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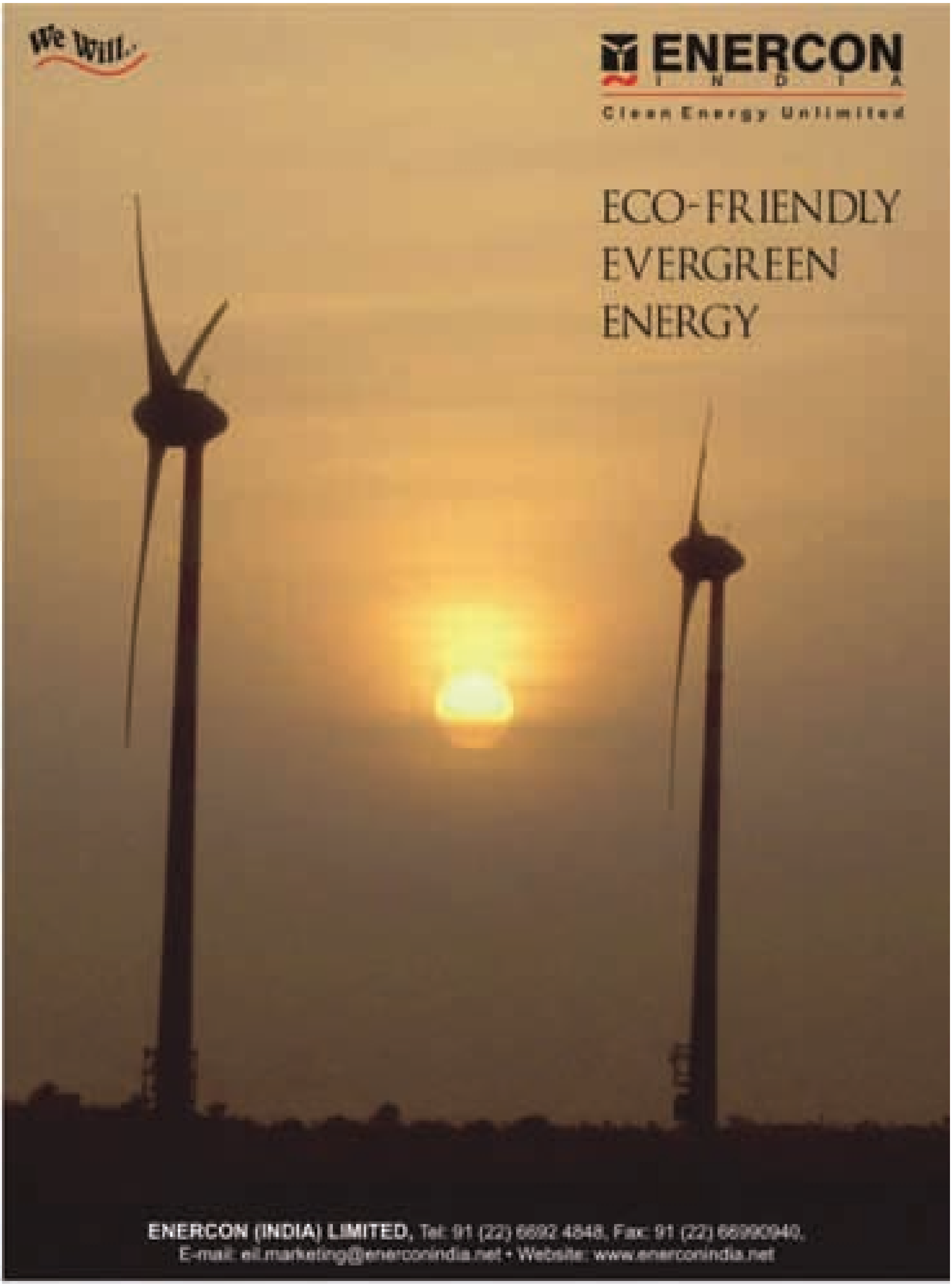
everything good

WINDPRO

Issue No. 164 June 2011


We Will..
ENERCON
INDIA
Clean Energy Unlimited
ECO-FRIENDLY
EVERGREEN
ENERGY
ENERCON (INDIA) LIMITED, Tel: 91 (22) 6692 4848, Fax: 91 (22) 66990940,
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WINDPRO

From the Editor's Desk...

India has the gross potential of development of 48000 MW of wind energy. The investors are also keen to invest their money in wind energy sector. In Governors' address on 3rd June, 2011 at Chennai, there was a welcome mention for the promotion of renewable energy; particularly wind energy and solar energy. Every State wants development of industries, which is the basic requirement for the improving the standard of living of the people. The development of a country is measured in terms of per capita utilization of the energy.

Though the scope for wind energy is still available in Tamilnadu, the evacuation lines to carry the wind energy generated to consumer are not adequate. To site an example; in Tamilnadu during year ended 31.03.2011 the wind mills been put up to an extent of 1000 MW, the entire energy lack evacuation for want of 400 KV &230KV sub stations and transmission lines.

The "wind" is the gift of nature and can be used as clean and green source of energy. There are discussions and discussions in various forums about the global warming; still this source of energy is not being tapped fully. While many countries have gone offshore for harnessing wind energy, in India the process of harnessing onshore wind energy itself is very slow leave alone off shore. This requires to be promoted in a big way.

In the 2nd International Wind Conference and Exhibition (2nd WE 20 by 2020) the experts have recommended that aadequate evacuation infrastructure has to be in place to achieve the goal of 20 % of wind penetration by the year 2020. Further MNRE officials had assured to look into the State Specific issues regarding evacuation facilities for RE and Effective RPO compliance. The Conference also requested MNRE to constitute a Task Force to Prepare State Wise Infrastructure Plan required for evacuation of the Wind Energy with the Grid along with details of wind projects in pipe line. I am sure that with the regular dialogues with the concerned authorities there will certainly be improvement in the evacuation infrastructure and other requirements of wind power.

3rd International Wind Conference and Exhibition (3rd WE 20 by 2020) is scheduled to be held at Coimbatore in Tamilnadu, in January 2012, which is having the large number of wind mills in the area. I We request your wholehearted support and involvement for successful conduct of the Conference and Exhibition to take the wind energy further in India.

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Minutes of the 2nd Annual General Meeting of Rajasthan State Council held at Jaipur on 03.05.11

Welcoming The Members :

Mr. Chandra Shekhar Khunteta, Hon. Secretary, Rajasthan State Council welcomed the members present & gave a introduction of Indian Wind Power Association to invitees. He briefed about the working of the association and the services provided along with the issues taken up by the Association during the year. He appealed the invitees to be the partner of the Association for the development of the wind energy in the country as well as state.

Election of the Office Bearers and Council Members :

The Nominations for the Election of the Office Bearers and Council Members for Rajasthan State Council were called earlier by the Returning Officer for the election. The Returning Officer had prepared the list of successful candidates and informed that all the nominations filed were found valid and there was no contest for the various posts. He declared the results as follows:

S.No.	Name	Designation company Address	Position
1.	Sh.Manak Talera	Director, M/s. Oswal Cables P. Ltd., Gulab Niwas, M.I Road, Jaipur – 01	President
2.	Sh. Rajendra Vyas	Corporate Advisor, M/s. Enercon Wind Farms (Jaiselmer) P. Ltd. 605-608, 5th Floor, Apex Mall Tonk Road, Jaipur – 15	Vice President
3.	Sh. Chandra Shekhar Khunteta	Director, M/s. Indocot, A-27/13, Kanti Chandra Road, Banipark, Jaipur – 16	Hon. Secretary
4.	Sh. Anil Kumar Saboo	Director, M/s. Elektrolites (Power) P. Ltd., S-758(A), Road No.9F, VKI Area, Jaipur	Hon. Treasurer
5.	Sh. Jagdish Narayan Chippa	Director, M/s. Rama Handicrafts, A-8, Central Spine, Vidhyadhar Nagar, Jaipur	Council Member
6.	Sh. Chandram Mookim	Director, M/s. Kyoto Energy Consultancy P. Ltd. C-44/45, Greater Kailash, Lal Kothi, Tonk Road, Jaipur	Council Member
7.	Sh. Manoj Gupta	Deputy General Manager M/s. Vestas India, 707, Apex Tower, Lal Kothi Scheme, Jaipur - 15	Council Member

All the above State Council members will hold office for the period of three years. Sri Manak Talera welcomed all participants and told that Rajasthan have huge potential in wind sector but the installations are very less. He appealed to the invitees to be the part of Word's biggest association to strengthen the Wind Energy sector in India. Chairman & others welcomed the elected members.

The Rajasthan State Council now comprises the following :

S.No.	Name	Position in IWPA-RSC	Position in Core Business	Name of the Organization
1	Sri Manak Talera	President	Chairman	Oswal Cables Pvt. Ltd., Jaipur
2	Rajendra Vyas	Vice President	Corporate Advisor	Enercon Wind Farms, Jaisalmer Pvt. Ltd.
3	Mr. C.S. Khunteta	Secretary	Director	Indocot, Jaipur
4	Anil Kumar Saboo	Treasurer	Director	Elektrolites (Power) Pvt. Ltd., Jaipur
5	Mr. Rahul Singhvi	Council Member	Director	Chemical & Mineral Industries (P) Ltd., Jodhpur
6	Mr. Gautam Nundy	Council Member	Head Bus Dev & Op	Enercon (India) Ltd., Jaipur
7	Mr. Nitin Goyal	Council Member	AGM-Business Development	Sulzon Energy Ltd., Jaipur
8	Mr. Kishan Daga	Council Member	Director	A Daga Royal Arts, Jaipur
9	Chandran Mookim	Council Member	Director	M/S Kyoto Energy Consultancy Pvt. Ltd, Jaipur
10	Lal Chand Choudhary	Council Member	Director	Choudhary Stone Crushing Company, Jaipur
11	Mr. Sanjeev Sardana	Council Member	CEO	Yamuna Power & Infrastructure Ltd., New Delhi
12	Sharad Saluja	Council Member	Director	Sterling Agro Industries Ltd., Jaipur
13	Mr. M.K. Sethi	Council Member	Director	Rishabh Construction P.Ltd., Jaipur
14	Mr. Jagdish Narayan Chippa	Council Member	Director	M/S Rama Handicrafts, Jaipur
15	Mr. Manoj Kumar Gupta	Council Member	DGM	M/s. Vestas Ltd., Jaipur

3. Address by the Chairman, IWPA :

Prof. K. Kasthurirangaian, Chairman IWPA thanked Rajasthan State Council for inviting them. He elaborated the need for wind power in country saying that the energy is the driver for the growth. He was happy and thankful about Rajasthan State Council adding members and appealed to the members to keep it up. He appealed State Council members to meet frequently / at least once a month to discuss the issues regularly. He praised the Council for taking up the recent issues. He reiterated that the wind mill installation is a nature friendly activity. He told that gathering wind energy is like honey bee collecting the nectar from the flowers without harming the flowers and helping in cross pollination. He also described that how wind energy is environment friendly and plays a useful role in overcoming the electricity shortage. He also requested members to take & resolve more & more issues in Wind Energy sector to get more investment & play an important role in country / state development.

4. Action Taken on issues: The following matters were discussed in the AGM.

a. **Tariff Review :** Rajasthan State Council has filed the appeal to tribunal for issue of surcharge on MAT & depreciation on long repayment. In which the arguments are complete, the decision is awaited.

b. **Tariff review on RERC :** Surcharge on MAT, Gadget notification under issue for amending section (21) of RERC regulation on the basis of hearing on 21st April 11. Order not released.

c. **Stamp Duty Matter :** Matter is related to Sikar - Tax Board of Ajmer has already granted stay in favor of Investor.

d. **Land Tax Matter :** Representation was filed to RREC & Energy Department, Rajasthan Govt. Energy Dept. has recommended our matter to Finance Dept. to waive off land tax on all kind of energy generation (renewable & non renewable). Matter is pending in Finance dept.

The meeting concluded with vote of thanks to the Chair.

Shri Chandra Shekhar Khunteta
Hon. Secretary

Shri Manak Talera
President

Minutes of the Investors Meet held at Jaipur on 03.05.2011

Members Attended :

The Investors Meet was attended by 45 members.

Welcome Address :

Mr.Chandra Shekhar Khunteta, Secretary, Rajasthan State Council of Indian Wind Power Association welcomed the members present & gave an introduction of Indian Wind Power Association to invitees. He briefed about the working of the association and the services provided along with the issues taken up by the Association during the year. He appealed to the invitees to be the partner of the Association for the development of the wind energy in the country as well as state.

Address by the Chairman, IWPA :

Prof. K. Kasthurirangaian, Chairman IWPA welcomed the Chief Guest Shri Kuldeep Ranka, IAS Chairman & Managing Director, Jaipur Vidyut Vitran Nigam Limited, Rajasthan and the members present. He explained the current scenario of Wind Industry in India and in Rajasthan. He also described that how wind energy is environment friendly and plays a vital role in solving the electricity crisis. He further requested the members to take up & resolve more & more issues in Wind Energy sector to attract more investment & play an important role in the development of the country and state.

Address by Chief guest :

Shri Kuldeep Ranka, IAS, CMD, Jaipur Discom (Jaipur Vidyut Vitran Nigam Limited, Rajasthan) thanked the members present and shared his experience in wind energy sector. He told that about 15 years ago he was posted in Jaisalmer District of Rajasthan and it was the beginning of the wind energy in State. Hence he is associated with wind energy since its inception in Rajasthan. He praised the role of Indian Wind Power association in taking up the issues on behalf of investors & told that IWPA can play an important role in coordinating & selecting project in renewable energy industry. He also described the incentive schemes offered by the Government. He assured the investors to provide the maximum possible help from State Government.

Open house discussion :

The open house discussion was mainly on delay in payments, lower priority for payment, payment through RTGS, and problems of low generation etc.

Mr. Chandalia, Director (Power Trading, JVVNL) informed that the Electricity Board is trying to release the payment on time. He suggested the members to submit the invoices on Monday instead on week days, which will enable the board to release the payment during same week. For RTGS he assured that same will be taken in system soon.

Sri Anil Kumar Saboo,
Hon. Treasurer,
Rajasthan State Council proposed the Vote of Thanks.

Chandra Shekhar Khunteta
Hon. Secretary

Letter to Hon'ble Minister MNRE

21.05.2011

Hon. Dr. Farooq Abdullah,
Hon. Minister, Ministry of New and Renewable Energy
Govt. of India, Block no. 14, CGO eomplex
Lodhi Road, New Delhi 110003

Dear Sir,

Sub : In Power Starved Tamil Nadu 1000 to 3000 MW Wind Mills installed cannot function for want of Evacuation - SOS Request for release of Rs. 1757 Crores from Clean Energy Fund

Ref : Letter No.CE/NCES/SE/EE/WPP/AEE2/F.MNRE/D.2233/10, Dt : 04.12.10 from TANGEDCO, Chennai

Tamil Nadu as a progressive state has yearly growth of demand at 10 % or 1000 to 1500 MW of additional firm power. Supply shortage of 1000 MW in 2009 has grown to 3000 MW shortage in 2011. **Neglect in the Planning of generation of additional firm power** for the last 10 years is causing the state being taken to dark nights. Scheduled power cut for seven hours a day for industries plus 2 more hours of unscheduled power cut is the order of the day. Nobody knows when power would come and when it would go.

On distribution side alsp there are bigger wows. Besides earlier installation of 5000 MW of infirm seasonal wind power, 1000 MW more of wind mills have been added in the year 2010 -2011 . The investors have laid lines up to 110 KV sub stations created by private developers, which in turn has been connected to TANGEDCO Sub Station. But this electrical energy cannot reach Consumer.

No 230 KV and 400 KV sub stations needed have been created by TANGEDCO or TANTRANSCO in 2010 -11. **Why? They have no money.** Even though 1000 MW of Wind Mills have come in 2010 -11 , they have to remain idle during high windy time of May to October 2011 when domestic, industrial and agriculture is starved for energy. Similar fate awaits 2000 MW or more of Wind Mills being erected in 2011 -13. TANGEDCO for your information has not paid the money for the energy supplied by wind mills from August 2010 for 9 months.

On 04.12.2010 TANGEDCO has sent a request to Ministry of Renewable Energy, Government of India for release of Rs 1757.00 Crores for carrying out this evacuation work in a space of 3 years. Please find a copy of this request with this letter.

We are glad to recall at during the conduct of International Wind Energy Conference "WE 20 By 2020" by Indian Wind Power Association in February 2011 at New Delhi, Honourable Dr. Farooq Abdullah was gracious enough to inaugurate the Conference and assure that Government of India would do all it could for speedy growth of Wind Energy in India. Most respected Mr. B.K. Chaturvedi, Member, Energy, Planning Commission and friend in need the Secretary, MNRE Mr. Deepak Gupta have also been good enough to participate in the Conference and assured all support to Wind Industry. We enclose a copy of booklet on the Major Findings of the above Conference and decisions arrived (please refer pages nos. 30 to 33). One of the action plans as you could find on rear inner wrapper of the booklet request Government of India to help wind power friendly States like Tamil Nadu with Financial assistance for evacuation of Wind Power to reach the consumers.

Sir, we the 1100 investors members of Indian Wind Power Association appeal to Honorable Prime Minister Dr. Manmohan Singh, Honourable Minister, MNRE, Dr. Farooq Abdullah, Secretary MNRE Mr. Deepak Gupta, and Mr. B.K. Chaturvedi, Member, Energy, Planning Commission to handle the request from TANGEDCO as an SOS call, from Tamil Nadu to release the amount forthwith and tell TANGEDCO not to prolong EVACUATION work for 3 years but to complete it in one year before March 2012, as Japenese do Tsunami rehabilitation work in Japan. TANGEDCO has capable Engineers to do the required work.

Another important work to be done without delay is to connect Tamilnadu and Southern grid adequately with National grid so that excess wind power can flow to North and West and other power can flow down south. Now these is no proper link. With adequate capacity. Central Government and power grid corporation to have do the task in shortest possible time.

