer clearances, coordination with various government departments and agencies such as Environment, Shipping, Defense, Maritime and Civil Aviation. The committee will also provide policy guidance for tapping offshore wind energy potential; approve plans and proposals relating to offshore wind energy development in the country; develop policy guidelines for offshore wind resource assessment through public/private entities and guidelines for awarding the sites to private sector for establishing offshore wind power projects. The Committee will include various stakeholders including government departments and agencies.*

14 *Scottish Development International (SCI) is the international economic development agency of Scotland. Ministry of New and Renewable Energy Presentation at the Round Table on Wind Power Programme held on 1-August 2012 at New Delhi. www.mnre.gov.in.*

15 *In a recently published study called the Action plan for comprehensive renewable energy development in Tamil Nadu by WISE (2012); the wind potential of Tamil Nadu was assessed for 80 m, 100m and 120 m using GIS. The total assessed wind potential for 80 m, 100m and 120m was assessed at over 160 GW, 260 GW and 299 GW respectively. Offshore wind potential been estimated as 127 GW at 80 m.*

REPOWERING POTENTIAL

Commercial wind power generation in India began in 1986. Many of the older low-capacity (< 500 kW) wind turbines installed more than 10 to 12 years ago occupy some of the best wind sites in India. These turbines need to be replaced with more efficient, larger capacity machines. One of the immediate benefits after repowering the old wind turbines is that more electricity can be generated from the same site. A study on repowering potential conducted by WISE for the Ministry of New and Renewable Energy estimated India's current repowering potential at approximately 2,760 MW[16].

However due to a lack of policy guidelines and incentives for repowering, concerns are raised on a number of subjects including disposal of old machines, fragmented land ownership in existing wind farms, clarity on the feed-in tariff offered to newly repowered projects and constrained evacuation of the extra power generated.

For example currently no project capacity increase is allowed in Tamil Nadu after repowering due to transmission constraints, thereby defeating the purpose of repowering an existing site. Consequently limited progress has been achieved in the absence of national or state level policy guidelines for repowering.

BARRIERS TO ACHIEVING HIGHER GROWTH

The 11th Plan had aimed to create 78.7 GW of additional capacity for grid connected power but actual realization was around 50 GW. The 12th Plan envisions installing 100 GW of new capacity of which 30 GW is projected to come from Renewable Energy Sources, of which wind would account for 15 GW. Historically the Indian wind energy sector has met and occasionally exceeded its allocated target[17].

During FY 2011-12, India installed a record 3.1 GW of new wind power capacity. For this scale of growth to be maintained and escalated it is essential that the industry is supported by a stable policy and regulatory environment. India had installed almost 18 GW of wind power capacity by August of 2012 (MNRE). With C-WET's updated wind power potential numbers and the movement towards promoting offshore wind development, there is a lot more that can be achieved in the country.

According to the 12th Plan approach paper a GDP growth rate of 9 percent per year over the Plan period will require energy supply to grow at around 6.5 percent per year. The ability to meet this energy demand depends on the country's ability to expand domestic production in critical energy sub sectors on an urgent basis. Power generation (utilities + captive) grew at 5.8 percent per annum during the twenty-year period from 1990-91 to 2010-11.

Wind power is a mature and scalable clean energy technology where India holds a domestic advantage. India has an annual manufacturing capacity for over 9.5 GW of wind turbines today. The country is seeing about 3 GW in annual installations under the 12th Plan target. This modest pace of utilization of the country's wind power manufacturing and resource potential so far is attributable to several factors, including lack of an appropriate regulatory framework to facilitate purchase of renewable energy from outside the host state, inadequate grid connectivity, high wheeling and open access charges in some states, and delays in acquiring land and obtaining statutory clearances. The broader global economic slowdown has reduced expectations for the fiscal year 2012-13 from the wind sector, which is still coping with the reduction of the Accelerated Depreciation benefit from 80 percent to 35 percent in the first year of a wind turbine's operation.

Besides these there are other potential barriers to achieving higher growth rates in the short to medium term. Over the last decade the federal government has offered three key incentives namely the Accelerated Depreciation (AD), the Generation Based Incentive (GBI) since 2009 and the Renewable Energy Certificates (REC) mechanism since 2010[18].

A fundamental reason for the growth of wind sector had been the availability of the AD benefit. With the quantum of this benefit reduced under the current Plan (from 1st April 2012), the other federal scheme called the GBI has now become a vital incentive for the wind sector. Though likely to be revived in near future, at present the GBI is also in abeyance.

The GBI in its first few years of operation has not attracted as many Independent Power Producers as envisaged, since the investors were of the opinion that the current rate of INR 0.5/ kWh [~ 1 US$ cent] was not adequate or at par with the fiscal benefit offered under the Accelerated Depreciation scheme; as the two continue to be mutually exclusive.

16 Old wind turbines with a total capacity of 1380 MW to be repowered to achieve a 2760 MW capacity with a minimum repowering factor of two.
17 Planning Commission of India www.planningcommission.nic.in/plans/planrel/.../ appraoch_12plan.pdf
18 For more details on the REC mechanism please see Indian Wind Energy Outlook 2011 available at www.gwec.net

© ReGen Powertech, India

The state-wise Renewable Purchase Specification (RPS) targets and the tradable Renewable Energy Certificates (REC) provide further support for the sector. However there are no incentives in the existing framework, especially for state utilities in wind-energy rich states, to adopt RPSs higher than the levels suggested by the National Action Plan on Climate Change. Also the REC Mechanism, due to its limited timeframe (five years) faces the challenge of acceptance as a revenue stream by the financial institutions.

Both the GBI and REC are at an early stage of implementation and require learning and capacity building for all stakeholders especially before the REC markets mature. Further, the multitude of regulatory agencies add to the confusion. The electricity regulatory framework consists of the Central Electricity Regulatory Commission (CERC) at the federal level and a State Electricity Regulatory Commission (SERC) at the state level.

The CERC issues guidelines for determining the feed-in-tariff for renewable energy based power generation and these are applicable to central government power generating stations and those who transmit power in the inter-state corridor. However, this is applicable to a very small number of power producers and the vast majority is still covered by the tariff determined by the SERCs[19]. This duality is not useful, as the tariff determined by the SERCs may or may not be equivalent to that of CERC tariffs. Tariffs vary across the states and remain fixed for a longer control period, this could impact the returns for new projects commissioned under this tariff regime and negatively impact new project development activity. In FY 2011-12 some of the state utilities, like Tamil Nadu, delayed FIT payments to wind power generators by over a year. This adversely affects investor confidence in the sector.

Inadequate grid infrastructure is another key issue that needs to be addressed urgently. Across most of the states with significant wind potential, the grid does not have sufficient spare capacity to be able to evacuate ever-increasing amounts of wind power. As a result, the state distribution utilities are reluctant to accept more wind power generation and usually tend to prefer thermal power generation. Thus, there is an urgent need to augment general grid capacity. Also the regional southern grid needs to be connected with the rest of the country on a real-time basis. This requires better forecasting of power demand across the nation, and a modernization of the grid.

In most states, availability of land for wind farms is a contentious issue. Even if private lands are available, conversion of land use status from agricultural to non-agricultural is a time consuming process. Further if the land is close to a protected area or forestlands then obtaining clearance from forest authorities for using the forestland for wind power generation is time consuming.

Another barrier to the growth of the wind sector is inordinately high borrowing costs. In India, a significant majority of wind power projects are conceived with a 70:30 debt-equity ratio as a project financing method. The high interest rates (at present > 13 percent) make for some very expensive debt under tough macroeconomic conditions. Further it would be beneficial for the small and medium enterprises to have access to concessional financing to bear the risks related to production capacity augmentation, especially for component manufacturers.

Lastly India's wind sector has tremendous job creation potential as the domestic industry grows. There is likely to be higher demand for trained manpower and accordingly, the technical training and academic curriculum across the States may need to be modified.

19 Tariff estimation is based on normative assumptions with respect to project cost, PLF etc., with validity over the control period of a longer duration ranging from 5 to 10 years. These tariffs also vary from INR 6.14 per kWh to INR 3.20 per kWh across the states due to differing assumptions.

2 | POLICY ENVIRONMENT FOR WIND

Wind farm in Dhule, Maharashtra © Suzlon

NATIONAL POLICY MEASURES SUPPORTING RENEWABLES

Legislation prior to the Electricity Act, 2003 (EA 2003) had no specific provisions that would promote renewable or non-conventional sources of energy. Despite this shortcoming, the Ministry for New and Renewable Energy has worked towards supporting the sector by way of policy guidelines since 1994-1995, with mixed results.

However, the EA 2003 changed the legal and regulatory framework for the renewable energy sector in India. The EA 2003 mandates policy formulation to promote renewable sources of energy by the federal government, the State governments and the respective agencies within their jurisdictions.

The SERCs determine the tariff for all renewable energy projects across the States, and the state-owned power Distribution Companies (DISCOMs) ensure grid connectivity to the renewable energy project sites, which generally are situated in remote locations away from major load centers.

Some States have come out with technology specific RPSs, which they continue to split between 'Solar' and 'Non-Solar' categories. Also a January 2011 amendment to the National Tariff Policy mandated SERC's to specify a solar-specific RPS at state level.

By June 2012, as mandated under Electricity Act[20], 26 SERCs had fixed quotas (in terms of % of electricity being handled by the power utility) to procure power from renewable energy sources. The mandate, which is called a Renewable Purchase Specification (RPS), varies from 0.5% to 10% in various states over 2012-13 [See Annex 3 on page 34 for more details].

AN INTEGRATED ENERGY POLICY FRAMEWORK

In India the first attempt at pulling together an umbrella energy policy came forth after almost 60 years of the country's independence. The Planning Commission brought out the 'Integrated Energy Policy: Report of the Expert Committee' (IEP) in October 2006, which provided a broad overarching framework for all policies governing the production, distribution, usage etc. of different energy sources. Although the report of the expert committee has been available since 2006, political commitment to it has been limited[21].

Upon examining the IEP report purely from the perspective of the support it provides to renewables, the key segment is to be found in Chapter 7 (Policy for promoting renewable and non-conventional energy sources), which emphasized the need to move away from capital subsidies towards performance incentives for promoting renewable sources[22]. The IEP report assigned a limited role to power generation from renewable energy sources even as late as 2032, with only 5.2 percent of renewables based electricity in the grid.

Wind farm in Dhule, Maharashtra © Suzlon

RENEWABLE ENERGY LAW

One of the critical requirements for India is to develop and adopt an integrated energy framework that has a long-term vision, a time-bound plan and an implementing mandate that supports India's efforts for achieving clean, secure and universal energy access for its people. Today, most countries with advanced levels of wind power development have this framework in place, usually in the form of a renewable energy law. Such a framework, if adopted, can help to address not only the concerns of investors in relation to volatile policy environment and market risks but also deliver indigenous power supply free from the fuel price risk associated with fossil fuels.

Recently the Energy Coordination Committee under the Prime Minister's Office has decided to support the enactment of a Renewable Energy Law. Subsequently, a national level technical working committee for a Renewable Energy Law was constituted by MNRE. Details about the outcomes and discussions under this committee are not known as of now.

20 Section 86 1(e) of the EA 2003 made the SERCs responsible for the following (a) Ensuring suitable measures for connectivity of renewable power to the grid, (b) Sale of renewables based electricity to any person, (c) Mandating purchase of a certain percentage of total energy consumption from renewables.

