Indian Wind Power

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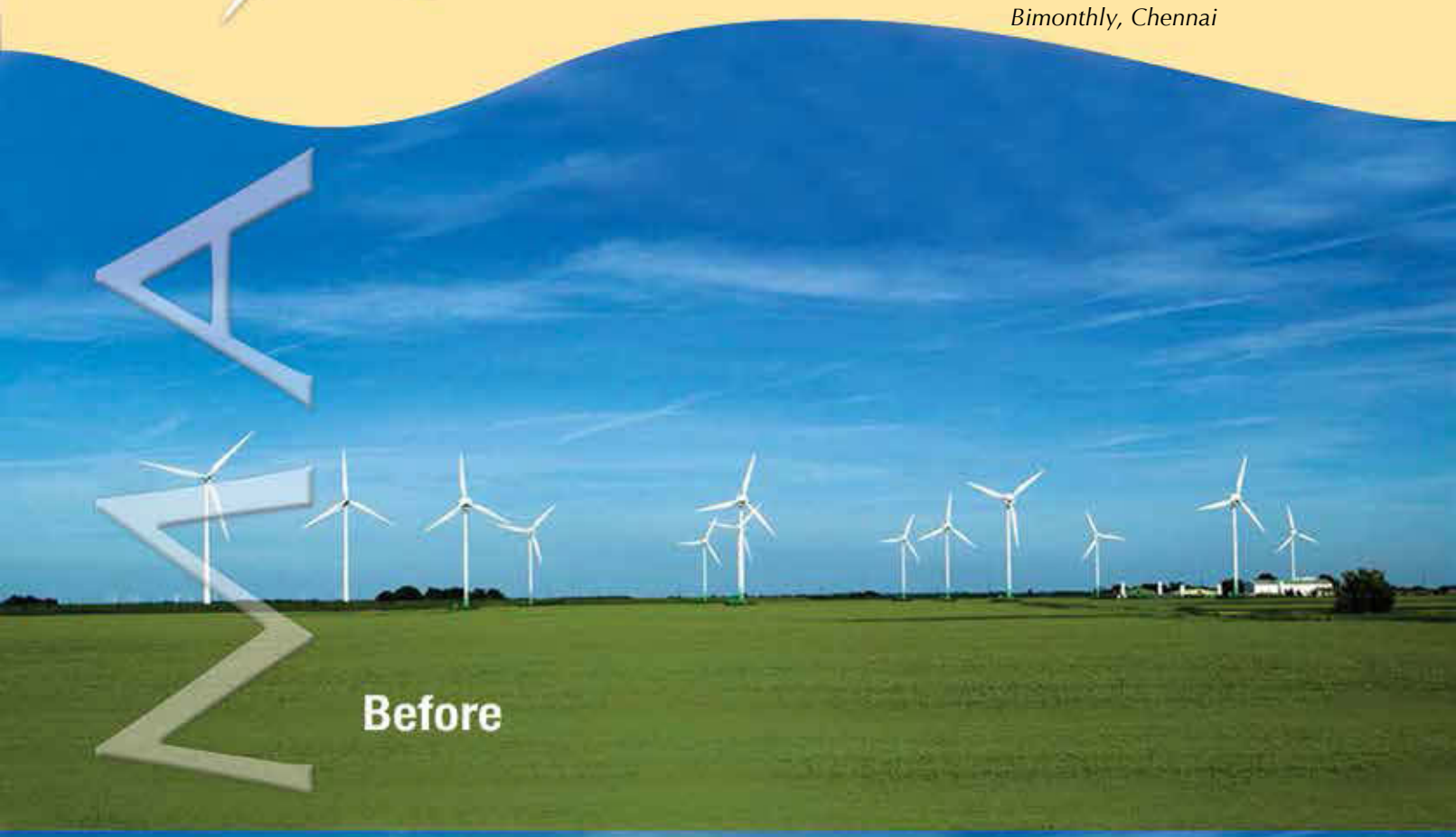

Repowering Special

IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

Expertise offered to Wind & Solar Energy Stakeholders

Research & Development

- Supports multi institutional research on wind energy
- Performance testing of Small Wind Turbines / Aerogenerators
- Empanelment of Small Wind Turbine manufacturers
- Acoustic Noise measurement
- Study of wind-solar-diesel hybrid system

Wind Resource Assessment

- Site condition assessments for wind monitoring & wind farm development and field visits
- Procurement, installation and commissioning of met mast of 50m to 120 m height
- Providing measurement campaign management, assisting clients in the Installation and monitoring of meteorological masts, LIDAR and SODAR stations
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- Technical due diligence in complying with international standards.
- Power curve demonstration guarantee test
- Preparation of Tender document for development of wind farm
- Helping the evaluation of tender as one of the tender evaluation committee members.
- DPRs (Detailed Project Reports) preparation through State of art software tool for wind farm developers