Thanking you and with Regards wind Community

Yours faithfully
For Indian Wind Power Association

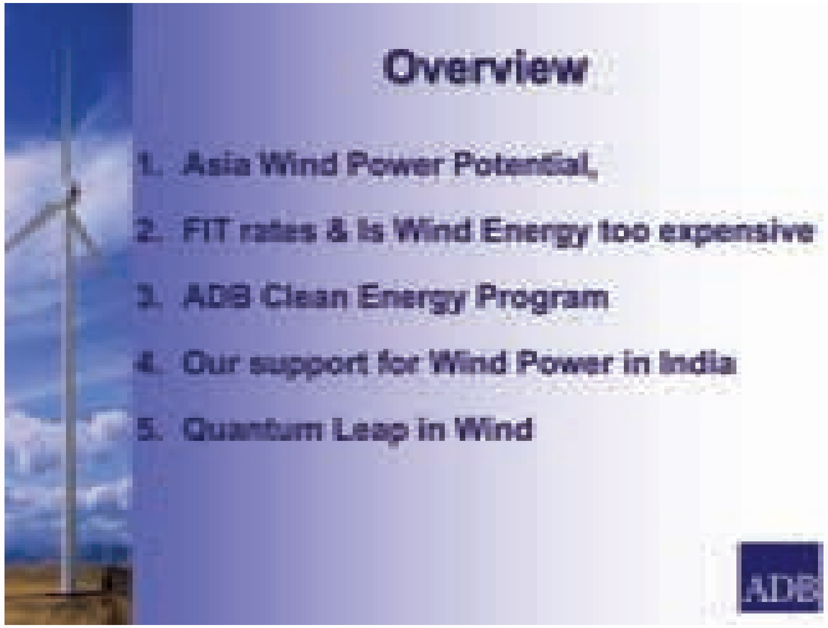
-Sd-

K. Kasthoorirangaian,
Chairman


Partner with the future !
750 kw
wind turbines from
Pioneer Wincon
Pioneer Wincon
P750

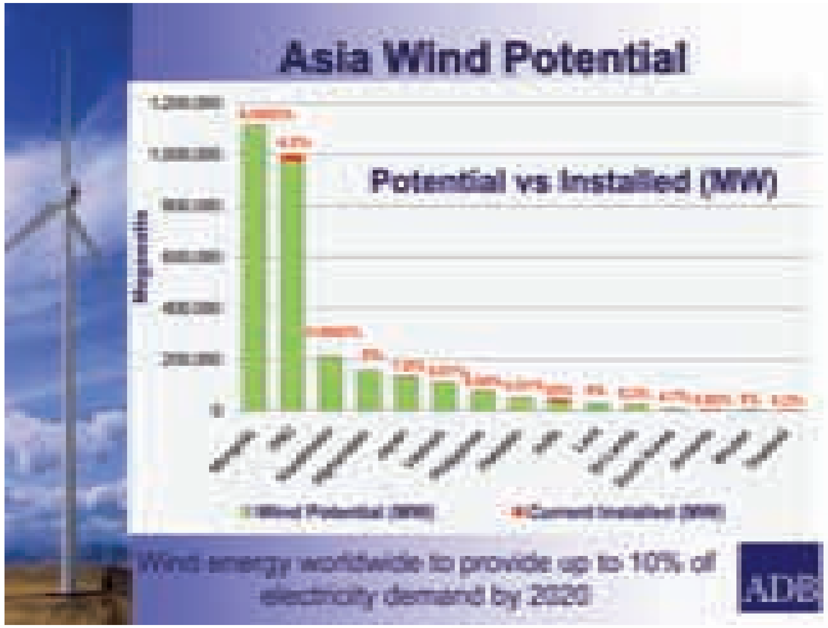
Role of ADB in supporting WE in Asia:

Jitendra (Jitu) Shah
Regional and Sustainable Development Department
Asian Development Bank
February 2011



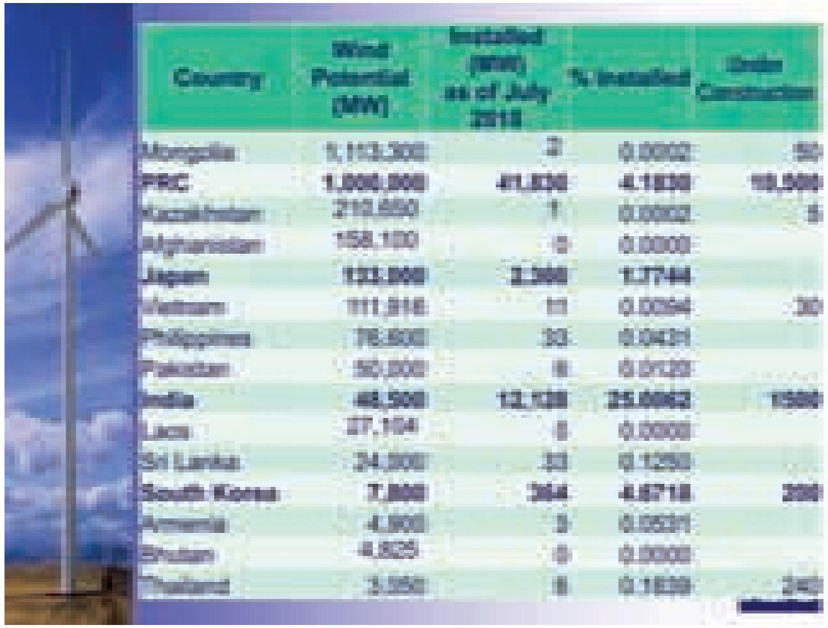
Overview

1. Asia Wind Power Potential,
2. FIT rates & Is Wind Energy too expensive
3. ADB Clean Energy Program
4. Our support for Wind Power in India
5. Quantum Leap in Wind

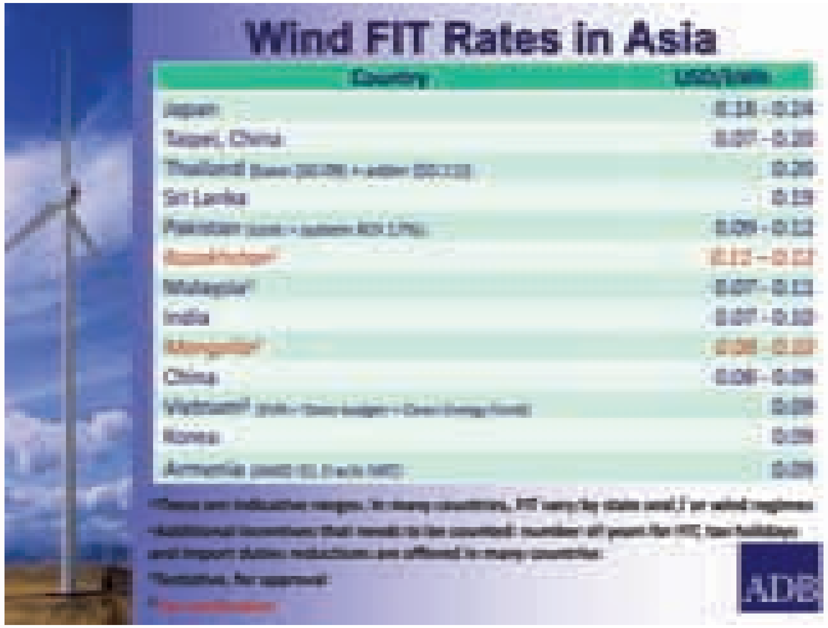


Asia Wind Potential

Wind energy worldwide to provide up to 10% of electricity demand by 2020



Country	Wind Potential (MW)	Installed (MW) as of July 2010	% Installed	Under Construction
Mongolia	1,113,300	2	0.0002	50
PRC	1,000,000	41,830	4.1830	10,500
Kazakhstan	210,650	1	0.0002	5
Afghanistan	158,100	0	0.0000	
Japan	133,000	2,360	1.7744	
Vietnam	111,916	11	0.0094	30
Philippines	76,600	33	0.0431	
Pakistan	50,000	6	0.0120	
India	48,500	12,128	25.0062	1500
Laos	27,104	0	0.0000	
Sri Lanka	24,000	33	0.1250	
South Korea	7,800	364	4.6718	200
Armenia	4,900	3	0.0531	
Bhutan	4,825	0	0.0000	
Thailand	3,050	5	0.1639	240



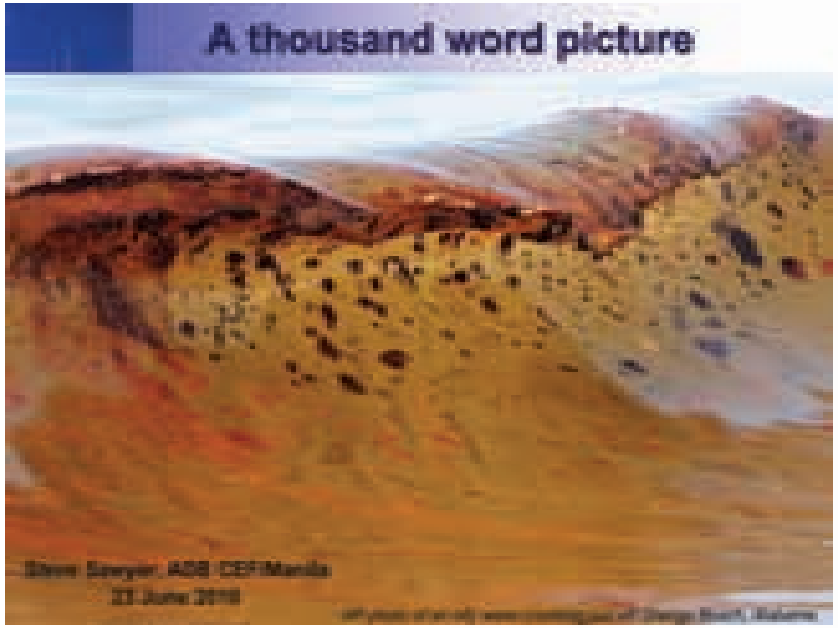
Wind FIT Rates in Asia

Country	USD/kWh
Japan	0.18 - 0.24
Taipei, China	0.07 - 0.20
Thailand [illegible]	0.20
Sri Lanka	0.19
Pakistan [illegible]	0.09 - 0.12
[illegible]	0.12 – 0.22
Malaysia	0.07 - 0.11
India	0.07 - 0.10
Mongolia	0.08 - 0.10
China	0.08 - 0.09
Vietnam [illegible]	0.09
Korea	0.09
Armenia [illegible]	0.09

*These are indicative ranges. In many countries, FIT vary by state and / or wind regimes [illegible]

[illegible]

ADB



A thousand word picture

Steve Sawyer, ADB CEF Manila
23 June 2010

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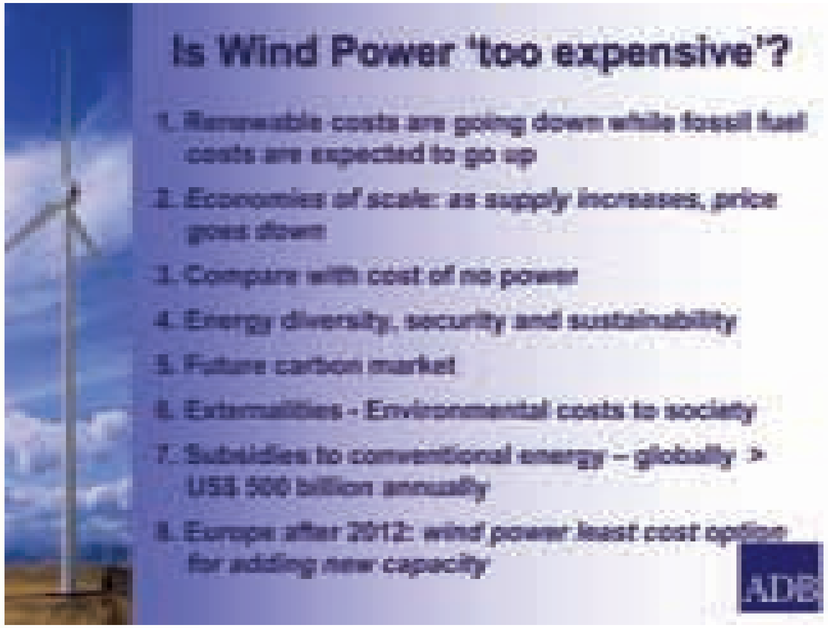
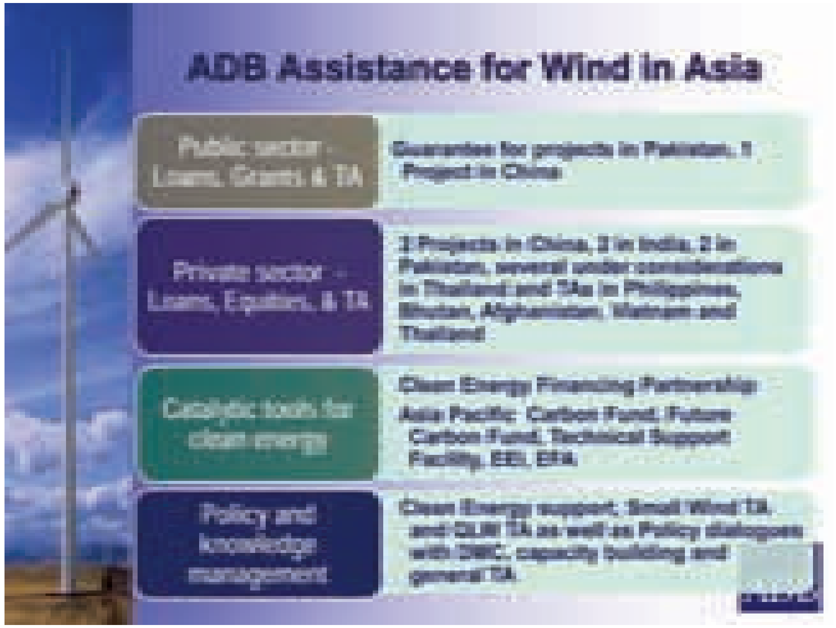


Is Wind Power 'too expensive'?

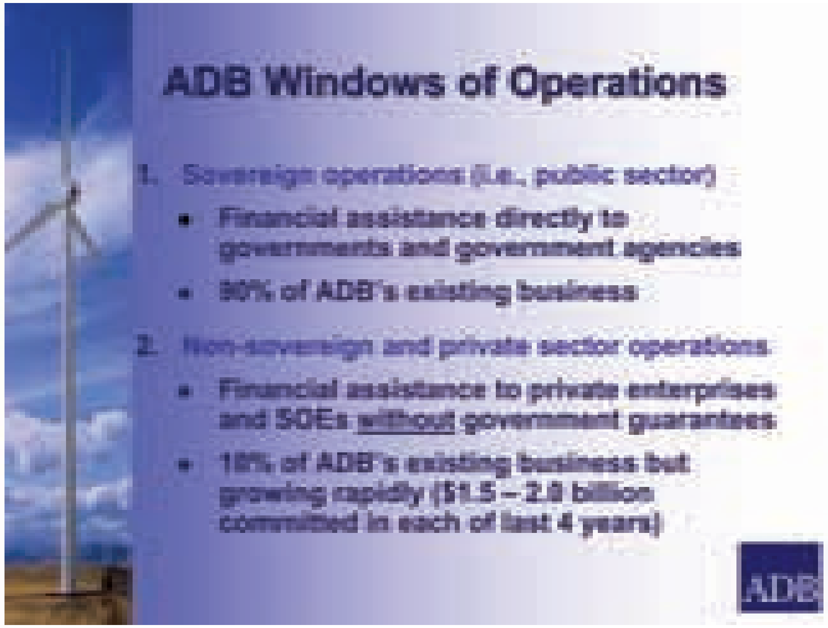
1. Renewable costs are going down while fossil fuel costs are expected to go up
2. Economies of scale: as supply increases, price goes down
3. Compare with cost of no power
4. Energy diversity, security and sustainability
5. Future carbon market
6. Externalities - Environmental costs to society
7. Subsidies to conventional energy – globally > US$ 500 billion annually
8. Europe after 2012: wind power least cost option for adding new capacity

ADB



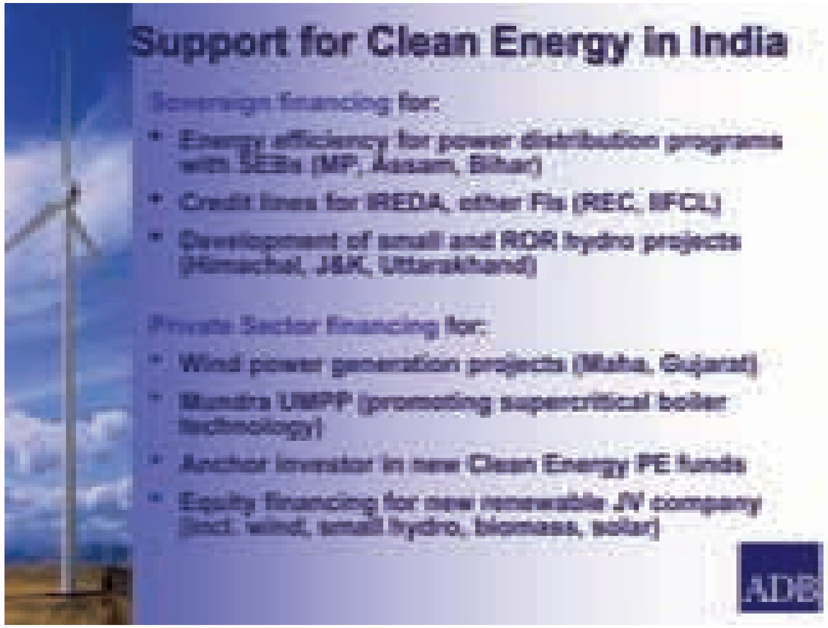
ADB Assistance for Wind in Asia

Public sector - Loans, Grants & TA	Guarantee for projects in Pakistan, 1 Project in China
Private sector - Loans, Equities, & TA	3 Projects in China, 2 in India, 2 in Pakistan, several under considerations in Thailand and TAs in Philippines, Bhutan, Afghanistan, Vietnam and Thailand
Catalytic tools for clean energy	Clean Energy Financing Partnership: Asia Pacific Carbon Fund, Future Carbon Fund, Technical Support Facility, EEI, EFA
Policy and knowledge management	Clean Energy support, Small Wind TA and CLIM TA as well as Policy dialogues with DMC, capacity building and general TA



ADB Windows of Operations

1. Sovereign operations (i.e., public sector)
   - Financial assistance directly to governments and government agencies
   - 90% of ADB's existing business
2. Non-sovereign and private sector operations
   - Financial assistance to private enterprises and SOEs without government guarantees
   - 10% of ADB's existing business but growing rapidly ($1.5 – 2.0 billion committed in each of last 4 years)



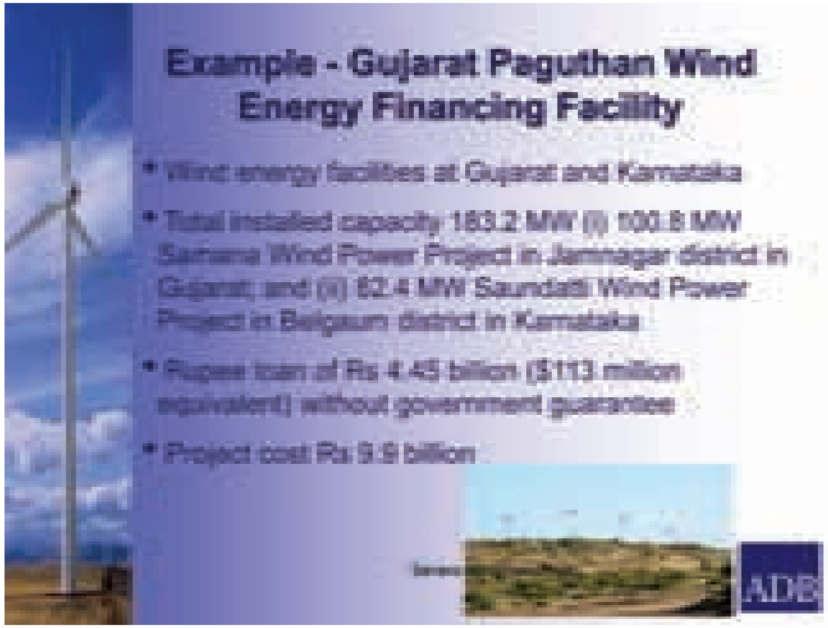
Support for Clean Energy in India

Sovereign financing for:

- Energy efficiency for power distribution programs with SEBs (MP, Assam, Bihar)
- Credit lines for IREDA, other FIs (REC, IIFCL)
- Development of small and ROR hydro projects (Himachal, J&K, Uttarakhand)

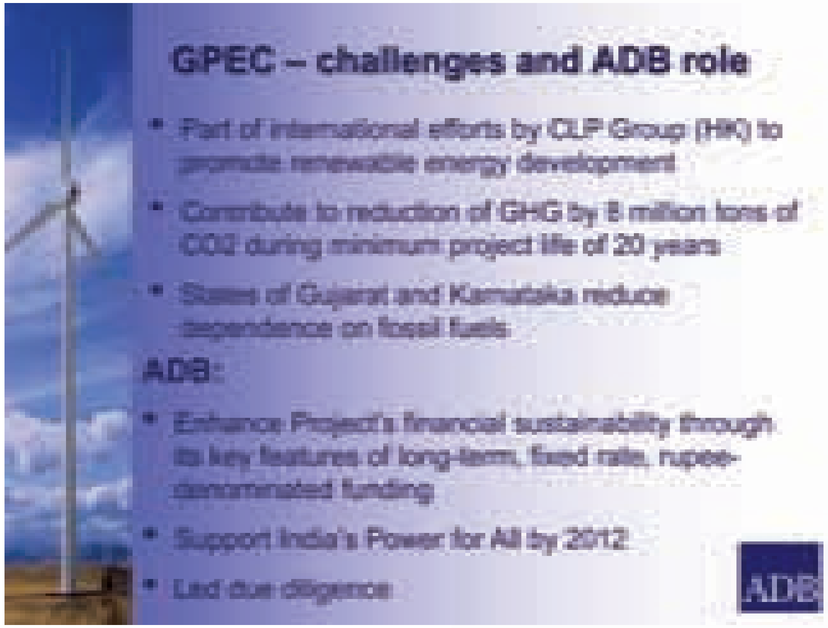
Private Sector financing for:

- Wind power generation projects (Maha, Gujarat)
- Mundra UMPP (promoting supercritical boiler technology)
- Anchor investor in new Clean Energy PE funds
- Equity financing for new renewable JV company (incl. wind, small hydro, biomass, solar)



Example - Gujarat Paguthan Wind Energy Financing Facility

- Wind energy facilities at Gujarat and Karnataka
- Total installed capacity 183.2 MW (i) 100.8 MW Samana Wind Power Project in Jamnagar district in Gujarat; and (ii) 82.4 MW Saundatti Wind Power Project in Belgaum district in Karnataka
- Rupee loan of Rs 4.45 billion ($113 million equivalent) without government guarantee
- Project cost Rs 9.9 billion