21 A Press Information Bureau press release in December 2008 indicated that the Cabinet had assented to the policy and enumerated key features of the IEP. The follow up on these recommendations are not as easily determinable as those for the National Action plan on Climate Change.http://www.pib.nic.in/newsite/erelease.aspx?relid=46172

22 http://planningcommission.nic.in/reports/genrep/rep_intengy.pdf

REGULATORY AND POLICY INCENTIVES FOR WIND POWER:

Over the next decade, India will have to invest in options that not only provide energy security but also provide cost effective tools for eradicating energy poverty across the board. India, as part of its obligations to the United Nations climate convention (UNFCCC), released a National Action Plan on Climate Change (NAPCC) in June 2008[23] that laid out the government's vision for a sustainable and clean energy future.

The NAPCC outlined its implementation strategy through the establishment of eight national missions. Two of these missions were energy related, namely the National Solar Mission and the National Mission for Enhanced Energy Efficiency. In its present state the NAPCC does not have a mission dedicated to wind power.

The NAPCC stipulates that a dynamic minimum renewable purchase target of 5% (of total grid purchase) may be prescribed in 2009-2010 and this should increase by 1% each year for a period of 10 years. That would mean that by 2020, India should be procuring 15% of its power from renewable energy sources.

To achieve such targets there is a clear need for comprehensive and long-term planning both at the federal and state levels. Current policy and regulatory incentives for wind power development are listed below.

REGULATORY AND POLICY INCENTIVES

Policy Incentives

- 100% Foreign Direct Investment in procuring in renewable energy sector allowed through the automatic route
- A total of 35% accelerated depreciation is allowed in the first year (effective from 1st April 2012): 15% normal depreciation and 20% additional depreciation for power sector projects.
- Tax-free income from sale of power for 10 years under section 80 I A of the Income Tax Act, if the renewable energy power plants start generation before 31st March 2013
- Value-added tax (VAT) at reduced rates from 12.5% to 5.5% in some States
- Allotment and leasing of forest land for development of wind power projects
- Concessional customs duty (5%) on some of the components of wind power machinery
- Institutionalization of sector financing through the Indian Renewable Energy Development Agency
- Wind sector is eligible for exemption from excise duty
- Institutionalization of R&D, training, product certification, testing and resource assessment via the establishment of the Centre for Wind Energy Technology
- Exemption of Electricity Duty by State Governments

Regulatory Incentives

- Preferential feed-in tariff in 13 states for wind power
- Favorable provisions for wheeling, banking and third party sale by wind power producers
- National-level dynamic Renewable Purchase Specification of 5% (2009/2010) increasing by 1% every year to 15% by 2020 mandated under National Action Plan on Climate Change
- Renewable Purchase Specification (RPS) announced in 26 states as mandated by the Electricity Act, 2003
- Renewable Energy Certificate (REC) mechanism introduced for inter-state trading of renewable power (solar and non-solar power separately)
- Concessional levy of cross subsidy surcharge in the case of third party sales by wind power producers

Note: The Government of India is likely to introduce a new direct tax code (DTC), which will be effective from 1 April 2013. The alternative incentive mechanism suggested under DTC provided for expenditure-based incentives to the business of generation, transmission and distribution of power. All revenue and capital expenditures (with a few exceptions) will be allowed as tax deduction upfront instead of claiming amortization/depreciation on capital expenditure and no tax holiday would be available.

23 http://pmindia.gov.in/climate_change.php

Wind farm in Kapatgudda, Karnataka © Suzlon

GENERATION BASED INCENTIVE (2009-2012)

In 2009, the Government implemented a Generation Based Incentive (GBI) scheme for grid connected wind power projects. A GBI of INR 0.50 per kWh (~ 1 US$ cent), with a cap of approximately $29,000 per MW per year, totaling $116,000 per MW over 10 years of a project's life was offered under this scheme[24]. Between March 2010 and October 2012, 2,021.29 MW capacity of wind projects had availed themselves of the GBI benefit and 1,830.43 MW projects of AD benefits[25].

The GBI scheme includes captive wind power projects, but excludes third party sale, for example, merchant power plants. GBI and AD benefits are mutually exclusive. The GBI is over and above the tariff approved by respective SERCs and disbursed on a half yearly basis through the Indian Renewable Energy Development Agency (IREDA). Initially this scheme was applicable to wind power projects commissioned before 31st March 2012. Earlier this year the MNRE recommended that the GBI continue over the 12th Plan period, with a possible revision of the incentive. The final approval from the Cabinet is pending as of October 2012.

In its original form, the GBI scheme was not attractive enough to pull developers away from AD. According to estimates by IREDA, at the prevailing tariffs in 2010, the IRR (post- tax) for wind assets would be higher by 1.2 to 1.5 percent in case of AD benefits across all key states other than Maharashtra. Also, the low capacity factors in most of the States meant that the present GBI would not have made a project more feasible in comparison to AD[26]. However, the GBI does not prohibit wind power producers from entering the REC market.

The government initiative to move away from tax subsidy (AD) support to performance incentive (GBI) support of INR 0.50 per kWh has not found an enthusiastic following largely due to the low value of the incentive and the caps on the claimed amount.

Continuation of the GBI scheme in its earlier form is uncertain. For the evolution of wind projects from a tax planning measure to an energy-planning instrument, the GBI scheme would have to be further enhanced. Industry experts in India suggest that enlarging the scheme to include captive and third–party sales, as well as doubling the incentive to INR 1.0 per kWh and/or removing the cap of INR 6.2 million [~ $116,000] per MW could help boost the appeal of the scheme.

STATE WISE TARIFF FOR WIND POWER

At present thirteen SERCs have declared preferential feed–in-tariffs (FITs) for purchase of electricity generated from wind power projects. All the SERCs have adopted a 'cost plus[27]' methodology to fix the FITs, which varies across the States depending upon the State's resources, project cost and more importantly the tariff regulations of SERCs. A brief comparison of wind power related tariff polices in key states is given in the Table on page 14.

24 Based on INR – USD exchange rates in October 2012
25 IREDA registry for GBI and AD projects http://www.ireda.gov.in
26 Indian Wind Energy Outlook 2011 http://www.gwec.net/publications/country-reports/indian-outlook-2011/
27 Capital cost considered for purpose of tariff fixation per MW for each renewable energy technology, commissioned in the last financial year.

STATEWISE COMPARISON OF FEED-IN-TARIFF POLICY FOR WIND POWER

States	Current tariff rates per kWh	Details of available tariff rates	RPS Targets (% for wind)
Andhra Pradesh	INR 4.70	Constant for 25 years for the PPAs to be signed by 31-03-2015	5% for all RE (2012-2013)
Gujarat [a]	INR 4.23	No escalation for 25 years of project life	5.5% for wind (2012-2013)
Haryana	Wind Zone I– INR 6.14	Tariff is for FY 2012-13	3% for all RE (2012-2013)
	Wind Zone II– INR 4.91		
	Wind Zone III– INR 4.09		
	Wind Zone IV–INR 3.84		
Karnataka*	INR 3.70	No escalation for 10 years	7-10% (2011/12) for all Non-Solar
Kerala	INR 3.64	No escalation for 20 years of project life	3.3% (2011-2012) & 3.63% (2012-2013) for all RE
Madhya Pradesh [a]	INR 4.35	No escalation for 25 years of project life	4% for wind (2012-2013)
Maharashtra	Wind Zone I– INR 5.67	No escalation for 13 years	8% for all RE (2012-2013)
	Wind Zone II- INR 4.93		
	Wind Zone III– INR 4.20		
	Wind Zone IV– INR 3.78		
Orissa	INR 5.31	No escalation for 13 years	5.5% for all RE (2012-2013)
Punjab	INR 5.07 (for zone I)	No escalation for 10 years	2.9% for all RE (2012-2013)
Rajasthan [a]	INR 4.46 & 4.69 (for FY 2011-12)	No escalation over project life of 25 years	7.5% for wind (2011-2012)
		INR 4.46/kWh for Jaisalmer, Jodhpur & Barmer districts while INR 4.69/kWh for other districts	
Tamil Nadu	INR 3.51	No escalation for 20 years of project life	9% for all RE (2011/12)
Uttarakhand	Wind Zone I– INR 5.15*	INR 5.65 for the first 10 years & INR 3.45 11th year onwards	5.05% for all RE (2012/13)
	Wind Zone II– INR 4.35*	INR 4.75 for 1st 10 year & INR 3.00 for 11th year onward	
	Wind Zone III– INR 3.65*	INR 3.95 for 1st 10 year & INR 2.55 for 11th year onward	
	Wind Zone IV– INR 3.20*	INR 3.45 for 1st 10 year & Rs.2.30 for 11th year onward	
West Bengal	INR 4.87	No escalation for 10 years	4% for all RE (2012/13)

* *RPS for Bangalore Electricity Supply Company Ltd. (BESCOM), Mangalore Electricity Supply Company Ltd. (MESCOM), and Calcutta Electricity Supply Company Ltd. (CESC) is 10% while for Gulbarga Electricity Supply Company Ltd. (GESCOM)< Hubli Electricity Supply Company Ltd. (HESCOM), and Hukeri, it is 7%.*
a *RPS percentage specified only for wind*
Conversion Rate: $1.00=INR. 53.50

There is an urgent need for adopting a uniform tariff regime across the country. Currently the CERC tariff regulation[28] specifies technology-wise operating norms for tariff determination while considering the risks associated with renewable energy projects. CERC has kept a provision for the revision of capital costs during each year of the control period to account for price escalation. The regulatory environment in India, although conducive to all renewable energy technologies, is not yet uniform across the States.

The SERCs unfortunately are not following the CERC tariff regulation. Some States have preferential tariffs for wind that are only marginally higher than the normal power costs. This raises concerns about the basis of the state-specific tariff calculation exercise, which is typically based on very conservative assumptions of capital costs, O&M costs, etc.; often very different from current costs of the industry. The SERCs need to adopt the tariff prescribed by the Central Electricity Regulatory Commission as was done by the Maharashtra Electricity Regulatory Commission. This is essential to ensure adequate return on equity for the investors.

28 *In 2009 the CERC formulated comprehensive regulation for determination of renewable energy tariffs, which was further notified in 2012.*

RENEWABLE ENERGY CERTIFICATE SCHEME

The Electricity Act 2003 proposed mandatory Renewable Purchase Specification (RPS) for all the states. To date, 26 states have specified targets for the uptake of electricity from renewable energy sources. With the introduction of the Renewable Energy Certificate (REC) scheme in 2010, states are now looking at fulfilling the RPSs under this provision by procuring equivalent RECs.

An REC is a tradable certificate of proof that a renewable energy plant has generated one MWh of electricity. Under this framework, renewable energy generators can trade RECs through a power exchange platform that allows market based price discovery, within a price range determined by the Central Electricity Regulatory Commission. The respective price limits are called forbearance price and floor price and their values are calculated separately for solar and all non-solar sources (i.e. wind, biomass, small hydro). While the CERC has stipulated floor and forbearance prices for RECs; the real price of an REC would be determined at the power exchanges based on prevailing electricity supply and demand situation, RPS compliance rates by the obligated entities and the overall supply of RECs in the market at any given point in time.