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- As per Internationally accepted procedures and stipulations for
- Power Performance measurements
- Power Quality measurements
- Yaw efficiency test
- Load measurements
- Safety and function tests
- User defined measurements
- The services are not limited by type or size of the Wind Turbines
- The services are certified as per the requirements of ISO 9001: 2008 and accredited as per the requirements of ISO/IEC 17025 : 2005

Certification Services

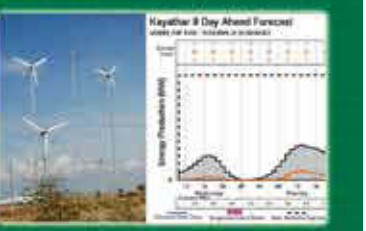
- Accord type approval / type certification to wind turbines in accordance with Indian Type Certification Scheme [TAPS - 2000 (amended)]. Type Certification Services are certified as per ISO 9001 : 2008
- Preparation of Indian standards on wind turbines
- Issue the Revised List of Models and Manufacturers (RLMM) of wind turbines periodically
- Issue the recommendation for grid synchronization to facilitate installation of prototype wind turbines

Training

- Capable of providing
- Wind / Solar Resource Measurement & Analysis
- Wind Resource Modelling Techniques
- Wind Speed Statistics / Solar irradiation and Energy Calculations
- Micro-siting and Layout of wind / solar farms
- Design and Safety requirements as per standards
- Wind Turbine / Solar Technology
- O & M practices

Solar Radiation Resource Assessment

- Direct Normal (DNI), Diffused Horizontal (DHI) & Global Horizontal (GHI) irradiation measurements
- Data quality checking
- Calibration Laboratory for solar
- Solar resource data delivery
- Solar Map preparation
- Preparation and vetting of feasibility, DPR of Solar projects



NATIONAL INSTITUTE OF WIND ENERGY

Formerly "Centre for Wind Energy Technology"

An Autonomous Research & Development Institution, Ministry of New and Renewable Energy, Government of India

Velachery - Tambaram Main Road, Pallikaranai, Chennai - 600 100

Phone : +91-44-2246 3982 / 83 / 84 Fax : +91-44-2246 3980 http://cwet.res.in www.cwet.tn.nic.in E-mail : info@cwet.res.in

IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

Indian Wind Power

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Volume: 1 Issue: 2 February - March 2015

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Indian Wind Turbine Manufacturers Association

4th Floor, Samson Tower, 403 L, Pantheon Road, Egmore
Chennai - 600 008. Tel : 044 43015773 Fax : 044 4301 6132
Email : secretarygeneral@indianwindpower.com
associatedirector@indianwindpower.com
Website : www.indianwindpower.com

From the Desk of the Chairman - IWTMA

Dear Readers,

Greetings from IWTMA!

The much awaited RE-Invest 2015 got up to a glittering start with the Hon'ble Prime Minister Narendra Modi's inaugural address. The Prime Minister emphasized the need for main streaming renewables and call for a mindset change to think of "Gigawatts" and not Megawatts. It was very appropriate from the words of the Prime Minister on popularizing Wind Solar Hybrid, the two strong RE sources on a win win situation to optimize land use, optimize generation and perhaps, save some costs. There was a feeling of positive approach towards renewables from bankers, international speakers, economists and other prominent speakers.

IWTMA and its members took part in the exhibition and showed solidarity in "Green Energy Commitments" and to support the "Make in India" campaign with almost 70% localization.

IWTMA sponsored a session on "Onshore Wind", which was well attended by the industry, the Government officials and the investors to analyze various issues posing challenges and opportunities to achieve the big target of 60 GW by 2022.

The Union Government presented its first full Budget and there was a clear mention in the Budget Speech to achieve 175,000 MW Renewable Energy by 2022.

It is requested to the Ministry of New and Renewable Energy to conduct a study and have a roadmap to achieve the 60 GW by 2022. It is important to plan and overcome all possible challenges in order to achieve this target.

The industry is eagerly awaiting a roadmap or roll out plan in innovative financing, realistic milestones for power evacuation through the Green Corridor. We urge the Government to place energy security as the single point agenda where RE can play a major role. There was an urgent requirement for the Union Government to have the cooperation and carry the wind states with policies and regulations to achieve the desired goal. The industry strongly urges the Government to spell out its plan to introduce "Renewable Energy Law" which would clear number of ambiguities and hurdles towards a greener India and wind power as a source of "Power Forever".

This issue is devoted to "Repowering" where the old technologies are replaced by modern turbines of MW class for higher generation and optimizing land use which is finite. The land aggregation and persuading the present land owners is a challenge. Formation of cooperative farming as multi-stakeholder wind farm can be one answer. Disposal of old turbines is an issue but a sincere attempt can be made for refurbishing and export to countries where wind energy development is in its nascent stage. The new technology turbines with higher efficiencies will contribute to the ever growing power requirement of India.