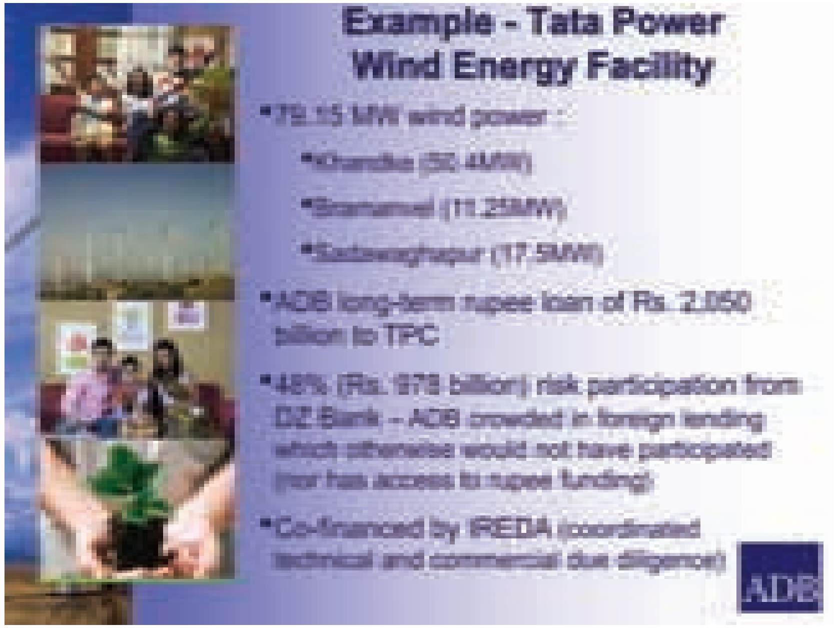


GPEC – challenges and ADB role

- Part of international efforts by CLP Group (HK) to promote renewable energy development
- Contribute to reduction of GHG by 8 million tons of CO2 during minimum project life of 20 years
- States of Gujarat and Karnataka reduce dependence on fossil fuels

ADB:

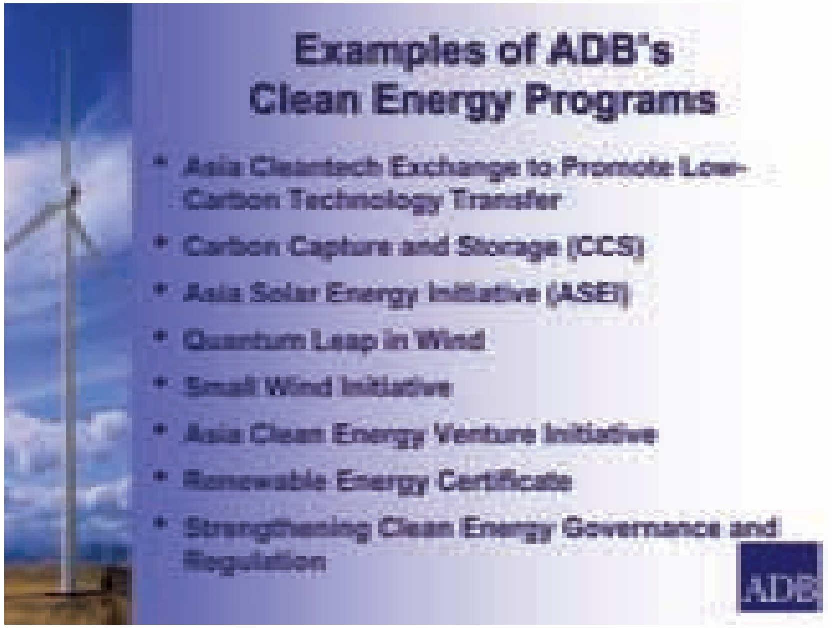
- Enhance Project's financial sustainability through its key features of long-term, fixed rate, rupee-denominated funding
- Support India's Power for All by 2012
- Led due diligence



Example - Tata Power Wind Energy Facility

- 79.15 MW wind power :
  - Khandke (50.4MW)
  - Bramanvel (11.25MW)
  - Sadawaghapur (17.5MW)
- ADB long-term rupee loan of Rs. 2,050 billion to TPC
- 48% (Rs. 978 billion) risk participation from DZ Bank – ADB crowded in foreign lending which otherwise would not have participated (nor has access to rupee funding)
- Co-financed by IREDA (coordinated technical and commercial due diligence)

ADB



Examples of ADB's Clean Energy Programs

- Asia Cleantech Exchange to Promote Low-Carbon Technology Transfer
- Carbon Capture and Storage (CCS)
- Asia Solar Energy Initiative (ASEI)
- Quantum Leap in Wind
- Small Wind Initiative
- Asia Clean Energy Venture Initiative
- Renewable Energy Certificate
- Strengthening Clean Energy Governance and Regulation

ADB

ADB's Clean Energy Program

- 2005: Energy Efficiency Initiative (EEI) – clean energy investment target $1 billion / yr
- 2008: Clean energy investment target reached and surpassed $1.69 billion
- Energy Policy 2009: Increased clean energy target to $2 billion per year by 2013
- 2009: Clean energy investment reached $1.26 billion
- EEI → Clean Energy Program

ADB

Barriers to Scaling Up Wind in Asia

- Policy and Regulations in other Asian countries
- Risk Perception – resource uncertainty
- Institutional Capacity
- Technical/Infrastructure
- Economic and Financial
- Market – energy planning does not include externalities

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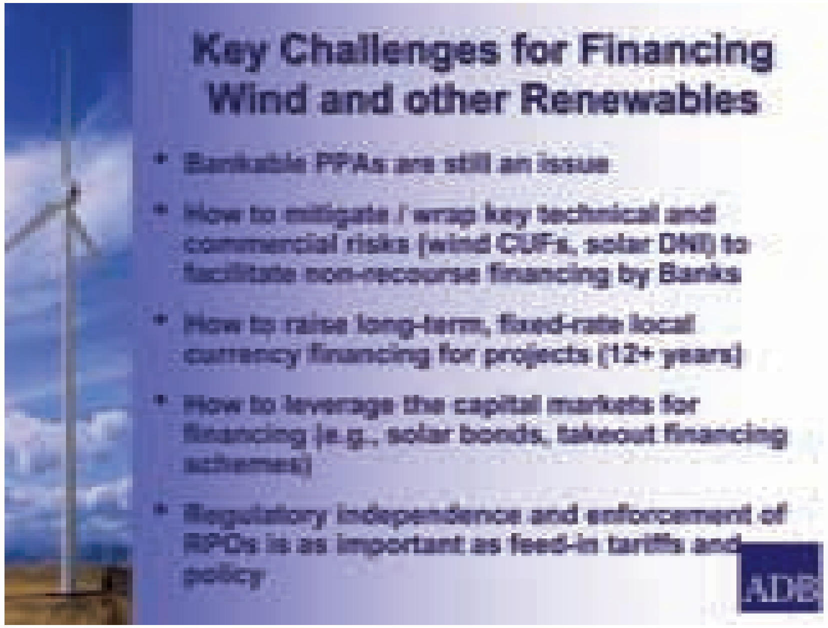


Key Challenges for Financing Wind and other Renewables

- Bankable PPAs are still an issue
- How to mitigate / wrap key technical and commercial risks (wind CUFs, solar DNI) to facilitate non-recourse financing by Banks
- How to raise long-term, fixed-rate local currency financing for projects (12+ years)
- How to leverage the capital markets for financing (e.g., solar bonds, takeout financing schemes)
- Regulatory independence and enforcement of RPOs is as important as feed-in tariffs and policy

ADB

How do we get there?

Phase I: Stakeholder Consultation

Quantum Leap in Wind Power in Asia, 21 June 2010

100+ Participants from 20+ Countries, of which: 50 Consultants and Academics; 40 Project Developers; 25 Governments; 15 Turbine Manufacturers; 13 Financiers; 11 Utilities; 40+ ADB staff – Manila and Country offices

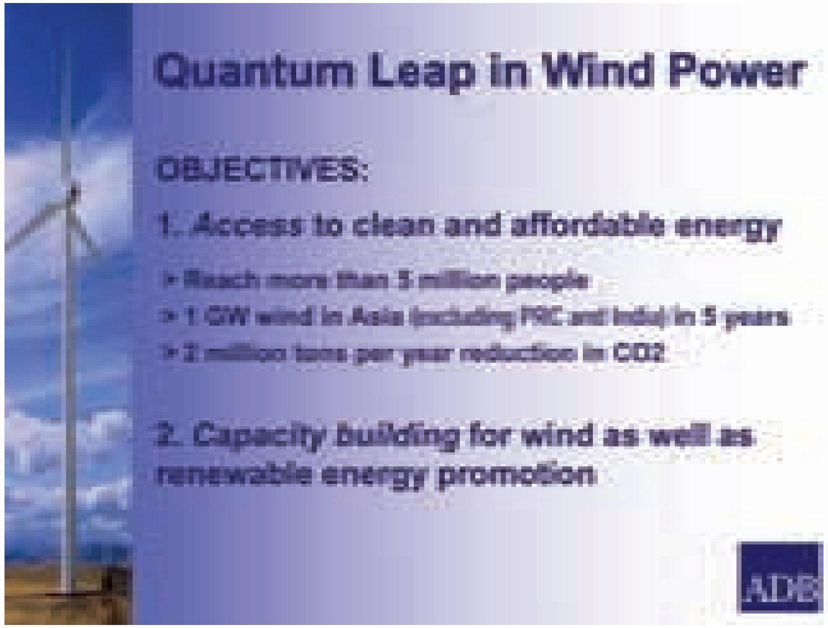
Phase II: ADB Wind Strategy 2011-2013

Technical assistance US$ 2 Million for: (i) Wind Energy Development Roadmap (ii) Wind Resource Assessment, (iii) Knowledge and Capacity Building, (iv) Pre-feasibility and economic analysis, and (v) Preparation of business models

Phase III: Wind Investments 2011 onwards

Support public & private projects
- Pilot wind farms (about 100 MW each)
- Support to over 1.5 GW wind power, over the next 5 years

ADB



Quantum Leap in Wind Power

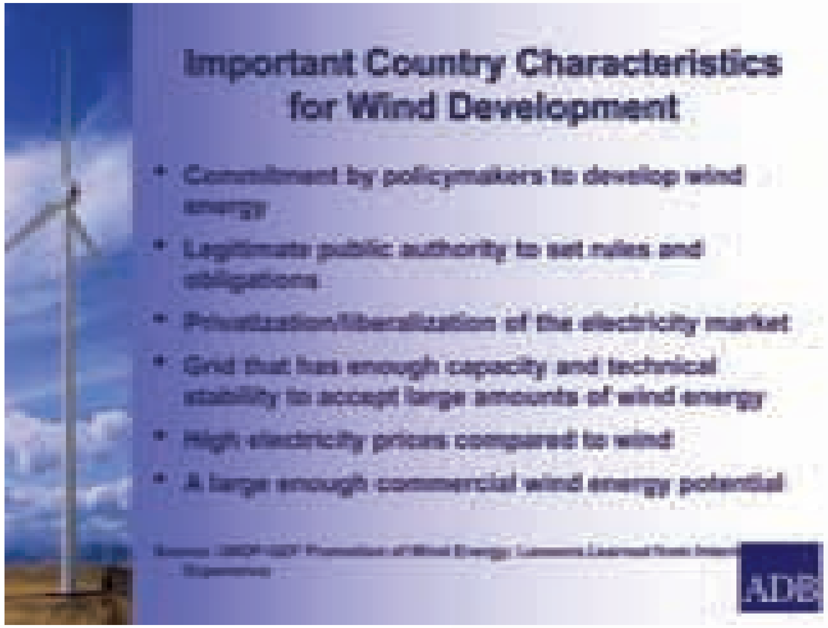
OBJECTIVES:

1. Access to clean and affordable energy

> Reach more than 5 million people
> 1 GW wind in Asia (excluding PRC and India) in 5 years
> 2 million tons per year reduction in CO2

2. Capacity building for wind as well as renewable energy promotion

ADB

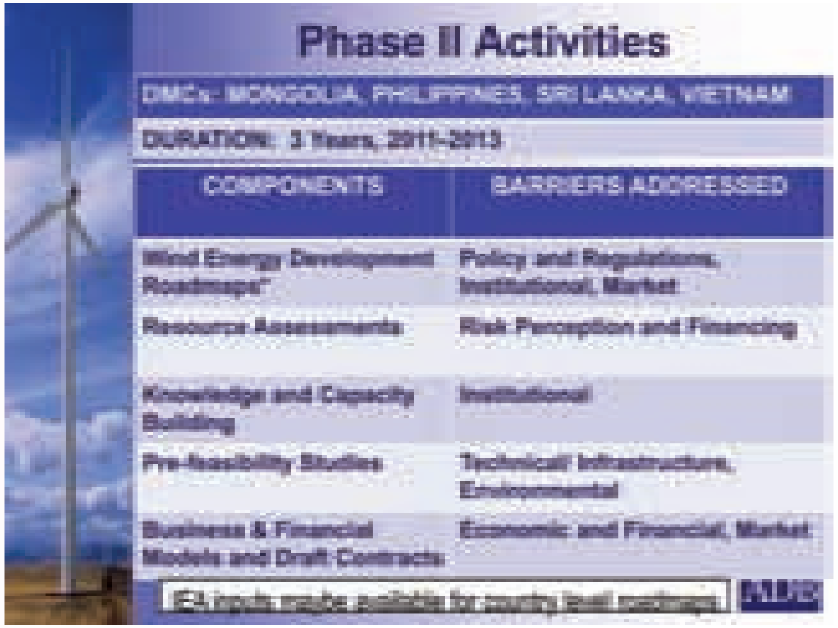


Important Country Characteristics for Wind Development

- Commitment by policymakers to develop wind energy
- Legitimate public authority to set rules and obligations
- Privatization/liberalization of the electricity market
- Grid that has enough capacity and technical stability to accept large amounts of wind energy
- High electricity prices compared to wind
- A large enough commercial wind energy potential

Source: UNDP-GEF Promotion of Wind Energy: Lessons Learned from [illegible] Experience

ADB



Phase II Activities

DMCs: MONGOLIA, PHILIPPINES, SRI LANKA, VIETNAM

DURATION: 3 Years, 2011-2013

COMPONENTS	BARRIERS ADDRESSED
Wind Energy Development Roadmaps*	Policy and Regulations, Institutional, Market
Resource Assessments	Risk Perception and Financing
Knowledge and Capacity Building	Institutional
Pre-feasibility Studies	Technical/ Infrastructure, Environmental
Business & Financial Models and Draft Contracts	Economic and Financial, Market

Thank You

Contact details for more information

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Web www.adb.org

Clean Energy Fund Approved

The Government of India has approved setting up of a National Clean Energy Fund (NCEF) that would finance innovate projects and schemes in clean energy technologies. The Finance Bill 2010-11 provided for creation of National Clean Energy Fund (NCE) to invest in entrepreneurial ventures and research in the field of clean energy technologies. The Fund was set up to serve as a separate non-lapsable corpus for funding green energy projects with the broader objective of cutting down India's carbon footprint. Collections for the fund are made from the clean energy cess of Rs. 50 per ton on coal, lignite and peat last year. In 2010-11, the government has collected over Rs. 3,124 crore from coal cess but it is yet to draw a firm roadmap for investing the money. The corpus under the fund is expected to swell to over Rs. 6,500 crore in 2011-12. All the schemes and projects from individuals, organizations would be eligible for funds not more than 40 percent of the total project cost.

The Cabinet Committee on Economic Affairs (CCEA) had approved the constitutions of NCEF in the public account. The CCEA nod was also given to the guidelines as well as modalities for approval of projects to be funded from the fund. Private sector will be allowed to access the national clean energy fund (NCEF). MS Sushma Nath, Finance Secretary, recently said that over Rs. 3,000 crore a year would be available in the NCEF for funding research and innovative projects in clean energy technologies. An inter ministerial group, headed by the Finance Secretary, has been set-up to approve the projects / schemes eligible for financing under the NCEF. The Government assistance under the NCEF would in no case exceed 40 per cent of the total project cost.

SMART GRIDS

With added emphasis on infrastructure building and power generation, India has done well to adopt early enough the smart grid technologies which facilitate the distribution electricity.

Smart grids are sophisticated, digitally-enhanced systems which use modern communications and control technologies to ensure greater robustness, efficiency and flexibility in the power systems and networks.

To encourage this initiative, Sam Pitroda, Chairman of Indian Smart Grid Task Force (ISGTF) recently launched the website of the forum, http://www.isgtf.in ISGTF is a non-profit voluntary consortium of public and private stake holders with the prime objective to accelerate development of smart grid technologies within the country's power sector. It has constituted five working groups to take up different tasks related to smart grid activities – trails / pilot on new technologies, loss reduction and theft, data gathering and analysis, power to rural areas and reliability and quality of power to rural areas and reliability and quality of power to urban areas, distribution generation and renewable, and physical cyber security, standards and spectrum.

Courtesy : CODISSIA Magazine

Wind Energy - International Status and Technical Development

J.P. Molly, Managing Director
DEWI GmbH – German Wind Energy Institute, Ebertstrasse 96, D-26382 Wilhelmshaven, Germany

1. Summary

In the last two decades wind energy took an unexpected technological and commercial development, initially in some countries of Europe like Denmark and Germany, for a long time the world market leaders, today in nearly all parts of the world with the largest and fastest in-creasing markets in Asia and the United States. In most of the countries the use of wind energy had been initiated by governmental financial supporting programmes. Depending on their struc-ture they were more or less successful. Tax credits, legally guaranteed reimbursement, auction systems, CO2- certificates and mixtures of all these systems have been created and applied by different countries. Wind turbine technology leadership as well as the advanced knowledge about grid integration are still with manufacturers, component suppliers, engineering companies, utilities and research institutions of European countries. With the offshore application of wind energy a new technological and grid integration challenge appeared and again the northern European countries are leading the development. Wind turbines of up to 7.5 MW are in operation and the 10 MW size with 150 m rotor diameter is under development. Even though the wind turbine size development slowed down during the last years, the world wide technological development still concentrates on wind turbine technology improvements, but not yet on the question which would be the best specific power lay-out of the wind turbine under grid integration aspects. In other words, the technical development deals with the lay-out for the most economic energy production of a wind turbine or wind farm and not with the most economic wind turbine for the national economy taking the electric energy distribution into consideration.

2. Status of Wind Energy Penetration Levels in the World

Historically seen the large-scale wind energy application started in the early eighties of the last century in Denmark, followed by a large-scale application in the United States of Amer-ica with about 1,600 MW installed in California by the middle of the same decade. The next country was Germany which started to use wind energy as a power supply for grid connected consumers. With the 250 MW demonstration programme in 1989, followed by the wind energy feed-in law in 1991, which guaranteed a fixed reimbursement for the energy generated, Ger-many created a very successful support programme. The reimbursement guaranteed over 20 years provided security for the investors and so accelerated not only the annual installation quantity of wind turbines, but also created the basis for the technical improvement and devel-opment of wind turbines by the manufacturers. As a consequence, after some years, the Ger-man industry took the lead in wind turbine technology in the world.

In the year 2000 Germany replaced the feed-in law by the Renewable Energy Sources Act (EEG) which still is in force after some positive modifications. Under this law the annual wind turbine installations in Germany reached a peak value of more than 3.200 MW in the year 2002. Today more than 26,000 MW are in operation, making the country the world-wide leader of onshore installations with 74 kW of installed wind power per square kilometre of land area, followed by Denmark (64.6 kW/km^2), The Netherlands (47.7 kW/km^2), Portugal (37.6 kW/km^2) and Spain (37 kW/km^2). The leading countries outside of Europe reach 3.7 kW/km^2 (USA), India 3.3 kW/km^2 and China 2.7 kW/km^2 (Fig. 1).

Fig. 1 Wind power installations per square kilometre land area (kW/km^2) in different countries

With the world-wide wind energy installations of 2009 and a land area of the globe of about 136.2 million km^2 (without Antarctica), the average wind power installation is 1.2 kW/km^2. Assuming the same wind turbine installation density as in Germany for the whole world, wind power installations onshore would count up to theoretically more than 10 TW and probably could be even doubled with offshore wind power. These values show the large installation potential still existing,

provide an excellent perspective for the manu-facturers of wind turbines and show that wind energy is a very large energy source when related to the world-wide conventional electrical power plant capacity of 3.5 TW existing today.

According to [2] the wind energy installation world-wide will increase from 160 GW in 2009 to 448 GW in 2014 and 966 GW in the year 2019. As Fig. 2 shows, the expectation is that most of these installations will occur in Europe, Asia and North America bringing each of them to a total of around 300 GW. The world wind power installation density then will be 7.1 kW/km², which is only 10% of the value reached in Germany today.

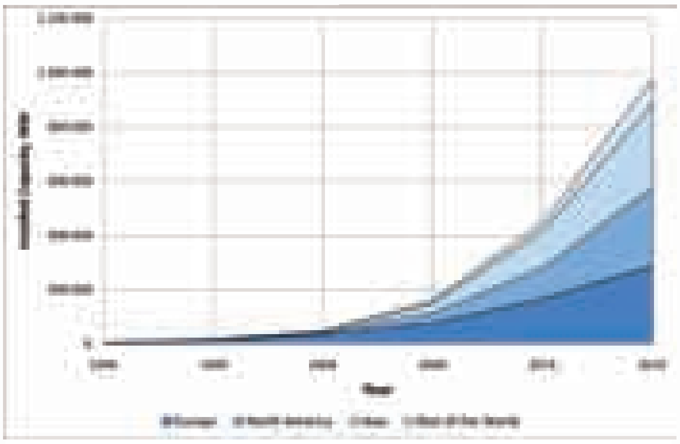

Fig. 2 Expected global wind power development until 2019 [2]

3. Key factors which have supported increasing wind power penetration

Wind energy use has been intensified by national support programmes in nearly all countries of the world. The variety of support systems is large and also always bound to special local traditions. But not all incentives worked as expected, causing several system changes to achieve a better result like it happened in the past for example in France or Great Britain. Today one of the most successful support tools is the German fixed reimbursement system for the generated energy together with the must for the utilities to purchase the energy generated by renewable energy sources. This scheme provides a high long term financing security for the in-vestors and the loan creditors. Therefore more and more governments in the world are applying this successful support system.