Maranchón, Guadalajara, Spain © Wind Power Works

The trading of RECs in the Indian market began in February 2011. In order to qualify for RECs, project developers need to register with the National Load Dispatch Centre. The issued RECs are traded at qualified power exchanges within the boundary set by the floor price and forbearance price, as determined by the CERC. For wind power generation, as of April 2012, the revised range is between INR 1,400 (~ $26) to INR 3,480 (~ $65) per MWh. By mid-October in 2012 the national REC registry had issued 3,384,257 RECs of which 3,381,714 were non-solar RECs[29].

Of the total accredited project capacity listed by the national REC registry, wind accounted for over 56% or 1993.46 MW of the capacity by October 2012. The rapid increase in volume suggests that more and more project developers are entering the REC market and the mechanism is inviting interest but weak enforcement of RPSs at the State level is leading to rising numbers of unsold RECs in the market. In September 2012, sellers offered to sell 7,11,171 (non solar) RECs, but only 2,64,446 were bought, and that too, at the floor price of INR 1,400[30].

During September 2012, no state-owned electricity Distribution Company (DISCOMs) came forward to buy the certificates, although they are all 'obligated entities'. This is due to lack of enforcement of their obligations. The RPS is applicable on the Distribution Companies (DISCOMs), open access consumers and captive power users uniformly. However, the present RPS framework is found lacking in effective compliance and enforcement at the State level. Moreover the captive power users in States like Gujarat, Rajasthan, Orissa are not very keen to purchase renewables based power for meeting the RPS and have challenged the RPS regulations.

The design of the REC mechanism is being improved with efforts being made to tackle the implementation issues as they arise and there is increased learning in the market. Some of the States have imposed penalties for non-compliance with RPO targets on the generators or utilities. Initiatives are being planned for developing a voluntary REC market also. Making REC a widely accepted instrument and a revenue stream for the project financing community still remains a challenge in India. Further there is a need for a dynamic RPS setting process with frequent upward revisions to meet the 15 percent renewables based electricity procurement target set under the NAPCC by 2020.

NATIONAL CLEAN ENERGY FUND

The government proposed the creation of the National Clean Energy Fund (NCEF) in the Union Budget 2010-2011 by imposing a clean energy tax (cess) of INR 50 (~ $1) per tonne on all coal produced as well as on coal imports in India.

29 *Website accessed on 23-10-12 www.recregistryindia.in*
30 *Website accessed on 20-10-12 http://panchabuta.com/2012/09/26/renewable-energy-certificates-trading-tepid-in-september/*

The Ministry of Finance, through the Clean Energy Cess rules 2010, set guidelines for the collection and assessment of this tax by the Revenue Department. Thereafter an inter-ministerial group was set up in the Ministry to approve projects and eligibility requirements for accessing funds from the NCEF[31]. However since its inception in July 2010, little information on the operationalization of the NCEF has been released in the public domain other than the guidelines and application form for proposals.

A study conducted by WISE estimates that at the current tax rate and the expected coal consumption rates, a cumulative total of INR 670 billion (~ $12.5 billion) could accrue to the fund by 2022. This fund could support grid and other infrastructure development to allow for greater evacuation of power generated from renewable energy sources. The fund could also be used for research, development and deployment of clean and renewable energy technologies.

The proposals brought forth by sponsoring national Ministries were found to mostly lack quality and innovativeness, which failed to advance the stated objective of the NCEF. Furthermore, the bulk of the NCEF fund remains unutilised. There is a need to revise NCEF guidelines to eliminate ambiguity surrounding the use of its funds, and to limit its use for meeting regular budgetary shortfalls of Ministries. Funding to support various Ministries' regular activities should be met from the appropriate sources available within the existing financing structure of the general Budget.

Although permissible under the guidelines, there has been limited involvement of Indian industry and research institutes to date in the proposal development process. This suggests limited awareness amongst Indian research institutes and industry on the NCEF funding opportunity. Given that sponsoring Ministries don't play a significant role in R&D for clean energy technologies, stronger interest by the Indian industry and affiliated institutes and a good working partnership between the sponsoring Ministries is essential - if NCEF is to realise its potential.

OTHER INITIATIVES: RENEWABLE REGULATORY FUND MECHANISM

The Indian Electricity Grid Code (IEGC) was adopted in April 2010 and supersedes the Indian Electricity Grid Code, 2006. It provides detailed guidelines on the role of various players involved in the operation of a power system.

Under Clauses 5 and 7 of the IEGC, unscheduled interchange[32] charges due to the variation in actual generation by wind and solar should be shared amongst all the States through the 'Renewable Regulatory Charge' to be operated through the 'Renewable Regulatory Fund' mechanism[33]. This would have made forecasting and scheduling of wind and solar power generation mandatory with effect from 1st January 2012 with the initial implementation of the RRF mechanism. However this still remains to be introduced, even though the detailed procedures prepared by National Load Dispatch Centre[34] were examined by CERC and the modified procedures were published on 18th February 2011.

RENEWABLE REGULATORY FUND MECHANISM

Objectives

- Forecasting of generation by Wind/Solar generators
- Encourage Wind and Solar generators to participate in scheduling
- Promote bilateral trading of power by renewable energy generators
- Make investment in renewable energy more attractive
- Assist States in meeting RPS
- Enhance System Operation

Approach to the RRF was based on the following considerations

- Achieving better generation data using weather forecasting tools
- Exempting Solar power generators completely from UI charges
- Developing a self-sustaining mechanism towards better acceptance of RE generation
- Exempting Wind power generators from paying for deviations in generation (UI charges) up to a certain level of variation
- Socializing the deviation charges owing to variations amongst different state utilities

The implementation of Renewable Regulatory Fund mechanism is delayed on account of several ground level issues; including a lack of coordination between the CERC directives and timely compliance by various SERCs. Resolving the concerns on both sides through early and preemptive participation of relevant stakeholders including various Regional and State Load Dispatch Centers, the MNRE and wind farm developers is critical. This would help in ensuring lower curtailment and higher generation numbers from both wind and solar power plants.

LAND ALLOCATION POLICY

In view of the growing number of wind power installations in the country and the increasing scarcity of permissible sites with adequate wind potential the MNRE, through its communication dated 15th May 2012, has requested state governments to examine their land policy for wind power installations and formulate a policy for land allocation on a 'footprint' basis. The MNRE is working towards implementing the best practices in this regard.

31 *The objective of the NCEF is to fund research and innovative clean energy technology projects. The 2010 guidelines permit projects with limited, if any, links to development of clean energy technologies. Source: Centre for Budget and Governance Accountability Report on Framework & Performance of National Clean Energy Fund, July 2012. www.cbgaindia.org*

32 *Unscheduled Interchange is the difference between actual generation and scheduled generation from a power plant.*

33 *wind generators shall be responsible for forecasting their generation up to accuracy of 70%. Therefore, if the actual generation were beyond +/- 30% of the schedule, wind generator would have to bear the UI charges. For actual generation within +/- 30% of the schedule, no UI would be payable/receivable by Generator. The host state should bear the UI charges for this variation, i.e. within +/- 30%. However, the UI charges borne by the host State due to wind generation, shall be shared among all the States of the country in the ratio of their peak demands in the previous month based on the data published by the Central Electricity Authority, in the form of a regulatory charge known as the Renewable Regulatory Charge operated through the Renewable Regulatory Fund mechanism. This provision shall be applicable …for new wind farms with collective capacity of 10 MW and above; connected at connection point of 33 kV level and above, and which have not signed any PPA with states or others as on the date of coming into force of the IEGC (2010).*

34 *NLDC website Accessed on 20-10-12 http://nldc.in/RRF.aspx*

Wind farm in India © Regen Powertech

ASSESSMENT OF GAPS IN THE POLICY FRAMEWORK

While the policy environment for renewable energy in India has been improving in recent years, the wind industry is facing challenges in the aftermath of the sudden reduction in tax incentives. The industry had still been heavily dependent on tax incentives to attract a specific category of investors. In a tough global economic situation, it will be difficult for the industry to compensate for the loss of this category of investors in the short-term.

In addition, the Indian power sector is plagued with inefficiencies and severe reliability problems that create a difficult environment for wind power growth. Probably the most important requirement for India is an integrated framework that has a vision, a plan and an implementing mandate that supports the renewable energy policies and regulations from the conceptual to the implementation stage. Such a framework, if adopted, can help to reduce investor risk by providing long-term regulatory certainty.

Besides that, there are a number of contradictions between existing policy guidelines and frameworks. For example the National Action plan on Climate Change (2008) and the Integrated Energy Policy (2006) of the Government of India are in opposition to each other on the issue of renewable energy. The NAPCC stipulates that by 2020, India should be producing 15 percent of its electricity from renewable energy sources (other than large hydro). This provision comes in direct conflict with the IEP, which visualizes only 5.2 percent renewable energy penetration by 2032. Since the cabinet has approved both documents, it is necessary to overhaul the IEP to bring it in line with the latest government policy i.e. the NAPCC.

An energy economy based on a much larger role for renewables is possible. To facilitate this much-needed transition from an inefficient, fossil fuel import-dependent economy to a cleaner indigenous energy economy, a range of policy, regulatory, legal and institutional capacity building measures need to be adopted.

The key, however, is the enactment of a comprehensive renewable energy law. Besides that, there is an urgent need for improving the acceptance and enforceability of RPSs. The future of the REC mechanism hinges on how effectively the SERCs enforce the need for compliance on the obligated entities. A greater impetus in sensitizing the obligated entities to the need for compliance would go a long way in achieving the RPS targets. The SERCs and state nodal agencies are best positioned to do this.

Further, 'priority sector' lending status for renewable energy projects, and reduction of subsidies for conventional fossil fuels could boost the wind sector. Lastly, a comprehensive grid modernization and development programme is needed to ensure investor confidence in renewable energy technologies. A delay in seriously addressing these concerns will only add to the cost of transitioning towards a clean energy future for India.

3 | GRID INTEGRATION ISSUES

Wind farm in Karnataka © Vestas India

India's transmission network has a two-tier structure: inter-state grids that are managed by the Power Grid Corporation of India (PGCIL) and the local grids, which are managed by the State Transmission Utilities. India still needs to establish an interlinked and unified grid through integration of its local, regional and national grids. Often inadequate and weak grids act as a barrier to smoother integration of power generation from renewables. India's power transmission system is divided into five regional grids: northern, northeastern, eastern, southern and western regions. Since August 2006, four regional grids have been fully integrated with the exception of the southern grid that is to be synchronized with these grids by 2014 [CEA, 2012[35]].

The variability of wind power can create problems for the traditional grids in maintaining a supply and demand balance. Most of the wind farms in India are located in remote areas that are quite far away from load centers. Due to a weak transmission and distribution network, it is difficult to transmit the power from wind farms to the load dispatch centers. This is one of the key constraints for the future of wind power development in the country.

In the past, with vertically integrated utilities, a single organisation was responsible for the planning and operation of networks and giving access to generators, and therefore the technical requirements did not have to be particularly clearly defined or codified.

Horse Hollow, Texas, USA ©Wind Power Works

Now, with increased ownership separation between grid operators and power generators the need for defining the technical requirements governing the relationship between them becomes essential. Renewable energy generation further complicates the process of evacuation and dispatch.