Countries without long term financial support systems for the wind farm operators like it was in the beginning of the wind energy development in Great Britain, The Netherlands, France and the USA lost their wind turbine industry existing in earlier times, whereas Denmark, Ger-many and Spain became the leaders due to the investment security provided by their long term reimbursement systems. So adequate financial support systems do not only ease the way for the application of renewable energies but are also an important local industry support that means they create jobs.

The right reimbursement tool is only one aspect of the positive wind energy development in Germany, Spain and Denmark. All three countries invested in wind energy research and gave subsidies for the development of increasing wind turbine sizes. Research institutes like DEWI, CENER and RISØ are very well known research centres of these countries. In addition wind turbine certifications made by companies like DEWI-OCC and others gave a certain security to the investors and banks that the wind turbines are of adequate quality. In the beginning of the wind turbine development certifications were needed mainly in Germany and Denmark. Today more and more countries, investors and banks oblige the manufacturers to present valid certifi-cations of their wind turbines.

To achieve a successful implementation of wind energy in a country some other impor-tant measures are necessary. Rules for grid connection conditions should be equal in all parts of a country to avoid unnecessary difficulties and costs for the investors. High quality of the energy yield prediction for a future wind farm creates confidence whereas low quality will cause doubts for the money lenders about the achievable economics of wind farms. High wind turbine manufacturing quality is a must to achieve the promised 20 years lifetime of wind turbines. Er-rors in design, manufacturing quality or maintenance will contribute considerably to a diminished life time and therefore to a loss of confidence in the reliability of this energy generation system. Without well skilled engineers and technicians the design of wind turbines, the lay-out of wind farms, the grid integration and the operation of wind farms cannot be done in a sufficiently high quality. To give an impression about the challenges of wind energy a comparison with automo-biles can be done. A car is designed for a lifetime of 4,000 hours or a life time of 250,000 kilo-metres. Everybody can imagine what this means in maintenance and spare parts. But a wind turbine has to operate with extreme high technical availability more than 160,000 hours, forty times longer and without changing major and costly components like rotor blades, gearboxes, generators or other drive train components.

This life time challenge leads to the necessity to think about why many manufacturers of wind turbines still have to battle against mechanical component failures appearing too early . Rotor blades, gearboxes, towers and even foundations are not trouble free or in other words the main components have problems to reach 20 years lifetime. In general one can say, little errors in design and quality during production bring the 20 years lifetime down to a few years.

What is the reason of this problem? One reason may be the fast wind turbine size de-velopment because the time to gather experience before going to the next size is too short. But there may be another problem as well. Many people think that wind turbines are made by simply connecting components available on the market. They are not aware that a wind turbine is seriously affected by high dynamic operation loads causing material fatigue and consequently reduced lifetime. Wind turbine design is done by very differently educated engineers. There is the aeronautical engineer for the aerodynamic and structural rotor blade design. Educated to make light weight structures he takes fatigue loading in consideration. For the machinery part we have the mechanical and electrical engineers, but they already think different, they think in durability something different from fatigue. And finally to fix the machinery at some height above ground, the civil engineer is needed for the tower and foundation layout. He thinks in masses of stiff structures and doesn't care about the lifetime influence which the elasticity of structures may have (Fig. 3).

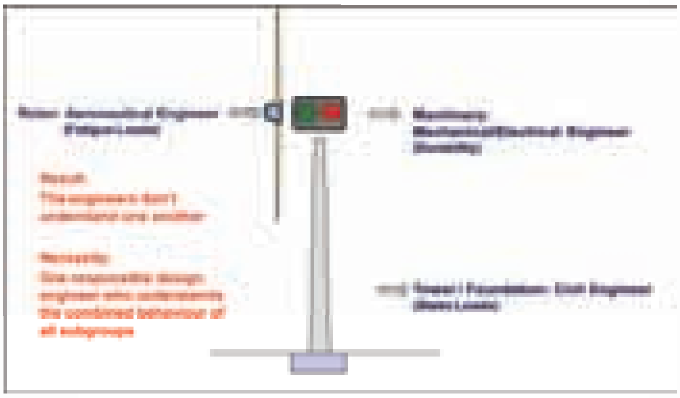

Fig. 3 Types of engineers involved in the design of wind turbines

The engineers don't understand one another and the overall responsible engineer who knows about the importance of all aspects very often is missing in the design teams. I like to repeat: wind turbines are not simply the result of combining components. It is absolutely necessary to know in detail the interactions between them. The same is valid for the responsible design engineers. The simple combination of the different specialists is not sufficient, if there isn't one who understands the operational properties of the whole wind turbine.

This short listing of necessities for a successful implementation of wind energy is certainly not complete and cannot be further discussed in detail in this paper. Here should be shown in short words that a sustainable implementation of wind energy needs many legal, procedural changes and accompanying efforts, because the surrounding engineering and energy application world was not designed for the use of wind turbines for energy production. They have to be adapted to the needs of wind energy.

4. Overview of Technology Developments in the Last Decade & Future Developments

For a long time most of the operating wind turbines were designed as stall regulated, three bladed, directly grid coupled wind turbines, called Danish type, which started their success story in the eighties of the last century. But pitch controlled wind turbines came up, originally developed in Germany, and were introduced into the market mainly by Vestas and Enercon. One of the most important further development steps came from Enercon using variable rotor speed, direct drive generators and inverter based grid connection. For many years Enercon was the only manufacturer with a direct drive concept and electrically excited large ring generators. Some years later the German Vensys team developed a direct drive concept using permanent magnet generators and also the variable rotor speed with pitch control. During the last three to four years some manufacturers like Goldwind in China and IMPSA in Argentina produced this type under a licence agreement of Vensys. With the growing size of wind turbines more and more manufacturers took over the pitch regulation of the rotor blades for power control and the loads reducing variable rotor speed. Today stall control for the multi-MW wind turbines doesn't exist any longer. Variable rotor speed could be achieved by different electrical lay-outs: indirect grid connection via a full frequency inverter system, doubly fed induction generators with rotor speed variations of 60%, respectively 40% of nominal rotational speed and a third solution with much less rotor speed variability (about 10%) achieved by an increased slip of the induction generator as used by Vestas. Some other manufacturers have concepts for variable rotor speed based on mechanical adaptations. One example is the DeWind wind turbine (2 MW) with the Voith "WinDrive" transmission gear, a mechanical-hydrodynamic adaptation of the variable rotor speed to the fixed grid

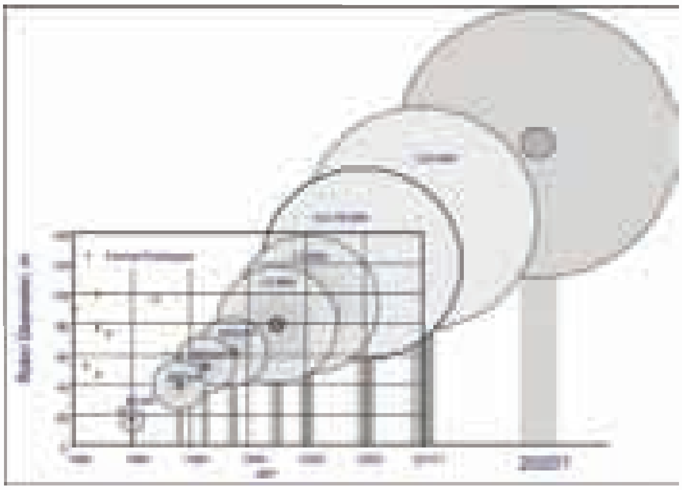

Fig. 4 Development of wind turbine size during the last 25 years

frequency other solutions are electro-mechanical differential gearboxes.

The lasting gear box problems, more frequently occurring in areas of high turbulences, and the pressure to have as few rotating components as possible in offshore applications to minimize maintenance, brought an increasing number of manufacturers to the decision to change at least part of their offered wind turbine types to the direct drive technology.

Up to now all these manufacturers apply the less complex permanent magnet excited generators. Only Enercon still uses the electrically excited generator. For permanent magnets rare earth metals have to be used (Neodym) which are only available in limited quantities, ex-tracted mainly by China which in addition restricts the exportation quantity. Some principal wind turbine types currently used in the market are shown in Fig. 5.

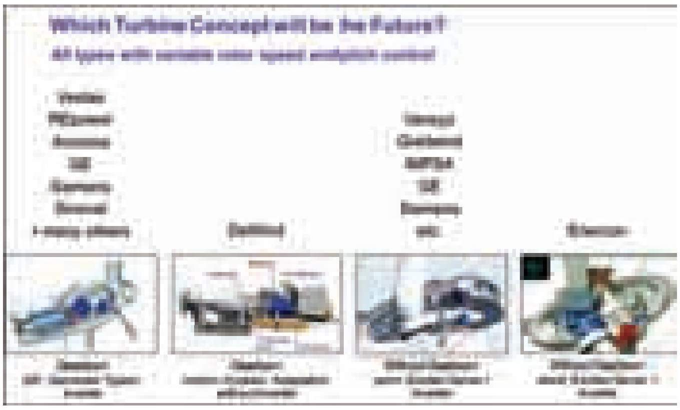

Fig. 5 Actual wind turbine types used in the market

5. Steps to be Taken in Achieving the Target Level of 20% by 2020 in India

To achieve 20% wind energy contribution in the electrical supply of India the local wind turbine manufacturers must not only be able to deliver technically reliable wind turbines and to provide the necessary long term maintenance, but also the electrical distribution infrastructure must be able to take over the load. Normally the electrical supply system of a country is based on power plants near the large consumer centres from where the energy is distributed to the low-consumption countryside. That means near the consumer centres the power lines are strong whereas their capacity in the countryside is low. But wind energy mainly will be produced in the countryside with the need to transport the electricity to the consumption centres or in other words, the weak grid in the countryside cannot take over the load generated by wind power. The consequences are that the power lines have to be reinforced or even new lines have to be built. The question has to be solved, should each wind farm developer pay his own power line or should it be the task of the distribution utility to provide a power line for the connection of several wind farms. If each wind farm has its own power line a waste of money and a negative impact on the landscape will be the result. In the second case the energy distributor will finance and build a line for several wind farms, which is less costly and has less visual impact. A country with high wind energy penetration in the electrical distribution grid has to investigate which means are necessary to maintain a stable grid operation in all wind situations.

6. Key Technological Challenges for Achieving 20% Grid Penetration by 2020

As described in the previous chapter many challenges have to be met and adaptations be made for the use of wind energy if electricity generated by wind shall reach 20 % grid penetration. Assuming an average capacity factor of 20% for wind farms in India [2], an electricity production share of 20 % means that in high wind speed situations up to 100% of the India-wide average energy consumption could be produced by wind farms. This figure shows that there is a need for a one-day-ahead wind energy generation prediction to be able to plan the electric power plant use of the next day. Those prediction tools for utilities exist, but certainly have to be adapted to the special meteorological situation and the behaviour of the conventional power plant installations of India.

Roughly said the statistically guaranteed capacity of wind turbines is about the average power output if the share of wind energy is less than 5% of the installed grid power. With in-creasing shares this value decreases to 0% guaranteed wind power if the energy supply by the grid is produced only by wind farms. In Germany federal states exist where wind energy provides on average more than 45% of the local electricity consumption. This means that with the 25% average wind capacity factor in Northern Germany under high wind speed conditions especially during night, wind is able to produce more than twice the energy needed to cover the consumption. Electric energy transport to regions with less wind energy penetration under this condition becomes a must or wind farms and/or conventional power plants have to operate with reduced power. Well defined rules have to be established about which kind of power plants have to reduce their power output under surplus conditions: wind farms or conventional power plants?

To be flexible, energy transportation lines to other regions have to be available and again rules have to be defined who is allowed to use them. Energy purchased on the spot market and sent to other areas or wind farm energy surplus which otherwise would be lost? This question leads to another important question: Are there any existing storage possibilities, like hydroelectric pump storages or hydro power stations which can be used to balance the wind energy fluctuations? But there is also the possibility to consider if the wind turbines should be designed for highest energy production at lowest cost (the actual situation) or if they should contribute better to the grid stability by producing a more steady energy flow? To explain this in simple words, a wind turbine of let us say 100 m rotor diameter could be equipped with a generator of 1 kW or with one of 10,000 kW. In the first case the wind turbine operates nearly 100 % of the year, but the cost of the generated energy is extremely high due to the cost of the large rotor and tower. At the same time the costs for the power lines and the substation are very low, because all equipment can be designed for a low and nearly constant energy flow. In the second case, the wind turbine generates the rated power only for some few hours a year, but the whole system has to be designed for this peak load of some hours, high additional costs which never will pay back. Between these two extremes there must be an optimum lay-out for the system consisting of the wind turbine and the grid connection.

Today wind turbines are designed for maximum energy production at lowest cost taking into account only the wind turbine. If they were designed for lowest energy production cost considering wind turbine and grid cost, the result would be a wind turbine with a lower specific power installation per square metre rotor disc area than it is usual today. But if the result of this design is that the wind farm operator generates less profit, someone has to pay the difference in profit, because it is a contribution of the wind farm to the guaranteed power capacity available in the grid. That means wind energy should be reimbursed for the energy generated and for its contribution to the stability of the grid.

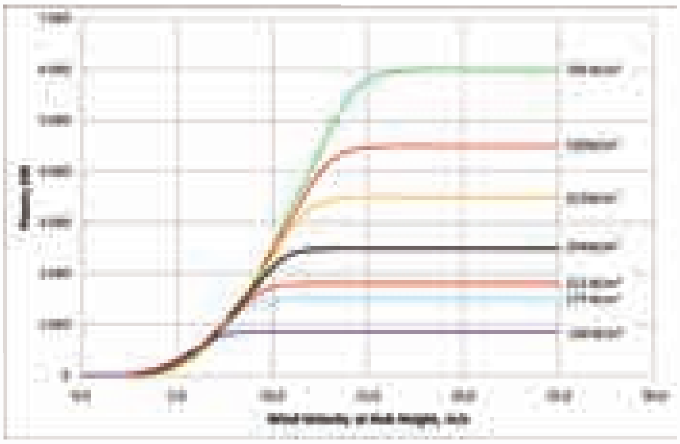

Fig. 6 Power curves of wind turbines with same rotor disc area but different rated power

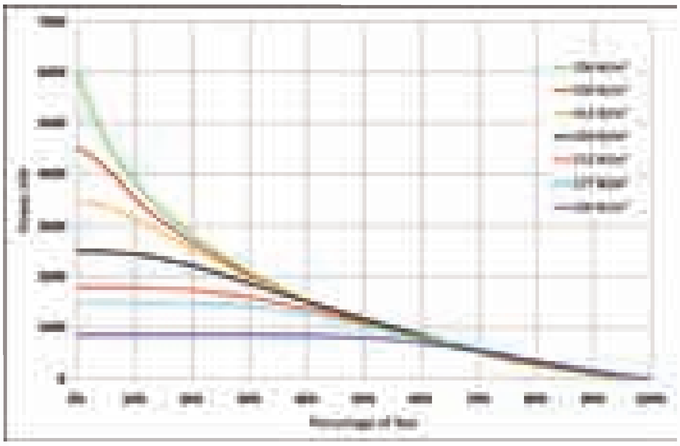

Fig. 7 Power duration curves of wind turbines with the power curves shown in Fig. 6

Fig. 6 shows the theoretical power curves of wind turbines with specific power installa-tions between 100 W/m² and 706 W/m². Whereas the wind turbine with the low power installation of 100 W/m² already reaches rated power at about 7 m/s (Fig. 6) and for nearly 40% (or 3,500 h) of the year (Fig. 7) the one with 706 W/m² needs wind speeds of more than 15 m/s which occur in the chosen case (average wind speed at hub height 7.9 m/s) for about only 100 hours a year. The statistical chance to have at least average power output is for the low loaded wind turbine (100 W/m²) around 64% of the year and for the other one only 39%, a considerable difference in supply security and predictability (Fig. 8).

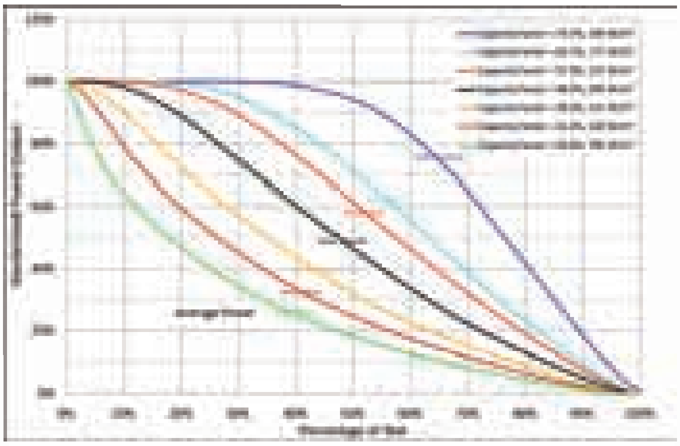

Fig. 8 Standardised power duration curves of wind turbines with different specific power in-stallations

As said above the cost for wind energy generation should not be related to the cost of the installed wind turbine alone but also should take into consideration the grid integration cost. In case of the 100 W/m² wind turbine, the turbine would have a power installation of 850 kW in the case described here, with a capacity factor of 75.5 %. That means the rated power is only 1.325 times higher than the average power output, and the cross section of the copper cables, the switches and substations of the power line are quite well used because they do not have to take over high peak loads.

In case of the 706 W/m² wind turbine (6,000 kW) the capacity factor at the same site is 25.6 % that means the electrical grid connection has to be designed for a peak load of 3.9 times the average power output of the wind farm. On average the cross section of the power line therefore is much less used and in consequence much higher in cost per kWh transported. Fig. 9 shows the normalised total energy generation costs for the wind turbines depending on the site-specific wind speed including the correspondent grid connection and based on the specific power installations used in Fig. 6 to Fig. 8. With increasing average site wind speed, the minimum of the cost trend for the generated energy becomes more and more flat. Under the assumption of a wind speed of 8 m/s at hub height the minimum is at about 350 W/m² to 400 W/m². If one wants to increase the capacity factor to contribute in the grid supply with more guaranteed power output, the specific power installation has to decrease. The trend in Fig. 9 however indicates that then the energy generation cost increases, certainly a not acceptable disadvantage for the operator of the wind farm. To convince him to install such a lay-out of the wind turbine, he must earn a monetary compensation for his contribution to the grid stability. The rough investigation presented here shows that with a well adapted wind turbine specific power installation a more predictable wind energy supply can be achieved. This would otherwise only be possible with a storage device which certainly is much more expensive than a necessary monetary compensation paid to the wind farm operator. The time is coming to think more about the optimum design of the supply system consisting of the wind turbine and the grid rather than only optimising the wind turbine economics. This is valid for onshore and even more important for the grid integration of the very large offshore wind farms if wind energy shall become an important part of a country's electric energy supply system.

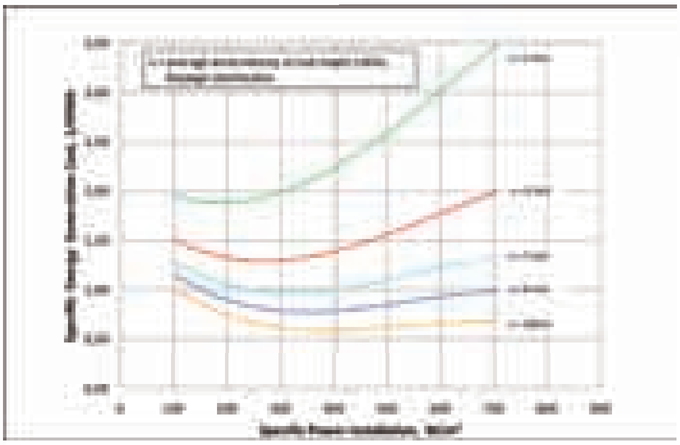

Fig. 9 Specific energy generation cost standardised in relation to 400 W/m² and 7 m/s wind speed

7. Literature

[1] Ender, C., Windenergienutzung in der Bundesrepublik Deutschland – Stand 30.06.2004. DEWI Magazin Nr. 25, August 2004, Wilhelmshaven

[2] BTM Consult ApS, World Market Update 2009, March 2010

[3] Ender, C., Windenergienutzung in der Bundesrepublik Deutschland – Stand 31.12.2010. DEWI Magazin Nr. 38, February 2011, Wilhelmshaven, Germany

isn't it time we looked at the wind as a serious alternative?

Today, wind energy is the fastest growing source of alternate energy. This makes it ideal in ensuring a sustainable future. At Suzlon, our expertise, experience and unfaltering commitment enables us to deliver profitable wind energy solutions, which add to global power portfolios. We have also helped propel socio-economic and infrastructural development. Partner with us, and let us show the world how efficiently the wind can power a cleaner, greener future.


SUZLON
POWERING A GREENER TOMORROW
∴ THEREFORE
SUZLON

Letter to NEDCAP, regarding Andhra Pradesh State Issues on Capacity Allotment

Dated : 23.4.2011

The Vice Chairman & Managing Director,
Non-Conventional Energy Development Corporation of Andhra Pradesh Limited,
5-8-207/2, Pisgah Complex, Nampally, Hyderabad – 500 001.

Dear Sir,

The Indian Wind Power Association (IWPA) has conducted a meeting on April 21, 2011, at Hotel Katriya, Somajiguda, Hyderabad to discuss the capacity allotments and other issues related to wind power projects. All the stakeholders and parties interested in investing in wind power projects in Andhra Pradesh state, have been invited for this meeting.

Though the meeting was organized by IWPA, the invitations were sent even to non-members of the association to ensure that we have a good discussion among the stakeholders to arrive at a consensus, which would in turn help NEDCAP to streamline the project sanctions.

Please find the minutes of the meeting for you immediate reference.

We thank you for the continuous support you have been extending for the development of wind power projects in the state and would also assure that the IWPA would be at the forefront in supporting the cause of realizing the untapped wind potential of the state.

We will be at your disposal for any further clarification.

With Regards
Yours Sincerely,
For **Indian Wind Power Association,**

Coordinator
AP Chapter

Copy to : Sri Kasthoorirangaian - Chairman, IWPA, Chennai

Minutes of Meeting held at Katriya Hotel & Towers on 21st April 2011

Members Present :

1. Mr. N. Gopala Krishnan – Ecorenenergy
2. Mr. Rajat Ray - Ecorenenergy
3. Mr. Tirumala Raju – Rayalaseema Wind Power Pvt. Ltd.,
4. Mr. Nitin Mathur – Vision Renergies
5. Mr. Sandeep .B – Speed Vidyuth Ventures
6. Mr. A. Venkata Naidu – NSL Renewable Power
7. Mr. A. Rajanikant – NSL Renewable Power
8. Mr. A. Narayana Reddy – Shalivahana
9. Mr. Sreedhar Kumar - Regen Powertech
10. Mr. P. Vilas Kumar – Helios Infratech (Developer)
11. Mr. K. Suresh Raju – My Home Power Ltd
12. Mr. N. K Das – Suzlon Energy
13. Mr. P. Vilas Kumar – Guttaseema Wind
14. Mr. K. Srinivasa Rao – Suzlon Energy
15. Mr. Chandrasekhar Nivarty – Belum Wind Power Pvt. Ltd
16. Mr. Ramu Kuppa – Vestas India
17. Mr. S.R. Deshmukh – Vestas India
18. Mr. M.H. Nath – Vayu Urja Bharath
19. Mr. S.S. Murali – Enercon (India) Limited
20. Mr. A.V. Bhargava – Enercon (India) Limited
21. Mr. A. Siva Kumar – Top View

A meeting was convened by the IWPA to discuss the procedures to be followed for the allotment for the developers. Invitaitons were sent to all the members as well as non members. On discussing at a length the following conclusions were arrived at.

Wind Monitoring Studies :

1. The areas should be allocated for taking up wind monitoring on first come first basis after checking that the areas are not over lapping with previous allocated areas.
2. Wind Monitoring should be permitted for 2 full wind seasons.
3. The applied areas should be demarcated on a full SOI color map of 1:50000
4. Wind Monitoring taken up in areas without NEDCAP MOU should not be eligible for Capacity Allocation.
5. To avoid huge areas being blocked, NEDCAP may take a view on the areas proposed to be taken up for wind monitoring.

6. It was felt that the restriction of the 500Ha area for doing the Wind monitoring in forest areas is inadequate as the developers are required to put more number of wind masts which is redundant and is not serving the purpose. Hence an area of minimum 3 km radius should be considered for Wind resources assessment in the Forest areas.

Capacity Allocation in notified areas :

1. For the MOUs already signed by NEDCAP in the notified areas, preference shall be given to the original developers for the capacity sanction.
2. Capacity Allotment should be given on first-cum-first serve basis by the NEDCAP as per the demarked areas given by the Developer supported with 1:50000 topo sheet.
3. Project execution time frame should be fixed from the date of land and evacuation clearance given by the concerned Government body/ agency in case of Revenue / Forest areas and not as per the Capacity Allotment agreement signed date with NEDCAP.
4. Private lands are available for development of the projects, developers without valid approvals / sanctions have been buying lands subsequently approaching for capacity sanctions, which should be discouraged and only the original allottee shall have the right to develop projects in these areas.
5. Since all the capacity allotments in the notified areas are supported by toposheets clearly demarcating the boundaries, the capacity optimization should be left to the developer and there should be on increasing the capacity of the site.

Capacity Allocation in self identified sites developed under MNRE guidelines :

1. Developers should be permitted to optimize the capacity in the identified areas and there should not be any restriction on the capacity allocation within the identified boundaries of the applied area. It may be noted that there should be no restriction on taking capacity allocation in notified private areas.
2. MNRE guidelines for wind measurement by private sector and subsequent development (No. 51 / 9 /2007-WE) should be followed for opening the site other developers.
3. Only after the allocations are made the areas and capacities should be uploaded in the website.

Bank Guarantee :

➢ Since NEDCAP is already collecting a substantially increased fee of Rs. 1.5 lakhs per MW Capacity Allocation, the Bank Guarantee amount for executing wind power projects should be reduced to avoid blocking of cash flows of the developers. This was also expressed during the developers meeting at Dr. Marri Chenna Reddy HRD Institute.

➢ Forest areas can be fixed at Rs. 25,000/- per MW as there is huge cost involved in procurement of Forest land.

➢ In Private Areas can be fixed at Rs. 25,000/- per MW

➢ In Revenue lands can be fixed at Rs. 1 lakh/- per MW

IWPA - Representation to TNERC, regarding Public Notice on Revision of Comprehensive Tariff Order on Wind Energy Order No. 1 of 2009 dated 20.3.2009

Please refer to your letter no. TNERC/D(E)/DD(E-II)/AD/SA/F.Wind/D.No. 487/2011 dt. 27.4.2011 on the above subject. We are submitting our views on the Revision of Comprehensive Tariff Order on Wind Energy Order No. 1 of 2009 dated 20.3.2009 for your kind consideration.

1. Capital Cost per MW :

The Hon'ble commission during the year 2009 fixed the capital cost as 5.35 crores /MW. Because of escalation in the land cost by 3 to 4 times and the machine cost to the tune of 20 – 30%, we suggest to revise the capital cost to Rs. 6.0 crores /MW.

2. Capacity Utilization Factor :

During the last Tariff Order, the Hon'ble Commission determined 27.15% as the capacity utilization factor. We would like to submit at present that most of the high wind region got exhausted on the insulation of wind turbines to the tune of around 6000 MW. The wind potentiality in the upcoming regions is not as good in the previous occasions. Therefore, our humble submission to keep the capacity utilization factor in the range of 25%.

3. De-rating of machines :

The Hon'ble Commission during the previous Tariff Order had fixed the de-rating at 1% per annum after the first 10 years. The commission has been again requested to fix the de-rating at 1% after the first 5 years. The existing statistics in all the wind mills in TamilNadu would clearly establish that the de-rating is taking place after 5 years and not after 10 years. Therefore, based on the statistics proved in this regard, the commission may fix the de-rating at 1 % per annum after 5 years instead of 10 years.

4. Debt - Equity Ratio :

In its prior order, the Commission had considered a debt: equity ratio of 70:30.

It may be changed to 75:25.

5. Term of Loan :

In its prior order, the Commission fixed the tenure of term loan as 10 years with moratorium of 1 year. It may be changed to 5 to 8 years.

6. Interest on Loan :

In its prior order, the Commission had considered an interest rate of 12%. It can be 12 to 13% current prevailing rates.

7. Return on Equity :

In its prior order, the Commission had 19.85% pre-tax return on equity and 15.5% post tax return to be allowed after 31-3-2009. We suggest a post tax return of 16%.

8. Life Period :

The Commission had fixed the life period as 20 years during the last Tariff Order. It may remain the same.

9. Rate of depreciation :

Straight-line method may be followed for the depreciation.

10. Operation and Maintenance Expenses (O & M Expenses) :

O and M Expenses may be fixed as 1.5 to 2.5% of the investment with annual escalation of 5%.

11. Insurance Expenditure Per Annum :

In its prior order, the Commission had proposed an insurance rate of 0.75% of the machinery cost (85% of the capital investment), for the first year to be reduced by half a percent of the previous year's insurance cost every year thereafter. Minor change suggested to consider insurance as a % of 100% of the capital investment value.

12. Components of Working Capital :

In the prior order, the components of working capital have not been mentioned.

It is proposed that the following be considered for computation of working capital:

i. Receivables equivalent to 2 months of Revenue.

ii. Payables equivalent to 2 months of O&M expenses.

13. Interest on Working Capital :

In the prior order, the interest on working capital has not been mentioned. It is proposed that an interest @12% on working capital loan be considered.

14. Infrastructure Development Charges :

In the prior order, infrastructure development charges of Rs.25 lakhs per MW has been considered which should be borne by the distribution licensee and the State Transmission Utility (STU). As mentioned earlier, it is proposed to consider the Infrastructure Development Charges to be at 29.16 lakhs/MW, which is present rate.

15. Auxiliary Consumption :

In the prior order, Auxiliary Consumption has not been discussed. It is proposed, that Auxiliary Consumption @ 5% be permitted by the utility.

16. Banking :

The Commission during the last Tariff Order had fixed 5% as the banking charges and so long as R&C Measures continues, the encashment benefits in respect of unutilized banked wind energy would fetch 100% of wind tariff fixed by the Commission. We humbly submit to the Hon'ble Commission that as the wind season starts mostly at the end of April every year, we suggest that the wind banking adjustment year may be changed from April – March to 1st May to 30th April. By adopting this, by and large there won't be much unutilized banked wind energy at the end of the wind period. Further, the Commission is requested to retain the present level of 5% banking charges for this time also.

17. Transmission & Wheeling Charges :

It is hereby suggested that the Commission may continue to have the same 5% in respect of wheeling and transmission charges.

18. Cross Subsidy Surcharges :

During the last Tariff Order, the Commission decided to levy 50% of the Cross Subsidy Surcharges for wind energy generators. As this cross subsidy surcharge is being phasing out in many states, we request the Commission to remove the cross subsidy surcharge for Renewable Energy.

19. CDM Benefits :

The Commission during the last Tariff Order had fixed CDM benefits as 50:50 between the developers and the consumers at the 6th year. It is the investment made by the wind mill owners and this concept of sharing should be avoided as TANGEDCO / Utility have no investment or efforts or role to play for claiming this benefit.

20. Reactive Power Charges :

The Commission may retain the existing provision.

10 paise per unit after minimum of 10 %.

21. Grid Availability Charges : Pro rata :

These should not be levied for wind power projects as Section 86(1)(e) of EA 2003 talks of measures required to be taken to enable connectivity to grid for renewable energy sources and grants the Hon'ble Commission the power to take such steps. To promote renewable energy generation in the state it is imperative that such gird be made available for the generating plants and all generation from such plants be injected in such grid on a "must-run" basis.

22. Adjustment of generated energy for captive use :

No lapsing of unutilised Banked Energy should be done at the end of the year. 100% billing value of to be paid at end of normal year and during power cut years Rs. 4, the H.T. tariff rate.

23. Scheduling and System Operation Charges :

The Scheduling and System Operation Charges fixed in Order No 2-5 dated 11/10/2008 at Rs.300/day/1.65 MW and pro rata for each service connection to remain the same.

24. Application Fees and Agreement Fees :

Existing provision may be continued.

25. Billing and Payment :

The invoices generated to be paid in 30 days. Interest @ 18% to increase in arithmetic progression over months.

26. Payment Security and Security Deposit :

2 months bank security. Existing provision may be continued.

27. Energy Purchasing & Wheeling Agreement :

To be kept as they are now.

28. Scheduling of Wind energy/ UI Mechanism :

Forecasting should be obtained by the utility. No scheduling and no UI should be made applicable for wind farms having capacity less than 10 MW, as per CERC norms.

29. Special treatments, If any, for wind farms beyond say 100 MW :

It is proposed that as an incentive to large promoters to come up with renewable capacities exceeding 200MW, the Commission should consider project specific tariff for each of such project. This Project Specific tariff should be higher than the Generalised tariff to compensate for the higher risk and efforts taken for large project.

30. Any Other Issues :

Time Value of Money : The tariff to be linked to the gold and steel prices and should not be flat or fixed for 20 years. Tariff to have yearly escalation to compensate for rising costs & falling value of money.

Forecasting : Utility should obtain forecasting of wind power from concerned experts. It should not be insisted from the investors with less than 10 MW capacity. The average size of wind farm in Tamil Nadu is 2.59 MW. One year banking and year round wheeling to stay without insisting on scheduling.

Revision of Tariff : When new tariff is announced, all existing windmills supplying power to utility at different rates like Rs. 2.75, Rs. 2.90 and Rs. 3.39 also to get new tariff now announced uniformly as quality of energy supplied is same and with efflux of time the tariff money has been continuously loosing its value and purchasing power.

Status of Wind Power in India

1.1 Renewable energy in India

Nearly two decades ago the Indian economy was snatched back from the brink of a composite economic crisis[1]. The Indian government undertook some hard-hitting liberalization measures that would have been unthinkable in a business as usual political landscape. Largely as a result of those actions, today India is in a position to be counted as one of the 'emerging economies'.

Successive governments have looked towards locking in an average economic growth rate of at least 6-8%, up from 3.5% from the 1950s through the 1980s. The original objective of the 11th Five Year Plan (2007-2012[2]) was to achieve a GDP growth rate of 9% over this period. This was revised to 8.1% last year[3] by the Planning Commission. Given the plans for rapid economic growth, the requirement for energy services and supporting infrastructure is simultaneously escalating.

Electricity demand has continuously outstripped production, and a peak energy shortage of around 12.7% prevailed in 2009-10[4]. To meet this shortfall as well as the National Electricity Policy target of 'Electricity for All by 2012'[5], the cleanest options available to India are Renewable Energy Technologies (RETs). For the government to seriously consider meeting its promise of electricity for all by 2012[6], renewable energy options including wind power will have to play a crucial role in India's emerging energy mix. Not only are they environmentally sound but also their project gestation periods are significantly shorter than those for thermal or nuclear power plants.

According to the Ministry of New and Renewable Energy (MNRE), today the share of renewable based capacity is 10.9% (excluding large hydro) of the total installed capacity of 170 GW in the country, up from 2% at the start of the 10th Plan Period (2002-2007). This includes 13,065.78 MW of wind, 2,939 MW of small hydro power, 1,562 MW of (bagasse based) cogeneration, 997 MW of biomass, 73.46 MW of 'waste to power' and 17.80 MW of solar PV for grid connected renewables at the end of 2010[7].

The originally stated cumulative target for the current plan period was to add 92 GW[8] of new capacity of which about 14 GW was to come from renewable sources. Given the right mix of regulatory and institutional support, renewable sources could meet the proposed capacity addition of 14 GW from renewable energy before the end of the 11th five year plan-period (2007-2012). This would bring the total share of renewable energy sources upto 15% of the new installed capacity in the 11th plan-period.

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 is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and has as part of its obligations released a National Action Plan on Climate Change[9] (released in June 2008) by Prime Minister Manmohan Singh which has laid out his government's vision for a sustainable and green future for India's economy.

India's developmental needs will be challenged by climate change impacts. This requires a timely pre-emptive shift towards achieving an energy efficient and green economy. Over the next couple of decades renewable energy will play a major role in delivering that shift.

1.2 Wind Power Scenarios

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 (GWEC) developed its scenarios in collaboration with Greenpeace International and the German Aerospace Centre (DLR). These scenarios are updated biennially. The resultant publication - the Global Wind Energy Outlook (GWEO)[10] - first looks toward 2020, and then onwards to 2030 and 2050. Some of the other prominent scenarios are the World Energy Outlook[11] (2010) from the International Energy Agency (IEA) and the Energy [R]evolution: A Sustainable World Energy Outlook[12] by Greenpeace (2010).

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[1] The gross fiscal deficit of the government (center and states) rose to 12.7% by 1990-91. This deficit had to be met by borrowings, the internal debt of the government rose from 35% of GDP at the end of 1980-81 to 53% of GDP by 1990-91. The foreign exchange reserves had dried up to the point that India could barely finance three weeks worth of imports and had to air-lift its gold reserves to raise 600 million dollars from the Bank of England. http://www.cid.harvard.edu/archive/india/pdfs/530.pdf

[2] The Indian Fiscal year runs from April to March. Hence 11th Plan period will run from April 2007 – March 2012, The 12th Plan period will run from April 2012 to March 2017.

[3] http://economictimes.indiatimes.com/Policy/Commission-scales-down-11th-Plan-growthtarget-to-81/articleshow/5714921.cms

[4] http://www.mnre.gov.in/pdf/mnre-paper-direc2010-25102010.pdf

[5] http://economictimes.indiatimes.com/news/news-by-industry/energy/power/electricity-for-all-by-2012-power-minister/articleshow/3836381.cms

[6] Currently about 400 million people do not have access to electricity in India.

[7] http://www.mnre.gov.in/ Click on link to 'Achievements' section. There could be some rounding-off errors.

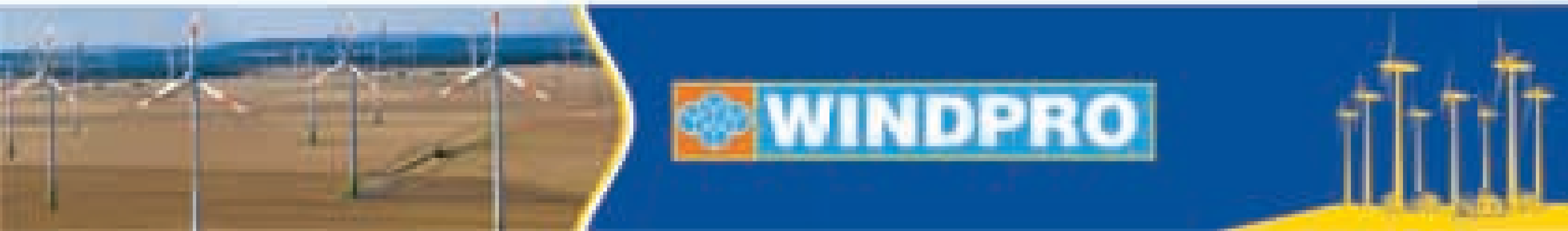
[8] http://planningcommission.gov.in/plans/planrel/fiveyr/11th/11_v3/11v3_ch10.pdf