GRID TRANSMISSION PLANNING PROCESS

Lack of adequate power evacuation capacity in the state grids is a major concern in transmission planning. Unless the transmission capacity planning process incorporates a long-term vision of planned wind power additions and involves wind sector players at the planning stage, bottlenecks related to evacuation capacity are expected to remain.

The remedy is more procedural than technical and requires administrative will rather than advanced technical understanding. The Ministry of Power (MOP) has recently constituted a committee chaired by the Joint Secretary of the MOP to work on accelerated development of RE through legislative and policy changes. One of the suggestions to streamline transmission planning for renewable energy is to have a separate sub-division in the Central Electricity Authority (CEA) and across all the state utilities for transmission planning of all renewable energy power plants.

India's local distribution systems are weak and would require substantial augmentation or laying of parallel power evacuation infrastructure, which will invariably add not only to the costs but also to construction time. The issue is further complicated by stipulations related to cost sharing of building this additional infrastructure. It is especially true for state-owned utilities (DISCOMs) that are severely cash-strapped. Another major concern is that of forced power outage (curtailment) due to a weak local grid, which results in substantial generation loss for the investor.

Moreover, difficulties related to institutional learning, ground level data and lack of extensive experience in grid integration of higher volumes of renewable energy and comprehensive power evacuation planning are adding to the delay. For utilities that are accustomed to the conventional model of centralized power generation, these issues are likely to linger for some more years.

In India, previous regulations under the electricity grid code (IEGC) did not allow renewables based power to connect to the inter-state transmission network, resulting in interconnection of wind power projects to a weak State transmission or distribution network leading to forced outage of generation, especially during the peak wind season. The need to allow power evacuation at higher voltages in the inter-state grid

35 *CEA (2012) Draft National Electricity Plan: (Volume 2) Transmission, New Delhi*

of the Central transmission utility (PGCIL[36]) is critical for the growth of the sector. The CERC recently allowed projects with capacities of over 50 MW to connect directly to the central transmission network subject to scheduling requirements[37]. This allowance has addressed one long-standing concern of investors by reducing the threat of curtailment.

INTERCONNECTION STANDARDS

Grid stability is the primary consideration in interconnecting any new system to an existing grid. For the conventional electricity network tuned to conventional generation's radial mode of power flow, wind power poses new challenges related to safety, reliability and efficiency of the interconnected systems. Because of the variable nature of wind power, the aim of developing an interconnection standard would be to enable the grid to sustain the variability without affecting the power quality adversely.

Under (IEGC) 2010, wind and solar projects have been offered 'must-run' status. The IEGC brings together a single set of technical and commercial rules, encompassing all the utilities that are connected to or use the inter-state transmission system. However the experience curve has been a relatively short one and there will be some delays while all of the relevant stakeholders build institutional capacity and adequate learning takes place within their jurisdictions. Full and successful implementation of the Renewable Regulatory Fund mechanism will be a good start in the desired direction.

GREEN ENERGY CORRIDOR

The MNRE and CERC recently commissioned the Power Grid Corporation of India (PGCIL[38]) to study and identify transmission infrastructure for renewable energy capacity addition during the 12th Plan period. After extensive consultations with various stakeholders including the State Nodal Agencies, the final report called 'Green Energy Corridors' was released in September 2012. It discusses issues of intra and inter-state transmission system strengthening and augmentation, establishment of a Renewable Energy Management Centre, improved forecasting to address variability aspects as well as grid integration issues of large-scale renewable energy generation.

An investment of approximately $8 billion (~ INR 42,557 crores) is being planned for the development of this corridor by 2017. Out of this amount, approximately $3.8 billion (~ INR 20,466 crores) is likely to be invested in strengthening intra-state grid network and approximately $4 billion (~ INR 21,867 crores) is likely to be invested in strengthening the inter-state transmission system. This initiative if implemented successfully could be a major driver for the development of the renewable energy sector in India.

INDIA SMART GRID TASK FORCE

Especially after the introduction of the IEGC, grids across the country are required to take on electricity produced from non-conventional energy sources under various schemes (RPSs and RECs). Hence the need to revamp and modernize the national/regional and local grids must be one of the primary areas of investment and development.

The Ministry of Power (MOP) took the first step towards grid reforms when it set up the 'India Smart Grid Task Force' (ISGTF) in June 2010[39]. The ISGTF is an inter- ministerial group that serves as the government focal point for plans related to Smart Grid development in India. MOP's vision of a smart grid was to bring together the fields of communications, IT and the power sector to establish a comprehensive power grid infrastructure. Further, on the demand side it envisioned giving a choice to the consumer to decide the timing and amount of electricity consumption based upon the real-time prices in the electricity market.

Further, under one of the missions of the NAPCC, called the National Mission for Enhanced Energy Efficiency, India's Bureau of Energy Efficiency[40] partnered with the IT firm IBM to create the country's first smart grid project in May 2011. The focus of the analysis will be determining India's readiness for deploying smart grid technologies. It will also develop a framework for adopting new smart grid technologies and identify regulatory frameworks. The analysis will calculate return on investment for a range of smart grid projects planned across India[41].

The ISGTF has set up five working groups, including for 'Trials on new technologies' and 'Transmission loss reduction and theft, data gathering and analysis'. In the meanwhile, based on the recommendations of the Indian Smart Grid Forum, the MOP is supporting 14 pilot project proposals worth approximately $72 million (~ INR 400 crores) for smart-grid pilot projects across various locations. These proposals focus on diverse areas of the power sector, including integration of renewable energy sources with the grid and lowering of aggregate technical & commercial losses[42].

For this vital initiative to be successful, it is essential that the various federal ministries such as the Ministry of Power, the Ministry of New and Renewable Energy, the Ministry of Communications and Information Technology and the Ministry of Environment and Forests, and their state level counterparts must come together to evolve a common action plan. Further, both state and national grid operators and their respective electricity regulatory commissions must begin a nationwide collaborative dialogue towards defining a common understanding of a truly smart grid infrastructure for India. A top down prescriptive report from the central government through the ISGTF could lead to costly delays, which would result in the investors and power producers moving on to other investment opportunities.

Wind farm in Tamil Nadu © Vestas India

IMPROVING WIND FORECASTING AND SCHEDULING[43]

In India the grid infrastructure is outdated and an under invested aspect of the national infrastructure. The existing electricity grid code allows inter-state sale of power by relaxing provisions for forecasting and scheduling for renewables based generation. According to the norms laid down in the 2010 Grid Code (IEGC), wind power generators are responsible for forecasting their daily generation with accuracy up to 70%. In Europe this requirement is closer to 95%. Only in the event of generation being ±30% of the scheduled the wind generator will have to bear the unscheduled interchange (UI) charges.

One way to overcome the lack of forecasting and scheduling is to improve the guidance to wind farm developers on scheduling requirements with suitable non-penal norms over the short to medium term. With continuously rising wind power penetration in the grid, wind power generators will have to work together with grid operators and electricity distribution companies to address issues related to grid stability and power quality in the immediate future.

Scheduling requirements as put forward by the IEGC, if put in place, will enable the generators to trade power and compete with schedulable conventional power on the electricity trading platform, thereby ensuring reasonably higher revenues. This is especially important for the country as it is a facing a severe power deficit and an ever-growing demand for power. By far, the biggest advantage of forecasting wind power will be to make wind farms appear more like conventional power stations bridging the 'perception gap' of system operators and policymakers.

However, partly due to old and often limited infrastructure and in part due to a lack of penalization for non-compliance with forecasting and scheduling requirements, IEGC's implementation has been delayed. For the long-term growth prospects for wind power the industry and the load dispatch centers must proactively prepare for forecasting and scheduling, to ensure its full operationalization.

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36 *Power Grid Corporation of India (PGCIL) is responsible for inter-state transmission of electricity across India www.powergridindia.com/*
37 *Refers to an Interchange Schedule which refers to an agreed-upon Interchange Transaction size (MW), start and end time, beginning and ending ramp times and rate, and type required for delivery and receipt of power and energy between the source and sink balancing authorities involved in the transaction. www.nerc.com/files/Glossary_12Feb08.pdf*
38 *Report on Green Energy Corridors: Transmission Plan for Envisaged Renewable Capacity. Volume 1, PGCIL, July 2012. Website accessed on 20-10-12 http://apps.powergridindia.com/PGCIL_NEW/home.aspx*
39 *Website accessed on 20-10-12 www.isgtf.in/*
40 *Bureau of Energy Efficiency, Ministry of Power, Government of India: http://www.bee-india.nic.in/*
41 *Website accessed on 20-10-12 http://www.business-standard.com/india/news/ibm-teamsbee-to-prepare-for-india8217s-first-smart-grid-project-/435980/*
42 *Website accessed on 20-10-12 http://www.elp.com/index/from-the-wires/wire_news_display/1766416399.html*
43 *See footnote 32*

4 | DOMESTIC WIND TURBINE MANUFACTURING INDUSTRY

INDIA: INTERNATIONAL MANUFACTURING HUB

Established and proven wind turbine technology in India led to huge investments in the sector. India is emerging as a major wind turbine-manufacturing hub today. Increased domestic demand and expansion of the in-house manufacturing capacity of the Indian wind industry has resulted in attracting many new manufacturers into the fray.

As of 2012, 16 existing manufacturers have a consolidated annual production capacity of over 9,500 MW. The expectations are that at least four new companies could enter the Indian wind sector over the next couple of years. Hence by 2013/14 more than 20 wind turbine manufacturers and turbine suppliers would be operating from India.

Indian manufacturers are engaging in the global market by taking advantage of lower manufacturing costs in India. Indian companies now export domestically manufactured wind turbines and blades to Australia, Brazil, Europe, USA and a few other countries. Some of the international companies with subsidiaries in India are sourcing over 80% of their components from Indian component manufacturers. Leading manufacturers like Suzlon, Vestas, Enercon, RRB Energy including newer entrants like Gamesa, GE, Siemens, Regen Powertech and WinWinD have set up production facilities in India. According to estimates by WISE the annual wind turbine manufacturing capacity is likely to cross 10,000 MW during the FY 2012-2013 if all manufacturers go ahead with their plans.

TURBINES FOR LOW WIND REGIMES

Most parts of India except in pockets in the State of Tamil Nadu have low wind regimes. Low wind regimes require considerable changes not only in the design of turbine components but also in generator configuration.

The turbine design and development objective is to reduce the cost of energy (COE). Turbine manufacturers usually utilize two parallel approaches of reducing production costs and maximizing power capture, thus optimizing performance and reducing the COE. Market forces in the low-wind-regime market already endorse this approach.

In the case of India, the trend is markedly clear as shown in Table 3; most of the new manufacturers offer Class III machines that are more suitable for low wind regimes. Manufacturers now offer Class II and Class III machines with newer technologies and higher power capture capabilities.