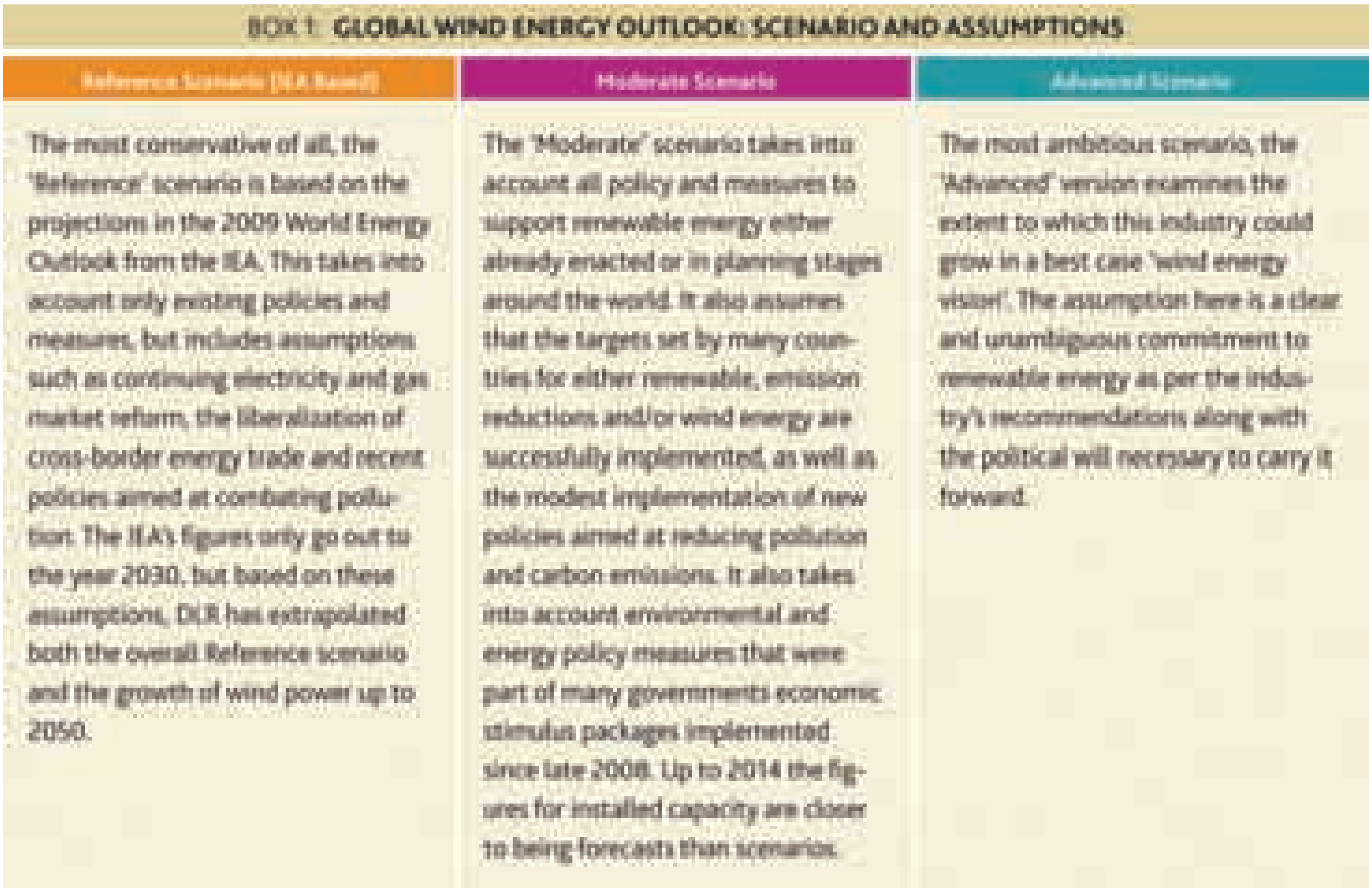
[9] http://pmindia.nic.in/climate_change.htm

[10] http://www.gwec.net/index.php?id=168

[11] http://www.worldenergyoutlook.org/docs/weo2010/WEO2010_es_english.pdf

[12] http://www.springerlink.com/content/nu354g4p6576l238/fulltext.pdf





BOX 1: **GLOBAL WIND ENERGY OUTLOOK: SCENARIO AND ASSUMPTIONS**

Reference Scenario (IEA Based)	Moderate Scenario	Advanced Scenario
The most conservative of all, the 'Reference' scenario is based on the projections in the 2009 World Energy Outlook from the IEA. This takes into account only existing policies and measures, but includes assumptions such as continuing electricity and gas market reform, the liberalization of cross-border energy trade and recent policies aimed at combating pollution. The IEA's figures only go out to the year 2030, but based on these assumptions, DLR has extrapolated both the overall Reference scenario and the growth of wind power up to 2050.	The 'Moderate' scenario takes into account all policy and measures to support renewable energy either already enacted or in planning stages around the world. It also assumes that the targets set by many countries for either renewable, emission reductions and/or wind energy are successfully implemented, as well as the modest implementation of new policies aimed at reducing pollution and carbon emissions. It also takes into account environmental and energy policy measures that were part of many governments economic stimulus packages implemented since late 2008. Up to 2014 the figures for installed capacity are closer to being forecasts than scenarios.	The most ambitious scenario, the 'Advanced' version examines the extent to which this industry could grow in a best case 'wind energy vision'. The assumption here is a clear and unambiguous commitment to renewable energy as per the industry's recommendations along with the political will necessary to carry it forward.

There are many variables that will determine the path of development and growth of wind energy. The box above lists the assumptions underlying the GWEO scenarios and associated assumptions for wind power development.

GWEO Scenario Results

The GWEO scenarios show that even with the continuation of current policy measures to encourage wind power development and serious government efforts to meet existing targets, the resulting 'Moderate' scenario growth will put the development of wind power on a dramatically different trajectory from the IEA-based 'Reference' scenario.

The global wind markets have grown by an average 28% per year in terms of total installed capacity during the last decade. The IEA's Reference scenario suggests that growth rates for wind power would decrease substantially in the coming years, and that 2010 would see an addition of only 26.8 GW. However, in reality the global wind industry added 35.8 GW during the year[13].

The Indian market grew by almost 68% on a year-on-year basis with 2,139 MW of new capacity installed between January and December 2010. This made India the third largest annual market after China and the USA for 2010. With more than 13 GW of total installed capacity at the end of 2010, India ranks fifth in the world in terms of cumulative installed capacity.

The IEA projects that 327 GW of power generation capacity will be needed in India by 2020, which would imply a yearly addition of about 16 GW. This is reflected in the stated target for new capacity addition by the Indian government under its 11th Five Year Plan. The plan envisages an addition of 78.7 GW by 2012 from traditional sources (coal, nuclear and large hydro) and an additional 9 GW by 2012 (revised from 10.5 GW) from new wind generation capacity.

During the first three years of the 11th Plan period ending March 2010, India added 4.6 GW of wind power capacity. With over a year to go before the current plan period is over it is very likely that Indian wind power installations will meet and exceed the 11th plan-period target, which will be a record of sorts as historically the targets have never been met through conventional thermal and hydro projects within a plan period.

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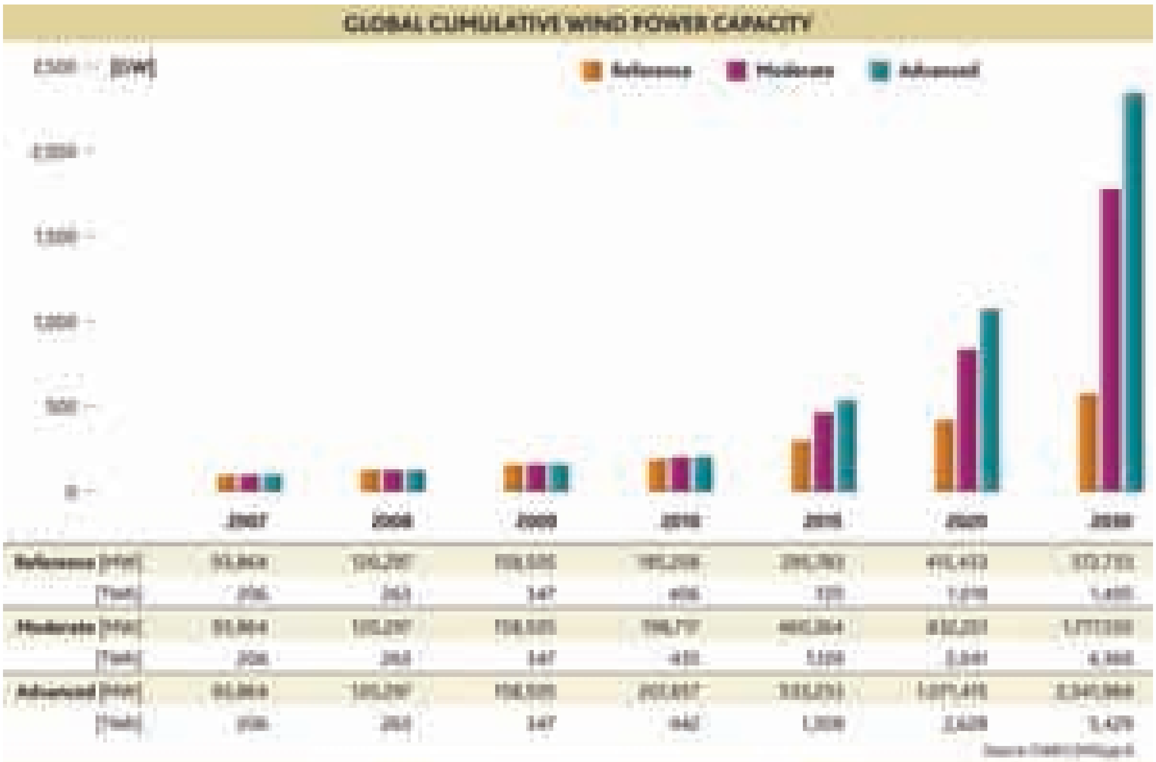
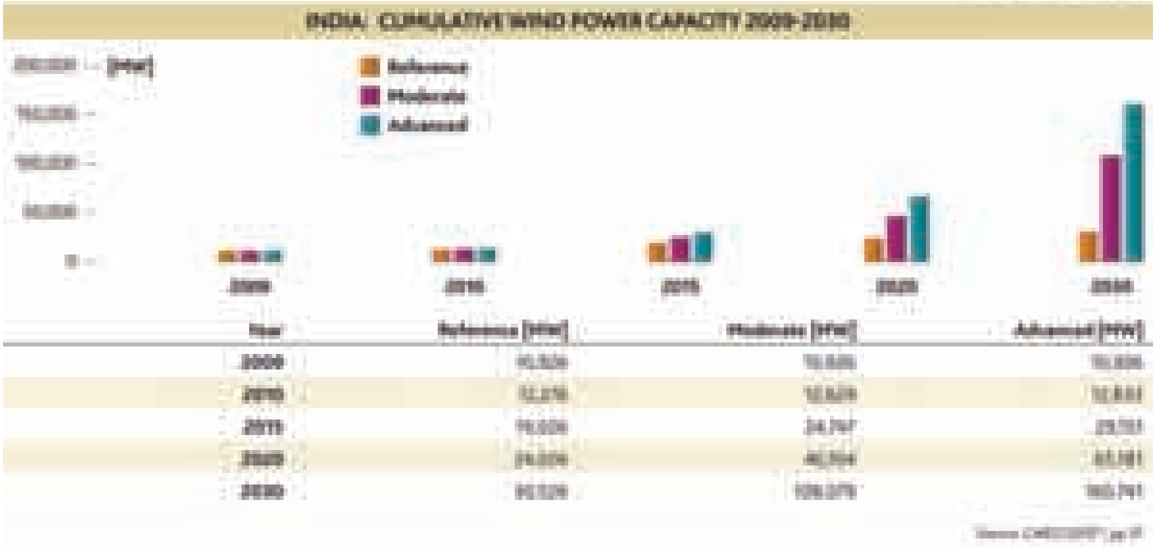
[13] http://www.gwec.net/index.php?id=30&no_cache=1&tx_ttnews[tt_news]=279&tx_ttnews[backPid]=97&cHash=01e9c85e9f





Under the IEA's Reference scenario, India's wind power market is shown to shrink considerably to only about 600 MW per year by 2030. This translates into a total installed capacity of merely 24 GW by 2020 and 30.5 GW by 2030. Wind power would then produce close to 60 TWh every year by 2020 and 75 TWh by 2030, and save 35 million tons of CO2 in 2020 and 45 million tons in 2030. Investment in wind power in India would drop to about $910 million by 2030[15] [at 2010 $ value].

However under the GWEO scenarios, we expect that by the end of 2015, between 24.7 GW and 29 GW will be installed in India. Under the moderate scenario this would reach almost 46 GW by 2020 and 108 GW by 2030. In this scenario, about $9 billion would be invested in Indian wind power development every year by 2020, representing a quadrupling of the 2009 investment figures. Employment in the sector would grow from the currently estimated 28,000 jobs to over 84,000 by 2020 and 113,000 by 2030.

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[14] The actual installed capacity at the end of 2010 was 13,065 MW, which was in fact ahead of even the Advanced Scenario projection.

[15] http://www.gwec.net/index.php?id=158

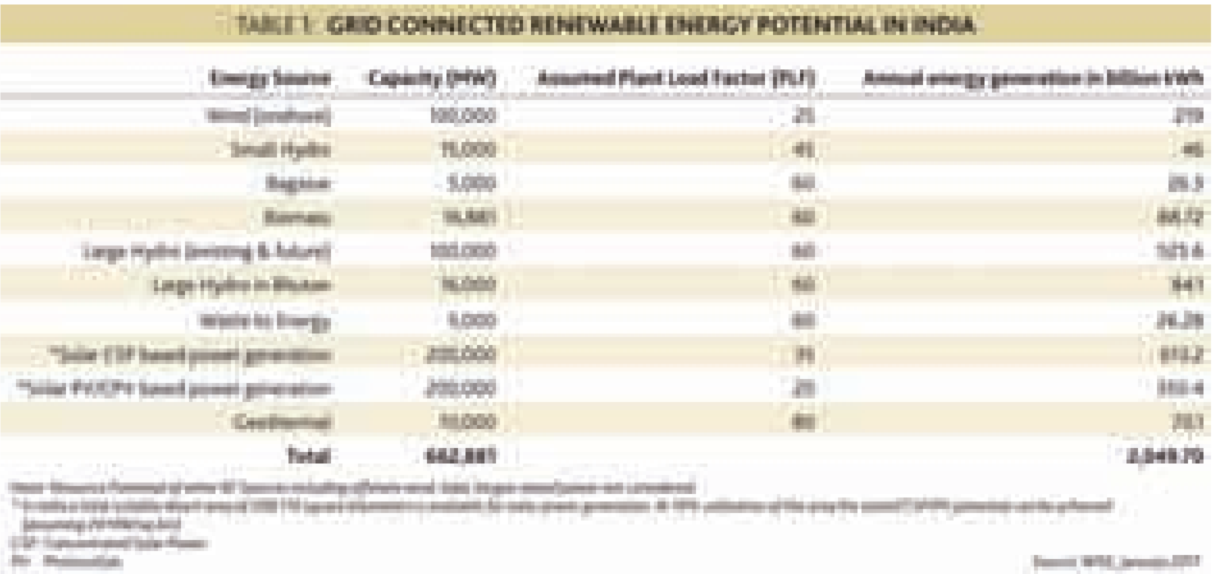

TABLE 1: GRID CONNECTED RENEWABLE ENERGY POTENTIAL IN INDIA

Energy Source	Capacity (MW)	Assumed Plant Load Factor (PLF)	Annual energy generation in billion kWh
Wind (onshore)	100,000	25	219
Small Hydro	15,000	45	46
Bagasse	5,000	60	26.3
Biomass	16,881	60	88.72
Large Hydro (existing & future)	100,000	60	525.6
Large Hydro in Bhutan	16,000	60	84.1
Waste to Energy	5,000	60	26.28
*Solar CSP based power generation	200,000	35	613.2
*Solar PV/CPV based power generation	200,000	20	350.4
Geothermal	10,000	80	70.1
Total	662,881		2,049.70

[illegible]

[illegible]

CSP: Concentrated Solar Power

PV: Photovoltaic

[illegible]

The GWEO advanced scenarios show that wind power development in India could go much further depending upon adequate regulatory support and political will. By 2020 India could have 65 GW of wind power in operation, employing 170,000 people and saving 173 million tons of CO2 emissions each year. Investment by then would be to the tune of $10.4 billion per year. The World Institute for Sustainable Energy (WISE) estimates deploying just the current generation of wind turbines could yield a potential onshore wind power capacity of 65 GW–100 GW.

The Ministry of New and Renewable Energy (MNRE) has so far underplayed the potential of renewable energy (RE) sources in India. WISE did a revised estimate of the true potential of grid-connected RE in India as given in Table 1. WISE sees its own numbers as a conservative estimation.

With the present level of momentum established in India's wind sector, the ten years between 2020 and 2030 could see spectacular growth if some of the systemic barriers are addressed in a timely manner. With the political will geared towards fully exploiting the country's wind resource and reaping the accompanying economic, environmental and energy security benefits, the 'Advanced scenario' could be reached, which would see substantial wind power growth in many regions of the country. Wind power would then be instrumental in achieving a genuine energy revolution, putting India on the path to a sustainable energy future. India is now at a crossroads for making these decisions, which will determine the future of her energy system. As well as, to a great extent, the future of the planet.

1.3 Estimated Wind Power Resource

The Centre for Wind Energy Technology[16] (C-WET) published the Indian Wind Atlas in 2010, showing large areas with annual average wind power densities of more than 200 Watts/m2 at 50 meter above ground level (MAGL). This is considered to be a benchmark criterion for establishing wind farms in India as per CWET and the MNRE[17].

The potential sites have been classified according to annual mean wind power density ranging from 200 W/m^2 to 500 W/m^2. Most of the potential assessed sites have an annual mean wind power density between 200-250 W/m^2 at 50 MAGL. The Wind Atlas has projected Indian wind power installable potential (name plate rating) as 49,130 MW at 2% land availability[18]. This is seen as a conservative estimate of wind power potential in India. Comparative wind power development across some of the Indian states is shown in Annex 1 on page 52.

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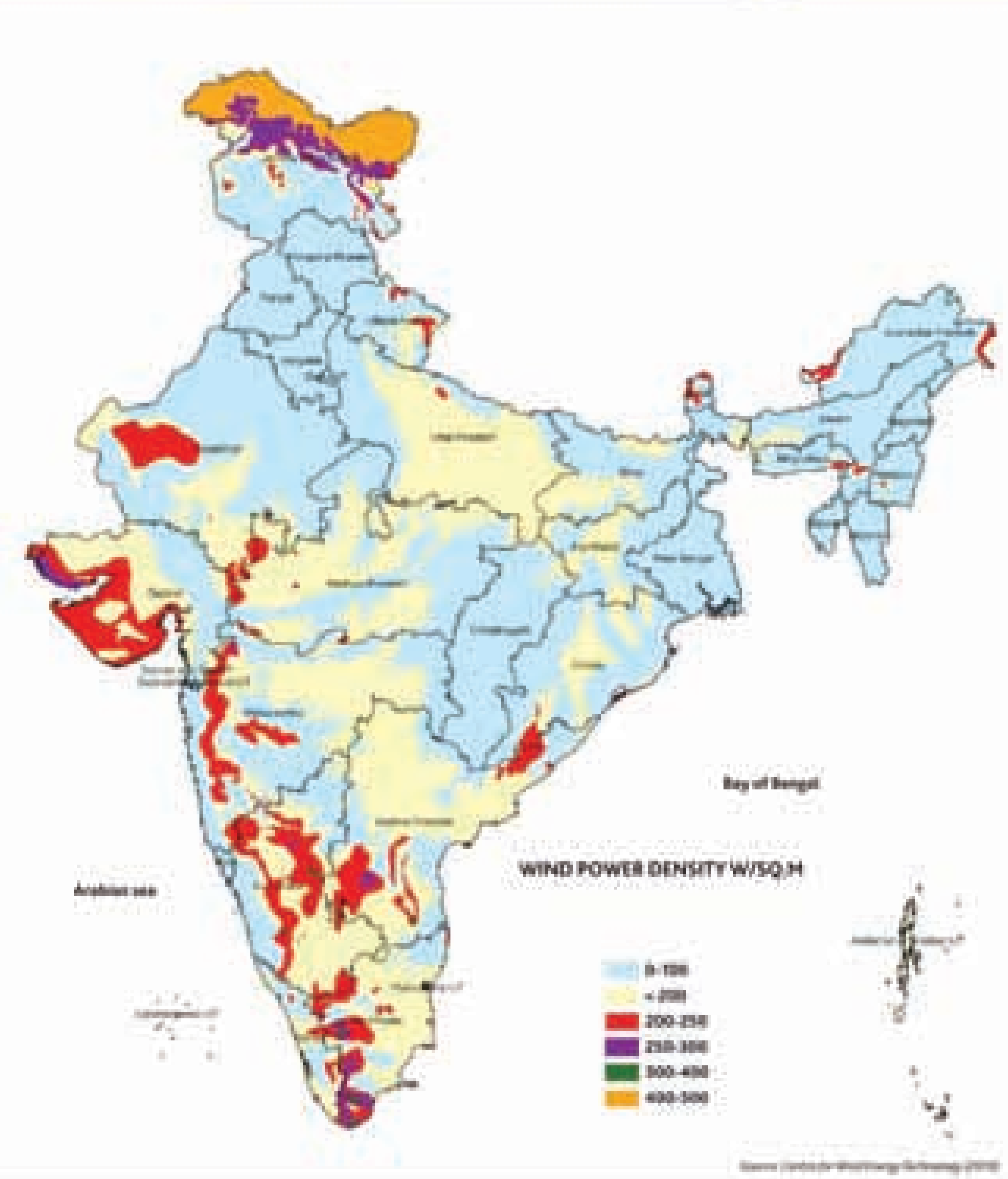
16 In April 2010 C-WET published an Indian Wind Atlas which was prepared in collaboration with Riso, Denmark. Fresh sites are selected for resource assessment by C–WET every year and the rest are closed down, having served their purpose.

17 Centre for Wind Energy Technology: Indian Wind Atlas (2010). In India a site having an annual mean wind power density of 200 W/m2 at 50 [MAGL] is considered a wind power potential site

18 The assessment in the India Wind Atlas is assumed at 2% land availability for all states except the Himalayan States, North-Eastern States and the Andaman & Nicobar Islands. In NE States and in the Andamans & Nicobar it is assumed as 0.5%, however the potential would change as per the real land availability in each state. Further the installable wind power potential is calculated for each wind power density range by assuming 9 MW (average of 7D*5D, 8D*4D and 7D*4D spacing is the rotor diameter of the turbine) could be installed per square km.