MANUFACTURERS OFFERING CLASS II AND CLASS III WIND TURBINES IN INDIA

Manufacturer	Technology				
	Rating (kW)	***Drive***	***Speed***	***Generator***	***Class***
Enercon	800	Gearless	Variable	Synchronous	II-S
GE Wind	1,500	Gear	Variable	DFIG	II A
GE Wind	1,600	Gear	Variable	DFIG	II
Suzlon	1,250/2,100	Gear	Fixed	Asynchronous	II A/III
Suzlon	1,500	Gear	Fixed	Asynchronous	III A
Suzlon	2,250	Gear	Variable	DFIG	II B
Vestas India	1,650/1,800	Gear	Variable	Asynchronous	II B/ III A
RRB Energy	1,800	Gear	Variable	Asynchronous	II/III
Gamesa	850	Gear	Variable	DFIG	II A/III B
Gamesa	2,000	Gear	Variable	DFIG	II A/III A
Global Wind Power Limited	2,500	Gear	Variable	Synchronous	III A
Inox Wind Limited	2,000	Gear	Variable	DFIG	III B
Kenersys India	2,000	Gear	Variable	Synchronous	II A
Leitner-Shriram	1,350/1,500	Gearless	Variable	Synchronous	II A/III A
ReGenPowertech	1,500	Gearless	Variable	Synchronous	III A/III B
WinWinD	1,000	Gear	Variable	Synchronous	III B

Source : WISE, 2012

5 | WIND POWER INVESTMENT IN INDIA

© Vestas India

Beginning in the third quarter of 2008, flows of equity and debt investment in the global markets have been disrupted by one of the longest running financial and economic crises since the 1930s, which has been worsened by the budget crisis in the Eurozone. The macro-economic and institutional monetary health indices have not recovered since then across much of the OECD. The tougher financing environment and tightened cash flows have disrupted the rising stream of investments in wind energy projects. This has had an impact on the outlook for wind projects in India as well.

According to the IEA, $38 trillion of investment is required to meet projected energy demand through to 2035. Of this, the IEA projects that almost two-thirds of incremental energy demand in 2010-2035 will be met by natural gas and renewables [WEO, 2011]. Global clean energy investment reached a new record of $280 billion in 2011[44]. This characterizes a key milestone for a sector that enjoyed an average compound annual growth rate of over 37% between 2004 and 2008, but then saw growth slow down in the face of the widespread recession in 2009. In 2011 the majority of investment was for the asset financing of utility-scale projects such as wind farms, solar projects and biofuel plants [BNEF, 2012[45]]. Looking at the wind energy sector alone, BNEF expects that annual investment in onshore wind will grow from $65 billion in 2010 to $137 billion per year in 2030 with a significant portion of this taking place in emerging markets.

In 2011, India saw an unprecedented $10.3 billion invested in clean technology, of which $4.6 billion was invested in wind energy. This accounted for 4% of the world's clean technology investments in 2011. This was about 52% higher than the $6.8 billion invested in 2010, and the highest growth figure of any significant economy in the world. Asset financing for utility-scale projects continued to be the main type of clean energy investment in India, accounting for $9.5 billion in 2011. This was noteworthy given that the higher lending rates observed over the last year might have impacted asset finance adversely. Venture capital and private equity investment also made a strong comeback with $425 million invested in 2011, more than four times the 2010 figure. The only major type of investment that fell in 2011 was in equity being raised via the public markets. 2011 saw $201 million raised in comparison to a record $735 million in 2010 when the Indian stock market was at an all-time high [BNEF, 2012a[46]].

Having said that, recent figures published by Bloomberg New Energy Finance suggest that the full-year 2012 figure for investment in clean energy will fall short of 2011's record $280 billion, although more wind and solar energy is likely to be installed – the reduction is due to the dramatic price reductions particularly in solar, but also in wind. If so, 2012 would be the first down-year for global investment in the renewable energy sector for at least eight years. This will have an impact on the Indian market as well [BNEF, 2012b[47]].

WIND FINANCING BEYOND 2012

Amidst rough winds in the global wind energy sector and a transition-phase after government incentives saw significant reductions post March 2012, Indian developers are building fewer wind farms in comparison to 2011. Indian turbine manufacturers are unlikely to offset the drop in demand with exports as other major markets like China, the U.S. and the E.U. will see a slow 2013.

With the reduction in AD rates, the balance sheet financing rates are subdued this year. With significant reduction in AD benefits this year it will be difficult for the industry to compensate for the loss of this branch of investors in the short-term. The IPPs too are already committed with their funds for the remainder of the fiscal year. This has lead to a market with limited liquidity, which will result in the domestic market growing by much less than its 3 GW range last year.

To a certain degree the establishment of dedicated domestic institutional finance agencies like the Indian Renewable Energy Development Agency (IREDA), Power Finance Corporation and Rural Electrification Corporation have helped renewables access financing. Despite the presence of an institutional financing mechanism, under IREDA, there are considerable barriers to securing local financing.

In contrast to balance sheet financing, the conventional debt-financing mechanism is not geared for financing renewable energy projects, which are typically seen as high-risk, low return projects. For most wind energy projects equity participation from private equity players is difficult to secure largely due to perception issues surrounding wind power. In 2011 the major share of financing for wind power projects had been through the asset-financing route.

As of October 2012, IPPs have a project pipeline of almost 16 GW; this is an important opportunity for Indian wind power sector. Going forward IPPs will be a major driver of the wind power market in India. IPPs in FY 2010-11, accounted for about 20 percent and in FY 2011-12 accounted for over a quarter of all wind capacity installations. This trend is expected to strength over the next five years [WISE, 2012].

The advent of IPPs in the wind power sector has helped to establish project financing as the new normal. Today an increasing number of domestic banks are considering renewable energy projects on a non-recourse basis. This shift in the attitude of financiers is reflected in extended maturities and tenor of loans and lower borrowing costs.

44 Website accessed on 20-10-12 http://www.bnef.com/PressReleases/view/222
45 Website accessed on 20-10-12 http://www.bloomberg.com/news/2012-01-12/clean-energy-investment-rises-to-a-record-260-billion-on-solar.html
46 Website accessed on 20-10-12 http://www.bnef.com/PressReleases/view/186
47 Website accessed on 20-10-12 http://www.bnef.com/PressReleases/view/246

OPTIONS FOR FINANCING A WIND POWER PROJECT

There are various routes to financing a wind power project through banks and other financial institutions in India:

1. Full recourse (Corporate guarantees/cash collateral)

Financing basis
- Creditworthiness
- Full recourse
- Balance sheet and share price/valuation implications

Highlights
- Interest rate depends on creditworthiness
- Standard documentation
- Usual credit assessment

2. Limited/non-recourse financing

Financing basis
- Cash flow of the project
- Non/limited recourse to sponsor

Highlights
- Interest rate depends on project risk
- Low risk profile and stable cash flows
- Comprehensive documentation
- Structuring effort/cost/time
- Project, regulatory and technical risk assessment by independent consultants

Source: Indian Wind Energy Outlook 2011 /www.vestas.com

On the other hand the counter-party credit risks of state utilities have increased significantly. For example in Tamil Nadu, IPPs were adversely affected by the significant deterioration in the financial situation of the state utility, which caused long delays in payments to wind power producers.

Venture capital and private equity firms are also viewing renewables as an emerging opportunity. Deals worth $437.3 million (~ INR 2348.30 crores) were struck during the third quarter this year and included project finance, debt financing and venture capital funds[48].

Changing market perception is also endorsed by the participation of renewable energy generation companies in the equity market through the IPO route. For example most recently the Indian firm Infrastructure Leasing and Financial Services announced its plans to list its wind power business through an approximately $325-$406 million business trust IPO in Singapore by early 2013[49].

ROLE OF MULTILATERAL AND BILATERAL FUNDS

Multilateral funding institutions are offering new avenues for investors in key developing country markets as part of their climate finance obligations and broader energy strategies. According to BNEF, development bank financing of renewable energy projects rose from $4.5 billion in 2007 to $13.5 billion in 2010, led by multilateral development banks (MDBs) such as the European Investment Bank, Asian Development Bank and the World Bank Group as well as national development banks (NDBs) such as KfW Bankengruppe (Germany), China Development Bank and BNDES (Brazil).

Over the same time period, the annual investment by these institutions specifically in wind has increased from $1.3billion to $7.2billion.The rising percentage of the World Bank Group's funding for renewable and energy efficiency projects in developing countries reflects the growing interest and demand for environment-friendly sources of power.

The Asian Development Bank (ADB) is involved in augmenting lending to the renewable energy sector through various financing schemes under a broad framework called 'Strategy 2020'. The strategy stipulates that ADB will help developing member countries to move their economies onto a low-carbon development pathway, by expanding the use of clean energy sources. The International Finance Corporation (IFC) offers various financing avenues through debt and equity participation. By the end of 2011 wind represented 25 percent of the IFC's power portfolio[50].

Bilateral funding agencies are also extending support to wind power development across Asia. To name a few, the United States Agency for International Development (USAID) has been actively promoting development of renewable energy through its Market Development for Renewable Energy programme, the Chinese Development Bank and the KfW (German development bank) have been financing clean energy investments in various developing countries including India.

Development banks have a key role to play in mobilizing capital when and where it is needed most. Commercial lenders, faced with global economic uncertainty and investments in unfamiliar markets often look to development banks to share various risks, whether perceived or real. An on-going positive dialogue between project developers, manufacturers, political and regulatory stakeholders and public funding institutes is the way forward to secure sustainable growth both from a financial and environmental point of view.

ROLE OF CDM AND FUTURE OF CARBON MARKETS

The enthusiastic participation of the Indian wind industry in the Kyoto protocol's project based offset mechanism (Clean Development Mechanism - CDM) over the last decade helped

48 Website accessed on 29-10-12 http://articles.economictimes.indiatimes.com/2012-10-29/news/34798581_1_wind-energy-national-wind-large-scale-project
49 Website accessed on 29-10-12 http://in.reuters.com/article/2012/09/26/ilfs-india-ifr-idINL4E8KQ68020120926
50 GWEC Annual Market Report, 2011 www.gwec.net

Wind farm in Tamil Nadu © Vestas India

raise awareness and built tremendous capacity in the market to be able to undertake projects with internationally applied due diligence. The CDM was designed as a climate finance instrument to deliver additional financing for sustainable and clean development in developing countries.

India has the second highest number of wind power projects registered under the CDM. By the end of Q1 in 2012, India accounted for over 18 percent of CERs by volume. Wind power accounted for approximately 10 percent of all CERs issued to Indian CDM projects as of May 2012[51]. However, the continuation of the CDM (in its current form) and the size of the CDM market beyond 31st December 2012 remain in doubt.

The discussion is veering towards New Market Mechanisms[52] based on the recent Durban Platform[53], within the UN climate talks for a post 2020 global climate agreement. In the meanwhile new national carbon markets (Australia, China, South Korea, U.S. RGGI[54]) are opening up across the world, which could conceivably set the trend for a broader uptake of market based mechanisms that allow for both domestic credits and off-sets based credits. The best case still would be a global climate treaty that helps set a price on carbon emissions.

STRENGTHENING INVESTMENT TRENDS

In 2011, clean energy investment in India was outstanding, due to the improving cost-competitiveness of both wind and solar energy in the country. Today much of the Indian power sector is struggling to meet its targets for conventional power capacity. Thus to bring the wind industry back on track it is essential that investment grade policy guidance is available at the earliest.

In the medium and long-term direct subsidies, which involve large volumes of financing, could be substituted with interest subsidies for debt. Thereby the government could contribute to significant capacity addition leveraged through smaller chunk of investment. By helping to bring down the risk profile of projects through such a mechanism, it could help developers reach financial closure earlier.

To achieve sustained growth in the wind sector, federal and state governments will have to ensure the following: first, this would require an early decision on the rate and length of the GBI; second, that transmission lines are available for projects; third, that renewable purchase specifications are enforced; and, finally, that wind project developers receive timely payment for the power they generate.

SMALL WIND AND HYBRID SYSTEMS IN INDIA

The global market for small wind turbines (SWTs) has been on the upswing over the last two to three years. This is driven by rapidly growing energy demand, higher fossil fuel prices and improved SWT technology, which can be deployed for a diverse pool of applications, both in 'grid-tied' and 'stand- alone' modes.

With the increasing shortfall in power supply and energy across the country, India could benefit significantly from exploiting the potential of micro-generation technologies that can meet energy needs under the distributed generation mode, so as to provide long-term solutions. WISE estimates India's micro-generation potential at about 83 GW. However, costs are a major hurdle and policy support needs to be oriented towards promoting mass manufacturing and early adoption of these micro-generation options.

A small annual market for such systems (~ 300-400kW) currently exists in India; the capital subsidy programme of the MNRE largely drives it. Most of the current installations are of the stand-alone type. By the end of the 11th Plan period a cumulative capacity of 1647 kW of wind-solar hybrid systems had been installed[55].

51 *IGES Market Mechanisms Country Fact Sheets (July 2012) http://www.iges.or.jp/en/cdm/report_country.html*
52 *Website accessed on 20-10-12 http://www.iges.or.jp/en/cdm/report_nmm.html*
53 *Website accessed on 20-10-12 of the UN Framework Convention on Climate Change COP 17 www.unfccc.int*
54 *U.S. Regional Greenhouse Gas Initiative www.rggi.org/*
55 *Website accessed on 20-10-12 http://www.mnre.gov.in/schemes/offgrid/small-wind/*

6 | GROWTH SCENARIOS FOR THE INDIAN WIND MARKET

Anthiyur wind farm in Tamil Nadu © Vestas India

GLOBAL WIND POWER SCENARIOS FOR 2020 AND 2030

There are several published scenarios that examine the future role of wind power globally as a part of the necessary energy system overhaul towards a clean energy future. The Global Wind Energy Council developed its scenarios in collaboration with Greenpeace International and the German Aerospace Centre (DLR). These scenarios are updated biennially. The latest resultant publication - the Global Wind Energy Outlook 2012 (GWEO)- first looks toward 2020, and then onwards to 2030 and 2050. Some of the other prominent scenarios are the World Energy Outlook (2011) from the International Energy Agency (IEA) and the Energy [r]evolution: A Sustainable World Energy Outlook by Greenpeace (2012).

GLOBAL WIND ENERGY OUTLOOK 2012: SCENARIOS AND ASSUMPTIONS

New Policies Scenario (IEA)

Previous editions of GWEO used the IEA World Energy Outlook's 'Reference' scenario as the baseline in this exercise. That scenario is basically an assumption of the status quo, and while it still exists within the World Energy Outlook (WEO) framework (as the 'Current Policies' scenario), it is no longer the central scenario.

The 'New Policies' scenario is based on assessment of current directions and intentions in both national and international energy and climate policy, even though they may not yet have been incorporated into formal decisions or enacted into law.

Examples of this would include the emissions reduction targets adopted in Cancun in 2010, the various commitments to renewable energy and efficiency at national and regional level, and commitments by governments in such fora as the G-8/G-20, the Clean Energy Ministerial, etc. The New Policies scenario has taken its place at the center of the WEO analysis, although the difference between that and the old Reference Scenario when it comes to wind power is marginal. The IEA scenarios go out to 2035 and were extrapolated to 2050 by DLR.

Moderate Scenario (GWEO)

The GWEO 'Moderate' scenario has many of the same characteristics as the IEA New Policies Scenario, taking into account all policy measures to support renewable energy either already enacted in the planning stages around the world, and at the same time assuming that the commitments for emissions reductions agreed by governments at Cancun will be implemented, although on the modest side.

At the same time it takes into account existing and planned national and regional targets for the uptake of renewable energy in general and wind energy in particular, and assumes that they are in fact met.

Through the five-year period out to 2016, the moderate scenario is very close to our annual five-year market forecast, based on industry orders and planning as well as intelligence from our global network about new and emerging markets. After 2016 it is difficult to make a precise forecast given the current set of global uncertainties.

Advanced Scenario (GWEO)

The most ambitious scenario, the 'Advanced' scenario explores the extent to which the wind industry could grow in a best case 'wind energy vision', but still well within the capacity of the industry as it exists today and is likely to grow in the future.

It assumes an unambiguous commitment to renewable energy in line with industry recommendations, the political will to commit to appropriate policies and the stamina to stick with them.

It also assumes that governments enact clear and effective policies on carbon emission reductions in line with the now universally agreed objective of keeping global mean temperature rise below 2°C above pre-industrial temperatures, recognizing that wind power is an absolutely critical technology to meeting the first objective in the battle to stay below 2°C – which is getting global emissions to peak and begin to decline before the end of this decade.

Assumptions on growth rates

Growth rates in the GWEO scenarios are based on a combination of historical trends, current and planned policies and trends, new and emerging markets for wind power, and assumptions on the direction of overall climate and energy policy. While double-digit growth rates as assumed in both the Moderate and Advanced scenarios out to 2020 may seem high for a manufacturing industry, actual wind industry cumulative growth rates have averaged about 28% for the past fifteen years. Interestingly, annual market growth rates over the period are also about 28%, although the inter-annual variability is much higher due to the vicissitudes of the marketplace and the state of the global economy. The cumulative market growth figures are a more useful way to look at the industry over the longer term.

In the Advanced scenario, cumulative growth rates start off well below the historical average at 21%, recover slightly in the middle of this decade and then taper off to 13% by the end of the decade, dropping to 6% by 2030. The Moderate scenario starts with about 19% growth in 2012, tapering off gradually to 11% by 2020 and then also to 6% by 2030, while the IEA New Policies Scenario starts at 16% in 2012, sinking to 6% by 2020 and then 4% by 2030.

It should be borne in mind that cumulative market growth figures will inevitably drop over time in almost any scenario as the size of the cumulative market grows; although even small percentage increases a decade out from now will mean a large actual increase in the quantity of wind power deployed.

Burbo Bank, Liverpool Bay, UK © Wind Power Works

GWEO SCENARIO RESULTS

While the IEA New Policies scenario shows a basically flat market and slightly decreasing market for wind power for the next two decades, the GWEO scenarios paint a picture of two different futures:

The Moderate scenario is more likely in a world which carries on more or less the way it has been, with wind power continuing to gain ground but still struggling against heavily subsidized incumbent energy sources, and with the patchwork of carbon emission reduction measures that exists at present, with a low price on carbon emissions, where one exists at all.

The Advanced scenario shows the potential of wind power to produce 20% or more of global electricity supply in a world where there is strong political commitment and international cooperation to meeting already agreed climate change goals, enhancing energy security, dramatically reducing fresh water consumption and creating millions of new jobs around the world.

The IEA New Policies scenario projects that annual wind energy markets will stay essentially flat out to 2015, and then shrink to about 10% below the 2011 market for the second half of this decade. It then projects a gradual decrease in the annual market to 2030 and remains flat for the rest of the period. On the basis of this, cumulative installed capacity would still reach 586 GW by 2020, and 917 GW by 2030. Ironically, the 2020 number of 586 GW is almost exactly the same as the IEA reference scenario predicted for 2030 two years ago.

The GWEO Moderate scenario follows the lines of our short-term market projections out through 2016, with annual market size topping 70 GW by 2020 for a total cumulative installed capacity of 760 GW by that date. We have taken into account what looks like a very difficult year in 2013, which contributes to a slightly more conservative projection for 2020 than we made two years ago, even though the market has outperformed the moderate scenario over the past two years. Under this scenario, growth would continue throughout the 2020s, with annual market size approaching 100 GW per year and a total installed capacity of about 1,600 GW by 2030.

The GWEO Advanced scenario maintains ambitious growth rates throughout this decade, assuming that current market difficulties are overcome in the near future. With annual market size topping 130 GW by the end of the decade, it assumes that manufacturing capacity continues to increase while market demand increases to fill it. Total installed capacity reaches 1,149 GW by 2020 and more than 2,500 GW by 2030, reflecting a full commitment to decarbonizing the global electricity supply which we need to do sooner rather than later.

INDIA GROWTH SCENARIOS FOR 2020 AND 2030

Under the IEA New Policies scenario, India's wind power market would shrink considerably from the current annual additions of around 3,000 MW to only 1,900 MW per year by 2020. The result would be a total installed capacity of 32 GW by 2020 and 66 GW by 2030. Wind power would then produce close to 81 TWh every year by 2020 and 174 TWh by 2030, and save 48 million tons of CO_2 in 2020 and 105 million tons in 2030. Investments in wind power in India would also drop from the current levels of €3.7 billion per year to only €2.4 billion by 2020.

Under the GWEO scenarios, we expect that between 18.6 and 19 GW of wind power capacity will be installed in India by the end of 2012. Under the Moderate scenario, the total installed capacity would reach almost 31.4 GW by 2015, and this would go on to grow to 59 GW by 2020 and 124 GW by 2030.

By 2015 the wind industry will see investments of €5.3 billion per year, €7.2 billion per year by 2020 and €8.3 billion per year by 2030. Employment in the sector would grow from the currently estimated 47,500 jobs to over 98,000 by 2020 and over 126,000 jobs ten years later.

Nevertheless the GWEO Advanced scenario shows that the wind development in India could go much further: by 2020 India could have almost 89 GW of wind power in operation, supplying 219 TWh of electricity each year, while employing over 179,000 people in the sector and saving almost 131 million tonnes of CO_2 emissions each year. Investment would by then have reached a level of €13 billion per year.

With the acute need for electrification and higher energy production in the country, wind energy is going to provide an increasingly significant share of the renewables based capacity. By 2030 wind power would be generating almost 504 TWh per year and be avoiding the emission of 304 million tons of CO_2 each year.

SUPPORTING ENERGY ACCESS IN INDIA

According to the IEA's World Energy Outlook (2011) India's energy demand increases by a compound annual growth rate (CAGR) of 3.1% from 2009 to 2035, which is more than double the world's energy demand growth at a CAGR of 1.3% for the same period. India's share of world energy demand increases from 5.5% in 2009 to 8.6% in 2035.The WEO 2011 assumes that India's GDP growth is on average 6.6% between 2009 and 2035, while the official Indian GDP growth target used in the government's IEP is 9%.