WIND POWER DENSITY MAP FROM INDIAN WIND ATLAS (2010)



Source: Centre for Wind Energy Technology (2010)

With the improvement in technology and increase in the hub height of the wind turbine it has become possible to generate more electricity than assumed in earlier estimates. Based on the resource assessment carried out by C-WET, wind speeds in India are in the low to moderate range except in some pockets like coastal southern Tamil Nadu and the Rann of Katch (Gujarat). Further India's as yet un-assessed offshore wind potential was not included in the C-WET study.

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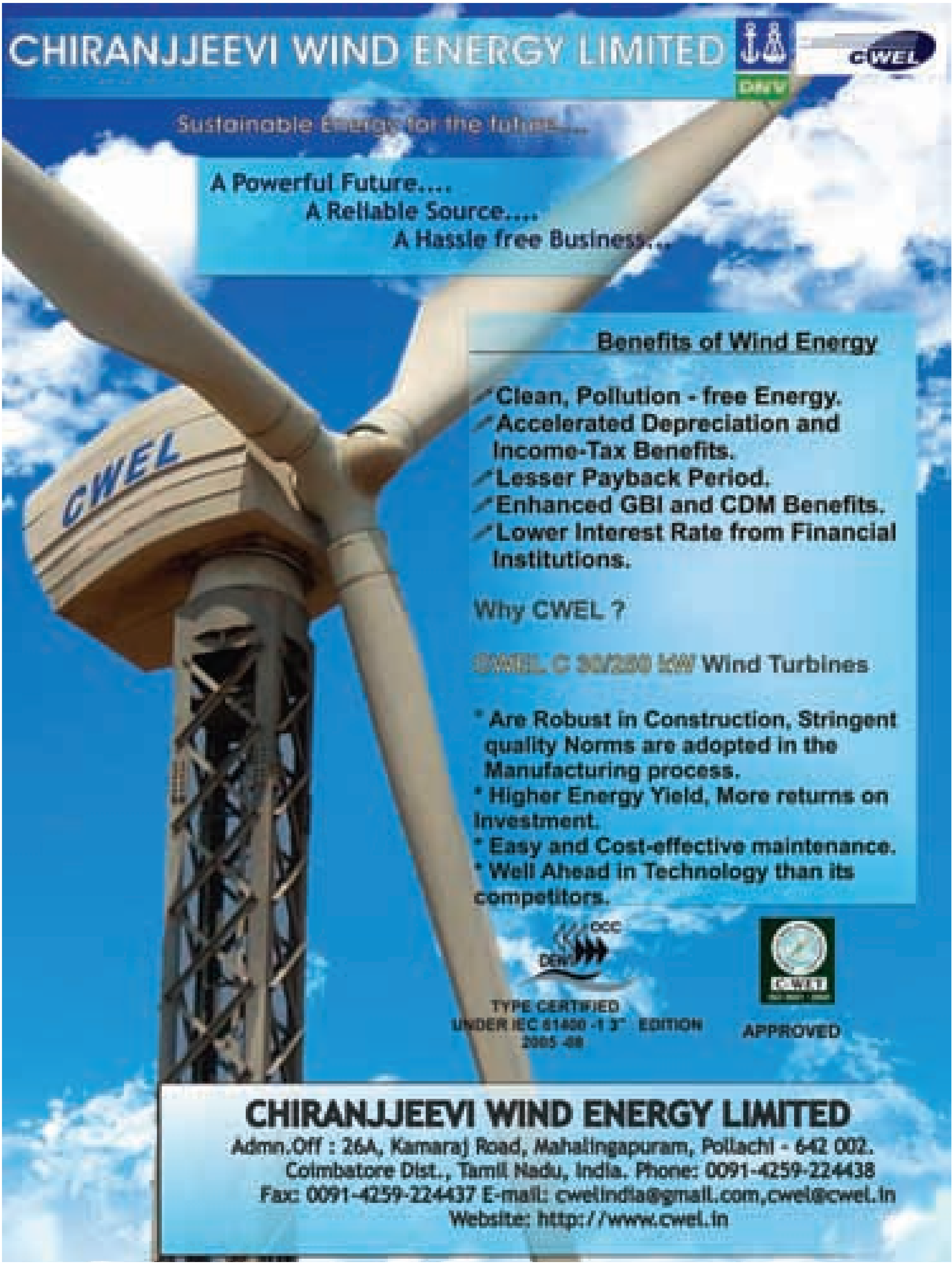

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1.4 Offshore Wind Power Development

A long coastline and relatively low construction costs could make India a favoured destination for offshore wind power.

Offshore wind development is a relatively new phenomenon, and Europe is the only sizeable market at present, with a total offshore capacity of 3 GW. The global offshore wind turbine segment has been dominated by two established players, Vestas and Siemens. However, there are other manufacturers active in the market such as REPower, Sinovel, Areva and Bard, with strong interest from GE Wind, Gamesa, XEMC and WinWinD.

Special construction requirements make offshore wind power 1.5-2.5 times more expensive than onshore, making largescale offshore deployment difficult in developing regions. The current average rated capacity of offshore wind turbines is 2.5 MW as compared to average onshore wind turbine capacity of 1.06 MW (BTM ApS, 2010). It should be noted that most of the 4-6 MW turbines currently in the testing or early deployment stage are designed for offshore operation. If the government supported small capacity offshore demonstration projects, it could build confidence and bring in public and private investment in this sector in the years to come.

To examine the feasibility of offshore wind farms, C-WET conducted the first phase of its study at Dhanushkodi in the State of Tamil Nadu. So far, the area around Dhanushkodi has shown good potential, where wind power density of 350–500 Watt per square metre (w/m^2) has been recorded. For the next stage, C-WET is currently awaiting approval from various government agencies.

Based on a study carried out by WISE on the clearances required for offshore projects, it is understood that more than 20 central and state ministries and departments would need to be involved in the process. As this technology is in its nascent stage in India there is a need for specific policy framework for offshore wind power generation.

On the corporate side, there have been a few early moves on offshore wind in India. Oil and Natural Gas Corporation (ONGC) announced its plans to tap offshore wind power. Further, in June 2010, global majors like Areva, Siemens and GE announced their plans to explore offshore wind power opportunities in the country. Tata Power is the first private sector player to submit a formal request to the Government of Gujarat and Gujarat Maritime Board for approval of an offshore project in India.

1.5 Wind Turbine Installations

Wind turbine generator (WTG) capacity addition in India has taken place at a CAGR[19] of 24.67% for the period of 1992-2010. The installed capacity increased from a modest base of 41.3 MW in 1992 to reach 13,065.78 MW by December 2010.

The official installation figures show that amongst the states, Tamil Nadu ranks the highest both in terms of installed capacity and in terms of energy generation from wind, with shares of 41.8% and 53.4% respectively. Other states like Gujarat, Maharashtra and Rajasthan have seen significant growth in wind capacity over the last four to five years, also due to a stable policy and regulatory regime. Table 2 provides an overview of the share of different states in installed capacity (MW) and cumulative energy generation (in Million Units[20]).

TABLE 2: STATE WISE GENERATION AND INSTALLED CAPACITY

State	Cumulative Generation (MU)	Cumulative installed capacity (MW)
Andhra Pradesh	1,411	138.4
Gujarat	8,016	1,934.6
Karnataka	9,991	1,517.2
Madhya Pradesh	554	230.8
Maharashtra	11,790	2,108.1
Rajasthan	3,938	1,095.6
Tamil Nadu	41,100	5,073.1
Kerala	110	28
Total	**7,6950**	**12,125.8**

up to 31st March 2010

Source: WISE, January 2011

1.6 Re Powering Potential

Repowering is the process of replacing older, smaller wind turbines with modern and more powerful machines, which would reap considerably more power from the same site. In India, about 46% of the WTGs were rated below 500 kW in 2010, adding up to 2,331.3 MW (about 18% of cumulative installed capacity).

Figure 1 shows state-wise repowering potential as of March 2009. Amongst the states with good wind potential Tamil Nadu leads with a repowering potential of more than 800 MW followed by Gujarat, Maharashtra, Andhra Pradesh and Karnataka.

A special drive for repowering of old wind farms undertaken by the central government would encourage the industry to take this up on a larger scale. This could be done by way of creating suitable mechanisms and offering support along with financial incentives, to make new repowering projects viable.

Currently, neither the states nor the central government provides dedicated policy support or incentives to encourage Indian wind power developers or investors to repower their old projects. However, there are some challenges to be addressed before a comprehensive repowering attempt in India. Some of the key challenges are listed in Box 3.

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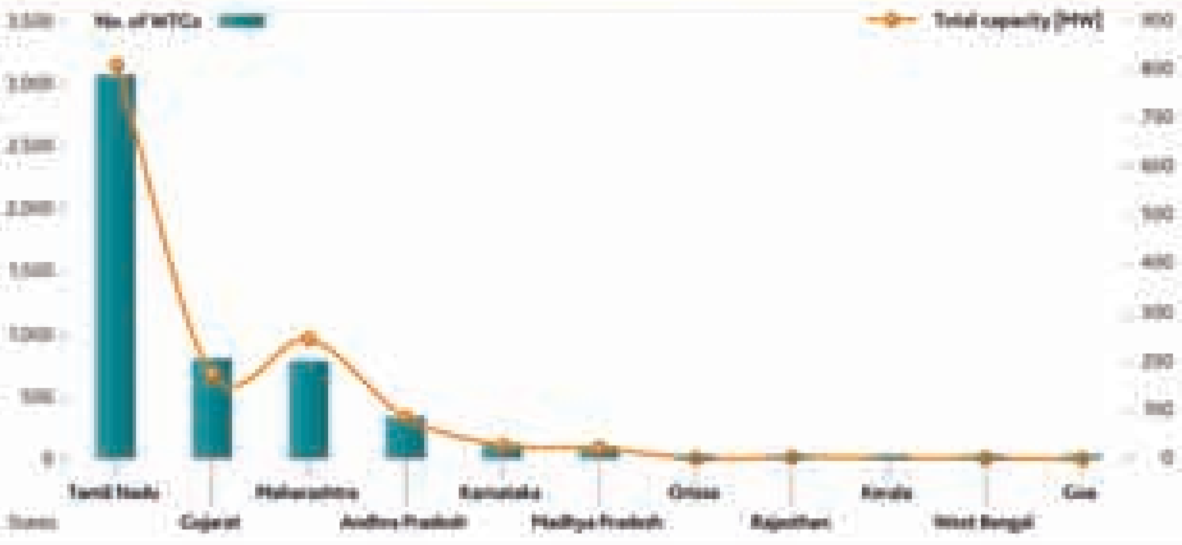
[19] CAGR : Compound Annual Growth Rate

[20] One Unit is = 1 kWh

BOX 2 **WHY REPOWERING?**

- Many of the states facing power shortages are also host to sites with good wind power potential which is not being used efficiently and is currently saddled with old and inefficient wind turbines. Repowering with more powerful turbines would bring considerable benefits to these states.
- Large areas are occupied by more than 8,500 small rating turbines (<500 kW capacity), manufactured by suppliers that have long since disappeared from the Indian market (as of March 2009). This leads to lapses in operations & maintenance (O&M), which in turn increases a machine's down time and reduces revenue. In addition, maintenance costs tend to be higher for aging WTGs.
- Breakdown of critical components badly affects machine availability and O&M cost for smaller capacity machines. The effective capacity utilization factor of small (<500 kW) machines in Tamil Nadu is estimated at less than 15%.
- Old wind turbines were often installed at maximum hub-heights of 30 to 40 meters and occupy land on good resource sites. However, these sites could benefit from modern turbines extracting energy from the much higher wind power density at high hub heights.

FIGURE 1 **STATE LEVEL REPOWERING POTENTIAL IN INDIA**



Source: WISE

All these issues related to repowering can no doubt be resolved by learning from the experiences in other markets such as Denmark and Germany, although they are still at the early stages of their own repowering. These markets have introduced various incentive mechanisms and policies to encourage repowering, and done away with provisions that initially hampered repowering. If a sensible policy package is developed, many old sites can provide two to three times their current electricity generation after repowering.

1.7 Technology Development Trends

Modern wind power technology has come a long way in the last two decades, and both globally and in India, improved technology has slowly and steadily improved capacity utilization. The existing and emerging trends in the development of wind power technology are discussed in this section.

A key trend in the Indian industry is the development of multimegawatt turbines installed at greater hub heights. Larger diameter rotors mean that a single wind power generator can capture more energy, or more 'power per tower'. This allows WTGs to take advantage of higher altitudes with stronger winds and less turbulence (wind speed generally increases with height above the ground). Subsequently larger machines

BOX 3 CHALLENGES FOR REPOWERING

- **Turbine ownership:** Repowering will reduce the number of turbines and there may not be one-to-one replacement. Thus, the issue of ownership needs to be handled carefully.
- **Land ownership:** Multiple owners of wind farm land may create complications for repowering projects.
- **Power Purchase Agreement:** PPAs were signed with the state utility for 10, 13 or 20 years and the respective electricity board may not be interested in discontinuing or revising the PPA before its stipulated time.
- **Electricity evacuation facilities:** The current grid facilities are designed to support present generation capacities and may require augmentation and upgrading.
- **Additional costs:** The additional decommissioning costs for old turbines (such as transport charges) need to be assessed.
- **Disposal of old turbines:** There are various options such as scrapping, buy-back by the government or manufacturer, or export. Local capacity may need to be developed.
- **Incentives:** One of the primary barriers to repowering is the general lack of economic incentive to replace the older WTGs. In order to compensate for the additional cost of repowering, appropriate incentives are necessary.
- **Policy package:** A new policy package should be developed which would cover additional project cost and add-on tariff by the State Electricity Regulatory Commissions (SERCs) and include a repowering incentive (on the lines of the recently introduced generation-based incentive scheme by MNRE).

have resulted in a steady increase in the capacity factor on average from 10-12% in 1998 to 20-22% in 2010.

For two decades now, global average WTG power ratings have grown almost linearly, with current commercial machines rated on average in the range of 1.5 MW to 2.1 MW. Details of existing capacity factors across the five key states of Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Tamil Nadu are presented in Annex 2 on page 52.

The average size of WTGs installed in India has gradually increased from 767 kW in 2004 to 1,117 kW in 2009. Currently, megawatt-scale turbines account for over half the new wind power capacity installed in India. The average size of WTGs installed in all the major markets between the years 2004-2009 is shown in Annex 3 on page 53.

The shift in India to larger WTGs is a result of improved infrastructure available to handle bigger turbines and improved economics of the sector. As generator size increases, fixed overall project costs fall on a 'per unit of output' basis. Given that finding sites and establishing transmission corridors is a significant investment, developers need to maximize the use of available sites for wind power generation. Installing fewer high capacity turbines, versus installing a greater number of smaller turbines, reduces overall capital investment by lowering installation, maintenance and potentially real estate costs. For example, instead of siting ten 600 kW turbines on acres of land, developers can instead site only three 2.0 MW WTGs. A detailed comparison of WTG technology options and development trends in India is provided in Annex 4 on page 53.

1.8 Investment In Wind Power Sector

The Government of India has outlined ambitious capacity expansion and investment plans for the current plan period (2007- 2012) and wind power projects form the majority of the proposed capacity addition. The total investments on development of RE during the plan period is expected to be in excess of $15 billion (~Rs. 60,000 crores). The majority of this investment is being raised through domestic private investors, concessional financing from specialised government agencies and multilateral financial institutions.

Due to growing awareness of the benefits of wind power and evolving government priorities more banks and lending institutions are showing interest in funding these projects. On top of the financing spectrum is IREDA, the Indian Renewable Energy Development Agency, the apex nodal agency for renewable energy development in India and a funding arm of MNRE. The other government agencies that actively fund renewable energy projects are the Power Finance Corporation (PFC) and Rural Electrification Corporation (REC).

The multilateral agencies such as the World Bank, the International Finance Corporation (IFC), and the Asian Development Bank (ADB), as well as bi-lateral agencies such as KFW (German Development Bank) have also stepped up their assistance to the sector in the last few years. Prominent domestic banks that fund renewable projects are IDBI, ICICI, IFCI, SBI and PNB among others. Foreign banks such as Standard Chartered, RBS India (formerly known as ABN Amro) and Rabobank are also providing renewable energy project financing.

Currently the market in India for the RE business is growing at an annual rate of 15%. The scope for private investment in RE is estimated at about $3 billion per annum. Given the evolving regulatory and policy regime, the business outlook is generally positive at this time. Proposed policy guidance and regulations are also coming into place to further strengthen this rate of growth.

1.9 Small Wind and Hybrid Systems

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 'standalone' modes.

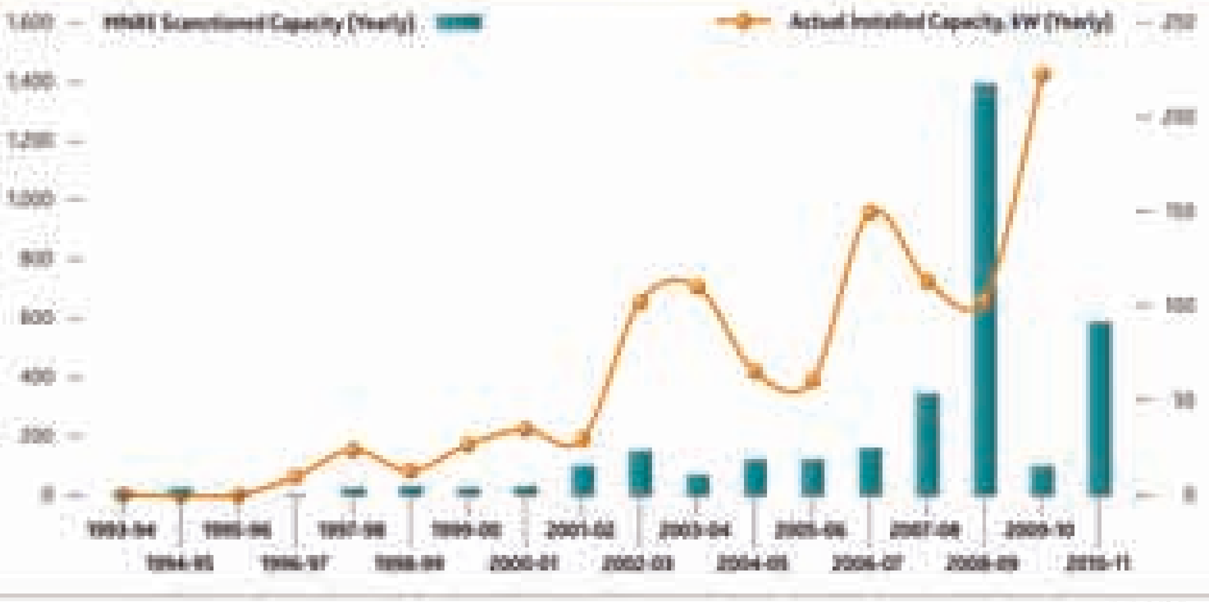
With the increasing shortfall in power supply and energy across the country, India could benefit significantly from exploiting the potential of micro-generation technologies that can meet energy needs under the distributed generation mode, so as to provide long-term solutions. WISE estimates India's 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.

Although a small annual market for such systems (~150–200 kW) currently exists in India, it is largely driven by the capital subsidy programme of the MNRE. Most of the current installations are of the stand-alone type.

The "Small Wind Energy and Hybrid Systems"21 programme initiated in 1994 by the MNRE focussed solely on small wind energy and hybrid systems. The objective of the programme is to develop technology and promote applications of water pumping windmills and aero-generators/wind-solar hybrid systems. Although the programme helped to promote awareness of small wind systems in India, it created interest only among select users and has yet to make a real impact. The implementation of the programme was extended in April 2010 to the fiscal year 2011-2012. The physical annual target was set to installed 500 kW aero-generator/wind-solar hybrid systems and 25 water pumping windmills with estimated financial budget of Rs. 50 million over 2010-2012.

The programme is implemented through State Nodal Agencies (SNA) mainly in Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Maharashtra, Rajasthan, Sikkim, Tamil Nadu, Goa, and West Bengal and the Andaman and Nicobar Islands. Manufacturers of water-pumping windmills, aerogenerators, and wind–solar hybrid systems are also eligible to market the systems directly to users. The programme is being extended to other potential states. The development path of wind-solar hybrid systems in India since 1994 is summarized in Figure 2.