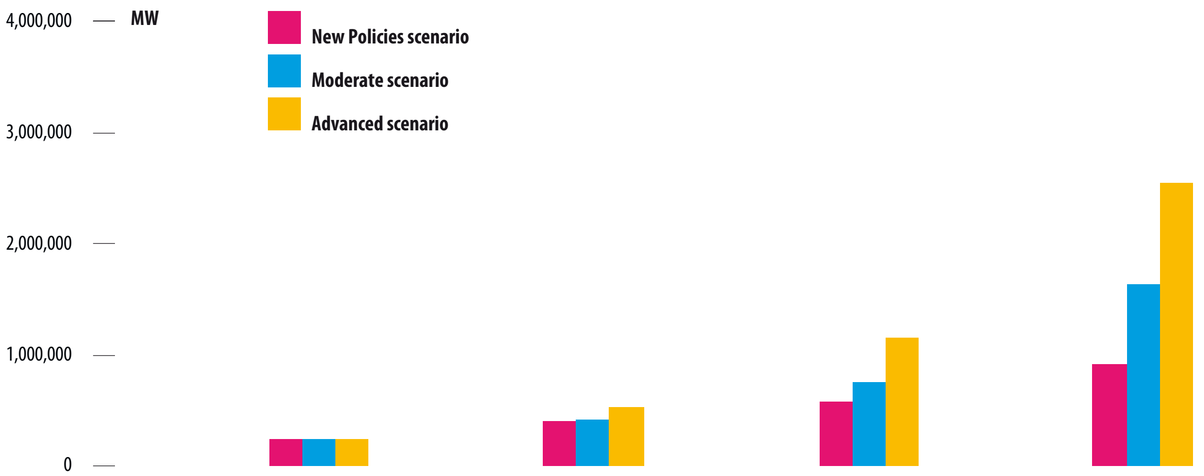
In the last two decades, India has more than doubled its electricity capacity to 207 GW. The Government of India had set itself an ambitious mission of providing 'Power for all by 2012'. By the end of 2010, India was generating 922 TWh of electricity[56]. Yet the 2011 national census shows that 75 million (~7.5 crores) rural households still did not have electricity compared to 78 million (~ 7.8 crores) such households in 2001[57]. In comparison, 95% of urban households now have access, but even then, this is not guaranteed at all times as load shedding is a very common phenomenon in smaller towns and during the summer months.

This scenario of low energy access is reflected in the Human Development Index, which ranks India relatively low at 134 among 187 nations, according to the latest Human Development Index released by the UN Development programme (2011[58]).

Poverty reduction and economic growth are the prime objectives of the National Integrated Energy Policy; and energy is the key driver of development. Whether economic growth will lead to 100% energy access and poverty eradication will depend on the political will towards developing a holistic growth model that allows for reforms across the board to deliver long-term socio-economic development. For India's development to be truly inclusive, each and every citizen should be guaranteed a minimum standard of access to the electricity grid. Wind energy is a key solution offering India's citizens access to clean, affordable and indigenous energy now.

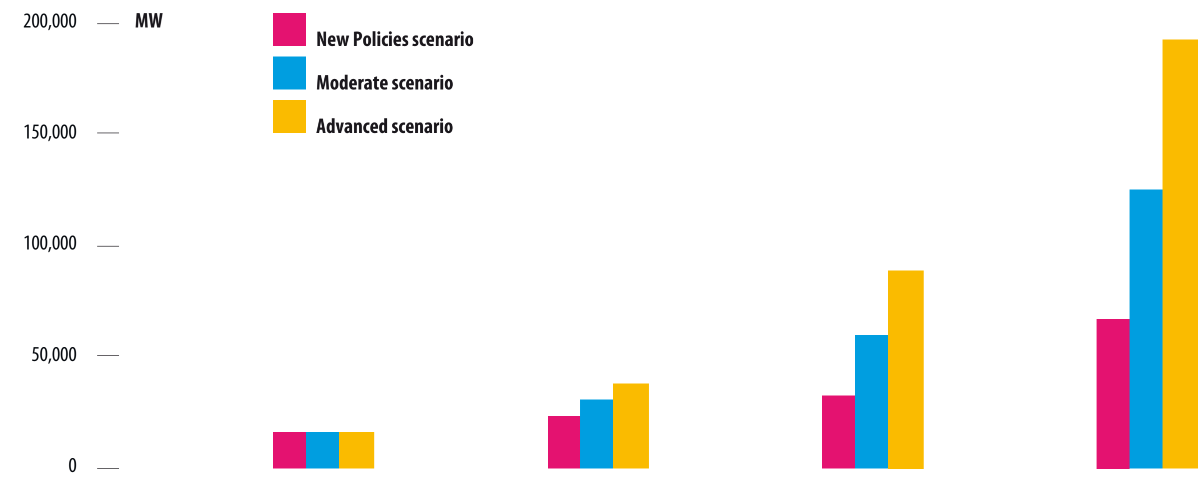
56 BP Statistical review of world energy 2011 www.bp.com
57 Website accessed 20-10-12http://www.thehindu.com/opinion/op-ed/article3800095.ece
58 Website accessed 20-10-12 http://hdrstats.undp.org/en/countries/profiles/IND.html

GLOBAL CUMULATIVE WIND POWER CAPACITY IN MW



	2011	2015	2020	2030
New Policies scenario				
[MW]	237,699	397,859	586,729	917,798
[TWh/a]	583	976	1,439	2,412
Moderate scenario				
[MW]	237,699	425,155	759,349	1,617,444
[TWh/a]	583	1,043	1,863	4,251
Advanced scenario				
[MW]	237,699	530,945	1,149,919	2,541,135
[TWh/a]	583	1,302	2,821	6,678

INDIA: CUMULATIVE WIND POWER CAPACITY IN MW



	2011	2015	2020	2030
New Policies scenario	16,084 MW	23,784 MW	32,933 MW	66,400 MW
Moderate scenario	16,084 MW	31,499 MW	59,351 MW	124,826 MW
Advanced scenario	16,084 MW	37,436 MW	89,299 MW	191,711 MW

ANNEX 1: STATE WISE COMPARISON OF WIND POWER DEVELOPMENT

Details	States							
	Andhra Pradesh	Gujarat	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Rajasthan	Tamil Nadu
Total number of identified sites	34	40	26	17	7	33	8	47
Identified number of potential districts	7	9	11	3	5	12	5	11
Annual mean wind speed (m/sec) @ 50 m mast height	4.86–6.61	4.33–6.97	5.19–8.37	4.41–8.12	5.0–6.25	4.31–6.58	4.02–5.73	4.47–7.32
Number of wind monitoring stations established till July 2012	78	69	59	29	37	128	36	70
Number of wind monitoring stations operating (as of August 2012)	16	6	12	2	-	20	1	2
Installable wind potential (MW) @ 80m height	14,497	35,071	13,593	837	2,931	5,961	5,050	14,152
Presently installed capacity (MW) as on 31st March 2012	245.5	2,966.3	1,933.5	35.1	376.4	2,733.3	20,70.7	6,987.6
Untapped installable potential (MW) as of April 2012	14,251.5	32,104.7	11,659.5	801.9	2,554.6	3,227.7	2,979.3	7,164.4

Source: WISE, 2012

ANNEX 2: AVERAGE CAPACITY FACTORS IN KEY STATES

State	Gujarat		Karnataka		Madhya Pradesh		Maharashtra		Tamil Nadu	
	Generation (MU)	Capacity Factor %	Generation (MU)	Capacity Factor %	Generation (MU)	Capacity Factor %	Generation (MU)	Capacity Factor %	Generation (MU)	Capacity Factor %
1997	117.86	10.9	7.25	24.17	5.98	9.01	2.58	8.92	702.17	13.67
1998	132.41	9.96	11.72	15.37	7.43	8.25	3.31	6.93	779.8	13.01
1999	91.32	6.25	26.62	17.12	10.51	8.66	9.8	9.8	894.93	14.35
2000	122.36	8.37	39.47	19.29	23.45	13.71	45.7	12.58	1,155.08	17.9
2001	142.23	9.73	72.26	22.36	28.86	14.58	142.58	15.23	1,095.84	16.01
2002	134.76	9.22	92.86	20.91	28.24	14.26	332.75	15.69	1,245.76	17.26
2003	147.34	9.99	175.11	24.2	32.63	16.48	666.63	19.04	1,305.5	16.73
2004	138.3	8.76	308.16	24.17	19.78	9.99	643.17	18.23	1,592.63	16.78
2005	224.97	11.96	778.6	34.24	39.64	18.72	688.9	18.74	2,113.65	15.77
2006	264.07	10.98	1,113.82	28	53.12	19.1	790	24.98	3,845.8	19.5
2007	303.18	8.24	1,449.05	25.42	70	17.89	1,714	19.37	5,301.01	19.93
2008	987.47	13.85	1,505.78	19.22	69	10.53	1,804	8.97*	6,065.86	19.47
2009	2,104	18.02	1,723	17.78	30	2.32	2,207	13.98	6,206	17.91
2010	2,988	20.78	2,687	22.42	82	4.33	2,625	15.19	8,146	20.96
2011	2,659	15.63	2,674	19.87	69	3.27	2,558	13.66	8,537	18.9

** Due to Cable Theft*

Source: WISE, 2012 MU: Million Units

ANNEX 3: STATUS OF STATE REGULATIONS FOR RENEWABLE PURCHASE SPECIFICATION TARGETS & RENEWABLE ENERGY CERTIFICATE AS ON 31ST AUGUST 2012

Sl. No.	States		Reference for RPS orders/ Regulations	Minimum percentage for renewable energy procurement				REC Regulation status (as on 31.08.2012)		Designation of State Agency
				RE Sources/ Eligible Entries	2010/11	2011/12	2012/13	Draft Regulation	Final Regulation	
1	Andhra Pradesh		Earlier order dated 29th Jan 2009, latest order dated 1st April 2012	*Non Solar*	4,75%	4,75%	4,75%	–	√	√
				Solar	0,25%	0,25%	0,25%			
				Total	5%	5%	5%			
2	Assam		Regulation dated 2nd Nov 2010	*Non Solar*	1,35%	2,70%	4,05%	√	√	√
				Solar	0,05%	0,10%	0,15%			
				Total	1,40%	2,80%	4,20%			
3	Bihar		Order dated 16th November 2010	*Non Solar*	1,25%	2%	3,25%	√	√	√
				Solar	0,25%	0,50%	0,75%			
				Total	1,50%	2,50%	4%			
4	Chhattisgarh		Regulation dated 4th March 2011	*Non Solar*	4,75%	5%	5,25%	√	√	√
				Solar	0,25%	0,25%	0,50%			
				Total	5%	5,25%	5,75%			
5	Delhi		Order dated 23rd February 2008	*NDPL*	1%	1%		√	–	–
				BYPL	1%	1%				
				BRPL	1%	1%				
				NDRC	1%	1%				
6	Gujarat		Order dated 17th April 2010	*Wind*	4,50%	5%	5,50%	√	√	–
				Solar	0,25%	0,50%	1%			
				Others	0,25%	0,50%	0,50%			
				Total	5%	6%	7%			
7	Goa		Gazette Notification dated 30th November 2010	*Non-Solar*	0,75%	1,70%	2,60%	√	√	√
				Solar	0,25%	0,30%	0,40%			
				Total	1,00%	2,00%	3,00%			
8	Haryana		Order dated 3rd February 2011	*Non-Solar*	1,25%	1,50%	2,25%	√	√	√
				Solar	0,25%	0,50%	0,75%			
				Total	1,50%	2%	3%			
9	Himachal Pradesh		Gazette Notification dated 3rd October 2011	*Non-Solar*	10%	10%	10%	√	√	√
				Solar	0%	0,01%	0,25%			
				Total	10%	10,01%	10,25%			
10	Jammu & Kashmir		Gazette Notification fated 11th March 2011	*Non-Solar*	0,98	2,90%	4,75%	√	√	√
				Solar	0,02%	0,10%	0,25%			
				Total	1,00%	3,00%	5,00%			
11	Jharkhand		Gazette Notification dated 21st July 2010	*Non-Solar*	1,75%	2,50%	3,00%	√	√	√
				Solar	0,25%	0,50%	1,00%			
				Total	2,00%	3,00%	4,00%			
12	Karna-taka	BESCOM, MESCOM, CESE	Regulation dated 16th March 2011	*Non -Solar*	10%	10%		√	√	√
				Solar	0,25%	0,25%				
		HESCOM, GESCOM Hukeri Society		*Non -Solar*	7%	7%				
				Solar	0,25%	0,25%				
13	Kerala		Regulation dated 3rd December 2010	*Non –Solar*	2,75%	2,75%	2,75%	√	√	√
				Solar	0,25%	0,25%	0,25%			
				Total	3%	3%	3%			

ANNEX 3: STATUS OF STATE REGULATIONS FOR RENEWABLE PURCHASE SPECIFICATION TARGETS & RENEWABLE ENERGY CERTIFICATE AS ON 31ST AUGUST 2012

Sl. No.	States	Reference for RPS orders/ Regulations	Minimum percentage for renewable energy procurement				REC Regulation status (as on 31.08.2012)		Designation of State Agency
			RE Sources/ Eligible Entries	2010/11	2011/12	2012/13	Draft Regulation	Final Regulation	
14	Madhya Pradesh	Gazette Notification dated 19th Nov 2010	*Solar*		0,40%	0,60%	√	√	√
			Non-Solar	0,80%	2,10%	3,40%			
			Total	0,80%	2,50%	4%			
15	Maharashtra	RPS-REC Regulation dated 7th June 2010	*Solar*	0,25%	0,25%	0,25%	√	√	√
			Non-Solar	5,75%	6,75%	7,75%			
			Total	6%	7%	8%			
16	Manipur and Mizoram Joint RPO	Gazette Notification May 2010	*Total*	2%	3%	5%	√	√	√
			(Solar)	(0.25%)	(0.25%)	(0.25%)			
			Total	5%	6%	7%			
			(Solar)	(0.25%)	(0.25%)	(0.25%)			
18	Meghalaya	Gazette Notification dated 21st December 2010	*Wind*	0,10%	0,15%	0,20%	√	√	√
			Solar	0,20%	0,30%	0,40%			
			Others	0,20%	0,30%	0,40%			
			Total	0,50%	0,75%	1,00%			
19	Orissa	Order dated 30th Sept 2010	*Non Solar*	1%	1,20%	1,40%	√	√	√
			Solar		0,10%	0,15%			
			Co-generation	3,50%	3,70%	3,95%			
			Total	4,50%	5%	5,50%			
20	Punjab	Order dated 3rd June 2011	*Non Solar*		2,37%	2,83%	√	√	√
			Solar		0,03%	0,07%			
			Total		2,40%	2,90%			
21	Rajasthan	Final RPS order dated 29th September 2006, RPS Order for Open Access & Captive Power Plants dated 7th April 2007	*Wind*	6,75%	7,50%		√	√	√
			Biomass	1,75%	2%				
			Total	8,50%	9,50%				
22	Tamil Nadu	Order dated 10th August 2011	*Solar*		0,05%		√	√	√
			Non-Solar		8,95%				
			Total		9%				
23	Tripura	Regulation dated 16th September 2010	*Non –Solar*	0,90%	0,90%	1,90%	√	√	√
			Solar	0,10%	0,10%	0,10%			
			Total	1%	1%	2%			
24	Uttar Pradesh	Regulation dated 17th August 2010	*Solar*	0,25%	0,50%	1%	√	√	√
			Non-Solar	3,75%	4,50%	5%			
			Total	4%	5%	6%			
25	Uttarakhand	Regulation dated 3rd November 2010	*Solar*	4%	4,50%	5%	√	√	√
			Non-Solar	0%	0,03%	0,05%			
			Total	4%	4,53%	5,05%			
26	West Bengal	Draft Regulation dated 25th March 2008	*WBSEDCL*	8,30%	10%		–	–	√
			CESC	8%	10%				
			DPL	7%	10%				
			DPSC	7%	10%				
			DVC	7%	10%				

Source: WISE, 2012

ANNEX 4: TYPE OF INCENTIVES AVAILABLE UNDER STATE ELECTRICITY REGULATORY COMMISSIONS

Scheme	Incentives
Feed-in tariff	• 13 SERCs have declared preferential feed-in tariff for purchase of electricity generated from wind power projects established in respective states. • All the 13 SERCs have adopted a 'cost plus' methodology to fix the tariff that varies across the states depending up on the state resources.
Renewable Purchase Specifications	• 26 SERCs have specified the mandatory purchase obligation under Section 86, 1(e) of the Electricity ACT, 2003, for purchase of fixed percentage of energy generated from RE sources. • The RPS percentage varies from 0.5% to 10.25%, depending on the local renewable resources and the electricity distributed in that area. • RPS obligation can be fulfilled trough tradable REC mechanism which can further generate revenue for wind power projects. The state-wise RPS percentage is analyzed and shown in **Annex 3**
SNA project facilitation	• State nodal agencies (SNAs) facilitate project development right from resource assessment to the final commissioning. • SNA through its initiative undertakes wind resource assessment studies and gets the sites approved from C–WET for further project development. • SNA supports the developer by facilitating development of infrastructure at identified sites and also verifies the legal statutory clearances sought by the developer from different departments. • MEDA in Maharashtra has created the **Green Cess (tax)** fund. This is a dedicated fund in Maharashtra for the development of RE and a part of this fund is utilized to create infrastructure for grid connectivity with proposed wind farms. Similar tax (Cess) is being collected in Karnataka.
Grid connectivity	• As per the Electricity Act, 2003, the respective State Transmission Utility (STU) is responsible for creation of grid interconnection infrastructure for connectivity up to the proposed wind farm at its own cost. However, with present poor financial health of these STUs and the time required to create such infrastructure, states adopt different practices for creation of the required infrastructure.

Source: WISE, 2012

ANNEX 5: STATE LEVEL GRID INTERCONNECTION, METERING PRACTICES AND CHARGES

State	State Nodal Agency	Grid connectivity & metering practice	Average Grid connectivity costs	Billing and Payment
Andhra Pradesh	**NEDCAP**	Up to pooling S/S execution & investment by WFD. Pooling S/S onward by WFD +10% supervision (APTRANSCO). Metering at HT side of pooling S/S	Average cost of evacuation INR 5 million per MW	Distribution Company (DISCOM)
Gujarat	**GEDA** (Project facilitator)	Up to S/S execution & investment by WFD. Pooling S/S onward by WFD + 7.5% supervision (GETCO) up to 100 km, beyond 100 km GETCO shall erect facility. Metering at HT side of pooling S/S	Average cost of evacuation INR 5 – 6.5 million per MW	DISCOM
Karnataka	**KREDL** (Project facilitator)	Up to S/S execution & investment by WFD. Pooling S/S onward by WFD +10% supervision (or INR 1.5 Million) whichever is lower to be paid to BESCOM. Metering at HT side of pooling S/S.	Average cost of evacuation INR 5-6.5 million per MW	BESCOM/ DISCOM
Madhya Pradesh	**MPURJA** (Project facilitator)	Up to pooling S/S & bay expansion execution by WFD +5% supervision (MPTCL). Metering at WTG site	Average cost of evacuation INR 2 million per MW	DISCOM
Maharashtra	**MEDA** (Project facilitator)	Up to pooling S/S execution by WFD onward by WFD/MSETCL. 50% of evacuation cost is given as subsidy to developer after one year of commissioning from **Green Cess.** Balance 50% invested by developer are given as interest free loan by utility which will be repaid to in five equal instalments by utility to developer after one year from commissioning. Metering at feeder.	Average cost of evacuation INR 4-5 million per MW	MSEDCL
Rajasthan	**RRECL** (Project facilitator)	Up to pooling S/S execution and investment by WFD onward by RRVPNL. Metering at HT side of receiving S/S	Average cost of evacuation INR 1.5 million per MW	RRVPNL/ DISCOM
Tamil Nadu	**TNEB**	Up to pooling S/S execution and investment by WFD with 11% E&S charges to TNEB.	Average cost of evacuation INR 3.5- 4 million per MW	TNEB
	(Project facilitator)	Pooling S/S onward execution and investment by TNEB. Metering at WTG site.		

S/S – Sub station
WFD – Wind Farm Developer
WTG – Wind Turbine Generator
NEDCAP – Non-Conventional Energy Corporation
GEDA – Gujarat Energy Development Agency
KREDL – Karnataka Renewable Energy Development Company Ltd.
MPURJA – Madhya Pradesh Urja Nigam
MEDA – Maharashtra Energy Development Agency
RRECL – Rajasthan Renewable Energy Corporation Ltd.
TNEB – Tamil Nadu Electricity Board
APTRANSCO – Andhra Pradesh Transmission Company
Discom – Distribution Company
BESCOM – Bangalore Electricity Supply Company
MPTCL – Madhya Pradesh Transmission Company Ltd.
MSEDCL – Maharashtra State Electricity Distribution Company Ltd.
RRVPNL – Rajasthan Rajya Vidyut Prasaran Nigam Ltd.

Source : WISE,2012

GWEC

GLOBAL WIND ENERGY COUNCIL

The Global Wind Energy Council (GWEC) is a member-based organisation that represents the entire wind energy sector. The members of GWEC represent over 1,500 companies, organizations and institutions in more than 70 countries, including manufacturers, developers, component suppliers, research institutes, national wind and renewables associations, electricity providers, finance and insurance companies.

GWEC works at the highest international political level to create a better policy environment for wind power. GWEC and its members are active all over the world, educating local and national governments and international agencies about the benefits of wind power.

Working with the UNFCCC, the IEA, international financial institutions, the IPCC and the International Renewable Energy Agency, GWEC represents the global wind industry to show how far we've come, but also to advocate new policies to help wind power reach its full potential in as wide a variety of markets as possible.

Find out more about GWEC's policy work, publications, events and other membership benefits on our website at **www.gwec.net**

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World Institute of Sustainable Energy (WISE) is a not-for-profit institute committed to the cause of promoting sustainable energy and sustainable development, with specific emphasis on issues related to renewable energy, energy security, and climate change. Since its inception in 2004, WISE has pioneered important initiatives across these areas. This includes:

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- Developing an RE pathway for achieving the National Action Plan on Climate Change 15% RE target by 2020. The Government of India officially accepted WISE's findings for inclusion in the five-year plan targets.
- Developing state-level action plans for climate mitigation through accelerated deployment of clean energy technologies.
- Engaging in developing state-level RE policies and capacity building for state RE development agencies.
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- Research initiatives to prove the long-term viability of renewables.

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The Indian Wind Turbine Manufacturers Association (IWTMA) is the only industrial body representing the country's wind turbine manufacturers, providing a single contact point for policy makers at national and state level, regulators and utilities. IWTMA's main objective is to promote wind energy in India, facilitate wider knowledge about the sector and interact with relevant stakeholders at national and global energy forums.

IWTMA is also associated with industrial bodies in India, including FICCI, ASSOCHAM and CII. It also cooperates closely with ECN, RISO and EWEA through the European India Wind Energy Network (EIWEN).

IWTMA represents the Indian wind industry on all Committees, Councils and Advisory groups constituted by the Ministry of New and Renewable Energy, C-WET and others, including financial institutions like IREDA.

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