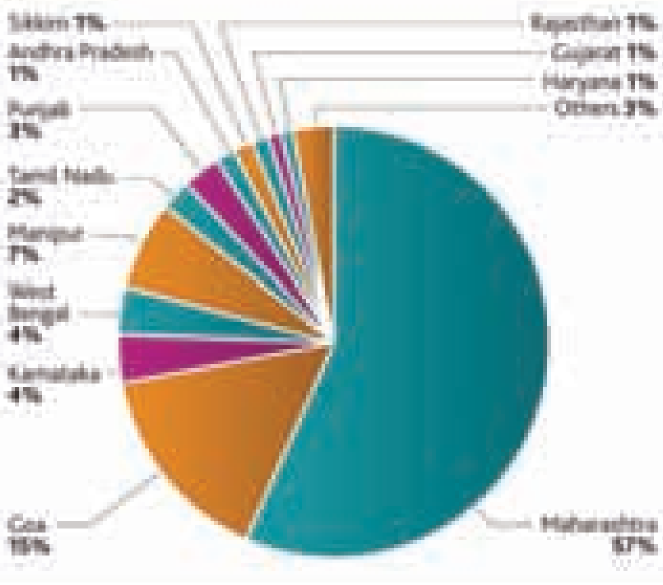
FIGURE 2: ANNUAL SANCTIONED & ACTUAL INSTALLED CAPACITY OF SWTs & WIND-SOLAR HYBRID SYSTEMS



Source: WISE

An aggregate capacity of 1.07 MW22 of aero-generators or hybrid systems was installed under the programme up to December 2010. Interestingly, almost 57% of the total cumulative installations in the country are in Maharashtra followed by Goa, Karnataka, West Bengal, Manipur and Tamil Nadu. Almost all the projects sanctioned by the MNRE and those actually commissioned availed themselves of capital subsidy benefits from the Ministry. The share of key states with SWTs and wind–solar hybrid systems is shown in Figure 3.

FIGURE 3. **STATE-WISE DISTRIBUTION OF WIND–SOLAR HYBRID SYSTEMS**



Source: MNRE

1.10 Barriers to Higher Growth

The low utilization of the country's wind power 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 wheeling23 and open access24 charges in some states, delays in acquiring land and obtaining statutory clearances.

In 2010, India installed a record 2.1 GW of new wind power capacity. For this growth to be maintained it is essential that the industry is supported by a predictable policy and regulatory environment. Proposed amendments to India's tax laws (such as the Direct Tax Code – DTC; Goods and Services Tax - GST) will have an impact on the investment portfolio of wind power. Besides these there are other potential barriers to achieving higher growth rates in the short to medium term.

The main reason for the growth of wind power has been the availability of Accelerated Depreciation (AD), providing the facility to offset taxes on income from other sources. With the possible introduction of the DTC from the next fiscal year (2012-13), the quantum of this benefit could be affected, which could have an impact on the investments in the Indian wind sector. The Generation Based Incentive (GBI) scheme has not attracted as many Independent Power Producers as envisaged, since the investors are of the opinion that the current rate of Rs. 0.5/kWh is not adequate or in line with the fiscal benefits offered under the AD scheme, and the two are mutually exclusive.

Further, the multitude of regulatory agencies adds to the confusion – there is the Central Electricity Regulatory Commission (CERC) and each state also has a State Electricity Regulatory Commission (SERC). The CERC issues guidelines for determining the feed-in-tariff from RE sources 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. This duality is not useful. For example an SERC could determine the tariff which may or may not be equivalent to the tariff determined by the CERC. This has a major impact on the project developers.

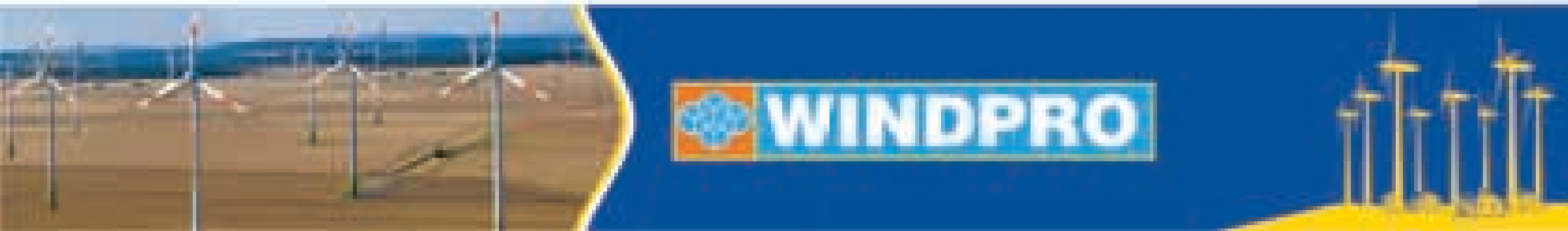
Inadequate grid infrastructure is another key issue that needs to be addressed urgently. Across most of those states with significant wind potential, the grid does not have sufficient spare capacity to be able to evacuate ever increasing amount of wind power. As a result, the state distribution utilities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

In most of the 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 forest lands then obtaining clearance from forest authorities for using the forest land for wind power generation is also time consuming.

Current and projected growth rates for wind power development in India are putting increasing strain on the WTG manufacturing sector, and the component supply chain needs to be improved. It would be beneficial for the small and medium enterprises [SMEs] to have acces to concessional financing to bear the risks related to production capacity augmentation.

As the industry grows, there will be demand for trained manpower and accordingly, the academic curriculum may need to be modified. The IWTMA has started an initiative towards this end by joining hands with a local engineering college to develop a cadre of trained manpower with the help of the industry. Depending on the success of the pilot programme, this industry driven initiative is planned to be replicated across other technical colleges and polytechnics.

Courtesy : Global Wind Energy Outlook



Use Of Forest Land For Wind Farm Project

Ministry of Environment and Forest (MOEF) has issued an elaborate guideline for allotment of forest land. However, at State level the guideline is interpreted differently which creates confusion and causes delay.

Generally the issues where different interpretations are being made are as below:

1. **Quantum of land used**

   On actual land area to be used for project, there is a difference of opinion regarding:

   a) The foot print area of foundation and unit substation.

   b) Width of pathway.

   c) Width for electricity lines.

2. **Regarding Charges payable to forest Department MOEF guidelines provides for :**

   a) NPV of the land used.

   b) Compensatory Aforestation charges.

   The State Agencies are asking for extra charges for development of medicinal plants on which the wind farm owners have no knowledge.

3. **MOEF guideline provides for one time lease rent at the rate of Rs. 30000/- per MW.**

   At local level however even a yearly lease rent is demanded.

   There is also confusion regarding registration of lease agreement and the value to be considered for payment of stamp duty.

Conclusion :

It is strongly felt that no new guideline needs to be issued by MOEF. All that is needed is to issue a clarificatory notification on the above mentioned three issues which should be uniformly followed by all states.

MOEF had earlier issued a clarificatory notification on use of land is to setting up Anemometric Mast. Similar kind of clarificatory notification note may please be issued on above mentioned three issues.

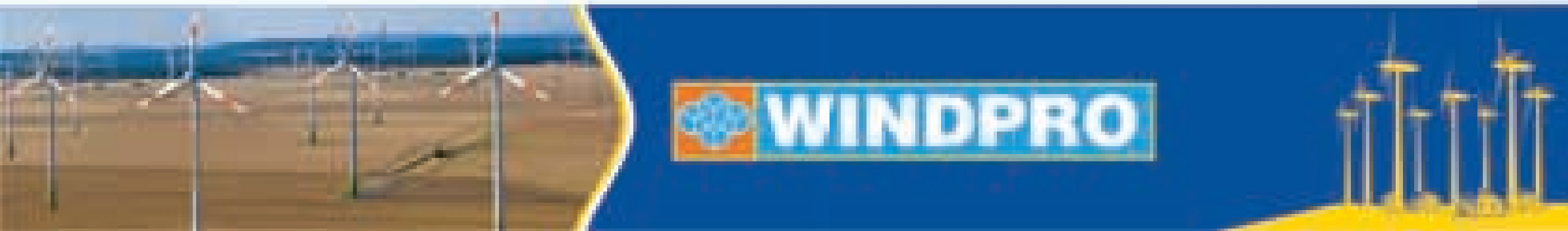
STATISTICS OF WEGs

REPORT ON MONTHLY GENERATION % OF RKVAH FOR THE MONTH OF APRIL 2011

S.No.	Name of the Wind Farm	Total Capacity	Location / Village	Region	State	April '11 Generation Units	% of RKVAH
1	M/s. Coimbatore Pioneer Fertilizers Ltd	0.450 MW	Kethanur	Coimbatore	Tamilnadu	21,527	--
		1.200 MW	Vadambacheri	Coimbatore	Tamilnadu	55,737	--
		1.800 MW	Mallegoundanpalayam	Coimbatore	Tamilnadu	1,12,560	--
		0.225 MW	Metrathi	Coimbatore	Tamilnadu	11,616	--
		0.500 MW	Bathra Kali Pudur	Coimbatore	Tamilnadu	26,088	--
2	M/s. Muthoot Fincorp	2.525 MW	Muppandal	Kanya Kumari	Tamilnadu	1,31,124	2.17%
3	M/s. Muthoot Fincorp	17.500 MW	Sankaneri	Tirunelveli	Tamilnadu	5,45,652	1.55%
4	M/s. Muthoot Fincorp	5.000 MW	Devarkulam	Tirunelveli	Tamilnadu	1,10,808	1.25%
5	M/s. Muthoot Finance Ltd	3.750 MW	Devarkulam	Tirunelveli	Tamilnadu	93,654	1.45%
6	M/s. Shanthi Casting Limited	1.500 MW	Azhaganeri	Tirunelveli	Tamilnadu	1,37,704	7.50%

REPORT ON MONTHLY GENERATION % OF RKVAH FOR THE MONTH OF MAY 2011

S.No.	Name of the Wind Farm	Total Capacity	Location / Village	Region	State	March'11 Generation Units	% of RKVAH
1	M/s. ACC Limited	9.000 MW	Sankaneri	Tirunelveli	Tamil Nadu	2,077,584	0.72%
2	M/s. Agni Steels P. Ltd	0.750 MW	Pazhavoor	Tirunelveli	Tamil Nadu	48,539	1.79%
3	M/s. Aquasub Engineering	2.900 MW	Muppandal	Kanyakumari	Tamil Nadu	5,37,200	2.65%
4	M/s. Aquapump Industries	1.500 MW	Muppandal	Kanyakumari	Tamil Nadu	2,86,324	3.89%
5	M/s. ARC Retreading Company (P) Ltd	0.250 MW	Muppandal	Kanyakumari	Tamil Nadu	6,804	--
6	M/s. Cape Flour Mills (P) Ltd	0.250 MW	Aralvoimozhy	Kanyakumari	Tamil Nadu	3,86,874	1.91%
	M/s. Cape Flour Mills (P) Ltd	0.500 MW	Muppandal	Kanyakumari	Tamil Nadu		
	M/s. Cape Flour Mills (P) Ltd	0.750 MW	Pazhavoor	Tirunelveli	Tamil Nadu		
7	M/s. Dalmia Wind Farm	16.525 MW	Muppandal	Tirunelveli	Tamilnadu	38,56,780	2.87%
8	M/s. Kanam Latex Industries Private Limited	1.000 MW	Erukkandurai	Tirunelveli	Tamil Nadu	2,01,431	2.06%
9	M/s. Kanishk Steel Industries Ltd	2.475 MW	Vadambacheri	Coimbatore	Tamil Nadu	3,64,056	0.39%
10	M/s. KLRF Limited	1.000 MW	Muppandal	Kanyakumari	Tamil Nadu	13,80,882	1.98%
		3.750 MW	Sankaneri	Tirunelveli	Tamil Nadu		
		1.500 MW	Pazhavoor	Tirunelveli	Tamil Nadu		



REPORT ON MONTHLY GENERATION % OF RKVAH FOR THE MONTH OF MAY 2011

S.No.	Name of the Wind Farm	Total Capacity	Location / Village	Region	State	March'11 Generation Units	% of RKVAH
11	M/s. Kurian Abraham (P) Ltd	1.800 MW	Muppandal	Kanyakumari	Tamil Nadu	3,04,694	4.08%
12	M/s. MRF Limited	0.900 MW	Chithabalam	Coimbatore	Tamil Nadu	1,50,883	0.62%
13	M/s. Narangs International Hotels Pvt. Ltd	3.375 MW	Pazhavoor	Tirunelveli	Tamil Nadu	3,83,100	0.08%
		2.250 MW	Muppandal	Kanyakumari	Tamil Nadu		
14	M/s. Newlink Overseas Finance Ltd	0.225 MW	Kayathar	Tirunelveli	Tamil Nadu	26,741	6.72%
		0.450 MW	Pazhavoor	Tirunelveli	Tamil Nadu	55,254	4.25%
		0.500 MW	Keezha Pavoor	Tirunelveli	Tamil Nadu	44,488	6.38%
		0.600 MW	Keezha Veeranam	Tirunelveli	Tamil Nadu	1,5,086	0.65%
15	M/s. NRG Tex	0.250 MW	Gudimangalam	Tirupur	Tamil Nadu	1,61,699	1.33%
16	M/s. Pandian Chemicals Ltd	1.000 MW	Aralvoimozhy	Nagercoil	Tamil Nadu	3,95,493	1.01%
		0.750 MW	Surandai	Tirunelveli	Tamil Nadu		
17	M/s. Pioneer Jellice India Pvt. Ltd	0.750 MW	Karungulam	Tirunelveli	Tamil Nadu	3,36,336	1.07%
		0.855 MW	Kanyakumari	Kanyakumari	Tamil Nadu		
18	M/s. Shanthi Casting Limited	1.500 MW	Azhaganeri	Tirunelveli	Tamilnadu	5,06,776	6.10%
19	M/s. Sree Ayyanar Spinning and Weaving Mills Ltd	5.950 MW	Kanyakumari	Kanyakumari	Tamil Nadu	9,31,416	1.94%
20	M/s. Southern Wires	0.450 MW	Muppandal	Kanyakumari	Tamil Nadu	1,22,623	0.95%
21	M/s. Sri Devi Cinemas Pvt. Ltd	0.600 MW	Sankaneri	Tirunelveli	Tamil Nadu	1,61,937	0.69%
22	M/s. The Bombay Burmah Trading Corporation Ltd.,	2.700 MW	Muppandal	Kanyakumari	Tamil Nadu	1,24,068	1.75%
23	M/s. Ucal Fuel Systems Ltd.	1.675 MW	Nallurpalayam	Coimbatore	Tamil Nadu	2,24,488	0.56%
		0.450 MW	Muppandal	Kanyakumari	Tamil Nadu	1,09,136	0.64%
24	M/s. Yogalaxmi Spinning Mills (P) Ltd	0.500 MW	Metrathi	Coimbatore	Tamil Nadu	75,952	2.14%

IWPA MEMBERS STATE WISE (GENERATING MEMBERS)

S.No.	State	No. of Members	Installed Capacity in MW
1.	Andhra Pradesh	36	199.240
2.	Gujarat	38	101.970
3.	Karnataka	59	413.785
4.	Maharashtra	71	1096.305
5.	NRC	40	413.500
6.	Rajasthan	32	32.550
7.	Tamil Nadu	725	1881.340
	Total	**1001**	**4134.690**

(NON - GENERATING MEMBERS)

S.No.	State	No. of Members
1.	Andhra Pradesh	2
2.	Gujarat	4
3.	Karnataka	23
4.	Maharashtra	17
5.	NRC	11
6.	Rajasthan	1
7.	Tamil Nadu	48
	Total	**106**

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Website : http:\\www.windpro.org

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NBCC Plaza, Pushp Vihar Sec. V
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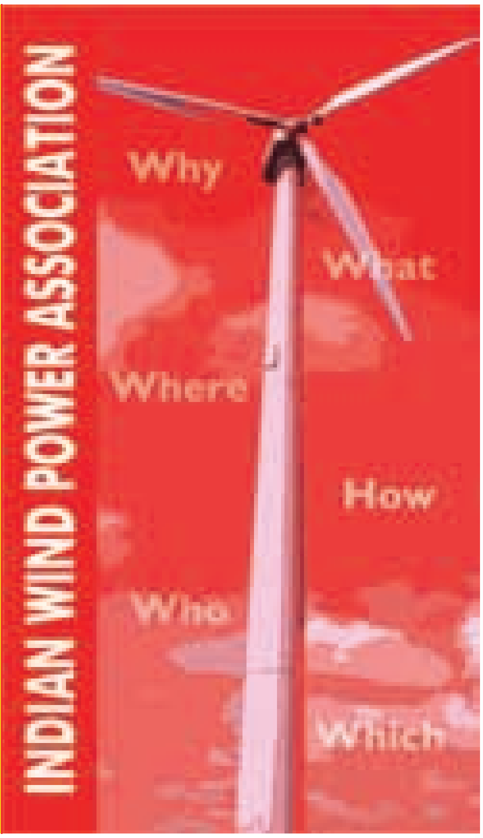

Why this Association?

To unite stakeholders under one banner
To create awareness to the public
To serve the Wind Industry for the development
To Interact with State Electricity Boards and Governments on Policy Matters
To Guide new investors on proper technology
Dissemination of information on running of Wind Farms

What it Does?

Publishes a prestigious Technical Monthly Magazine?
Organizes Seminars and Training Classes
Promotes Research and Development
Assists in efficient operation of Wind Farms
Helps to access sources of Finance and Technical Assistance
Acts as a Data Bank for Wind Sector

Where it Functions?

It is a National Level Association
It has its National office at Chennai
It has members from 10 States in India
It has State Council Offices at New Delhi, Mumbai, Ahmedabad, Jaipur, Hyderabad, Bangalore
Our members own 4000 MW of Wind Electric Generators spread all over India
Our members strength is 1100 as on date

How it Works?

Highly on democratic lines
Run on well-conceived Bye-Laws and Rules as per Society Act
Activities controlled by National Council
The National Council is formed by Elected Members
State matters pursued by State Council
A totally dedicated Service Organization

Who can be Our Members?

Generating Members
Manufacturing (Machine / Ancillary) Members
Service Providers / Consultant Members
Educational / Research Members / Promotional Bodies
Financial / Insurance Members
Honorary Members

Which are Our Core Areas?

Impress upon Governments for Uniform National Policy?
Follow up with Financial Institutions for low cost funds
To improve the skill of the qualified technicians
To develop our wastelands with Agriculture / Horticulture Crops
To arrange access to our members on Carbon Credit Sales
Provide a forum to express views on Industry and Government Policies

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Mr. Ramesh Kymal, M.D., M/s. Gamesa Wind Turbines India, Chennai
Mr. Rajsekhar Budhavarapu, Director Development, M/s. Acciona Wind Energy, Bangalore
Mr. J. Rajasekar, M.D., M/s. R.S. Windtech Engineers, Aralvoimozhy
Mr. U.B. Reddy, V.P. (BD & Operations), M/s. Enercon (India), Bangalore
Mr. Sharad Saluja, Director, M/s. Sterling Agro Industries, New Delhi
Mr. C.M. Sambasivam, CEO., M/s. AL – Wind Energy, Chennai
Mr. Sunil Jain, COO., M/s. Green Infra, New Delhi
Mr. S. Sri Murali, General Manager - (BD & Operations), M/s. Enercon (India), Hyderabad
Dr. R. Venkatesh, President, Power Quality Solutions, M/s. EPCOS India, Nashik

GAMESA WIND TURBINES PVT. LTD.,
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GAMESA G5X-850 kW

OPTIMUM PERFORMANCE WITH MORE THAN 8,600 UNITS INSTALLED WORLDWIDE

Reliability is the definition of the Gamesa G5X-850 kW platform. A robust adaptable platform which guarantees excellent performance from the wind turbines belonging to the G52-850 kW and Gamesa G58-850 kW platforms, making them the most installed product platforms in Europe.

The Gamesa G5X-850 kW platform features speed control and variable pitch. It also exploits the latest advances in technology to extract maximum energy from the wind with the greatest efficiency: Gamesa WindNet®, the new SCADA system developed by Gamesa, Gamesa SMP predictive maintenance, or Gamesa NRS® noise control, in addition to ensuring the highest quality connections to the grid.

Excellent performance on low, high and medium winds. This is the guarantee offered by the Gamesa G5X-850 kW wind turbines. We aim to express our commitment to Sustainable Economic Development through a new concept: Global Technology. Everlasting Energy. Our objective is to continue developing technological solutions to ensure that the wind farms supplied by Gamesa are the most efficient and sustainable in the market.

	IEC	Power	Grid Code	Tower Heights	50 Hz
Gamesa G52-850 kW	[illegible]	850 kW	✓	[illegible]	✓
Gamesa G58-850 kW	IIIA	850 kW	✓	[illegible]	✓

Suitable for IEC CLASS IIIB (Annual average wind speeds of below 7.5 m/s) sites of India

Gamesa

www.gamesacorp.com

GLOBAL TECHNOLOGY. EVERLASTING ENERGY.

Indian Wind Power Association

Organizes

3rd International Wind Conference and Exhibition

(3rd WE 20 by 2020)

Conference : 23rd to 25th January 2012

Exhibition - 23rd to 26th January 2012

Venue : CODISSIA Trade Fair Complex, Coimbatore, Tamil Nadu

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