We are nearing the closure of the financial year 2014-15 with promises and hopes and we wish to see a cherished dream of 2015-16 with an installation of 4000 MW, a new milestone over 3000 MW installed in 2011-12. As the old adage goes, "TOGETHER WE CAN MAKE IT HAPPEN".

We wish our readers, happy reading and your feedback will help us to better our standards.

With regards,

Madhusudan Khemka
Chairman

Global Wind Statistics 2014

GLOBAL INSTALLED WIND POWER CAPACITY (MW) – REGIONAL DISTRIBUTION

		End 2013	New 2014	Total (End 2014)
AFRICA & MIDDLE EAST	Morocco	487	300	787
	South Africa	10	560	570
	Egypt	550	60	610
	Tunisia	255	-	255
	Ethiopia	171	-	171
	Cape Verde	24	-	24
	Other[1]	115	14	129
	Total	1,612	934	2,545
ASIA	PR China*	91,412	23,351	114,763
	India	20,150	2,315	22,465
	Japan	2,669	130	2,789
	Taiwan	614	18	633
	South Korea	561	47	609
	Thailand	223	-	223
	Pakistan	106	150	256
	Philippines	66	150	216
	Other[2]	167	-	167
	Total	115,968	26,161	142,119
EUROPE	Germany	34,250	5,279	39,165
	Spain	22,959	28	22,987
	UK	10,711	1,736	12,440
	France	8,243	1,042	9,285
	Italy	8,558	108	8,663
	Sweden	4,382	1,050	5,425
	Portugal*	4,730	184	4,914
	Denmark	4,807	67	4,845
	Poland	3,390	444	3,834
	Turkey	2,958	804	3,763
	Romania	2,600	354	2,954
	Netherlands	2,671	141	2,805
	Ireland	2,049	222	2,272
	Austria	1,684	411	2,095
	Greece	1,866	114	1,980
	Rest of Europe[3]	5,715	835	6,543
	Total Europe of which EU-28[4]	121,573 117,384	12,820 11,791	133,969 128,752

		End 2013	New 2014	Total (End 2014)
LATIN AMERICA & CARIBBEAN	Brazil**	3,466	2,472	5,939
	Chile	331	506	836
	Uruguay	59	405	464
	Argentina	218	53	271
	Costa Rica	148	50	198
	Nicaragua	146	40	186
	Honduras	102	50	152
	Peru	2	146	148
	Carribean[5]	250	-	250
	Others[6]	55	28	83
	Total	4,777	3,749	8,526
NORTH AMERICA	USA	61,110	4,854	65,879
	Canada	7,823	1,871	9,694
	Mexico	1,859	522	2,381
	Total	70,792	7,247	77,953
PACIFIC REGION	Australia	3,239	567	3,806
	New Zealand	623	-	623
	Pacific Islands	12	-	12
	Total	3,874	567	4,441
	World total	318,596	51,477	369,553

1 *Algeria, Iran, Israel, Jordan, Kenya, Libya, Nigeria*

2 *Bangladesh, Mongolia, Sri Lanka, Vietnam*

3 *Bulgaria, Cyprus, Czech Republic, Estonia, Finland, Faroe Islands, FYROM, Hungary, Iceland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta,Norway, Romania, Russia, Switzerland, Slovakia, Slovenia, Ukraine*

4 *Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK*

5 *Caribbean: Aruba, Bonaire, Curacao, Cuba, Dominica, Guadalupe, Jamaica, Martinica, Granada, St. Kitts and Nevis*

6 *Bolivia, Colombia, Ecuador, Venezuela*

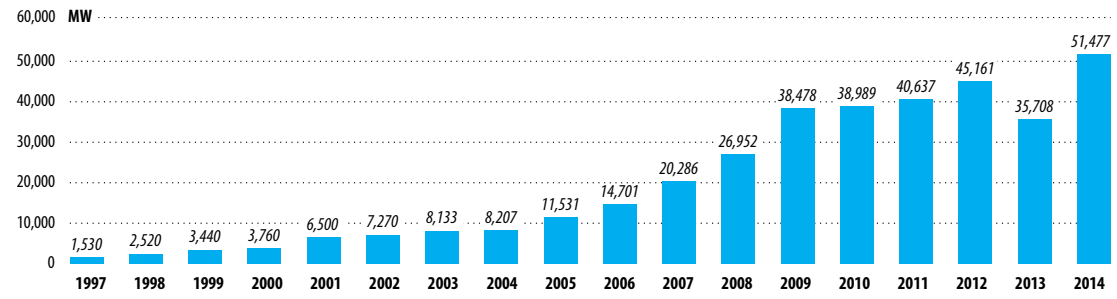
Note:

Project decommissioning of approximately 523 MW and rounding affect the final sums

*** Provisional figure**

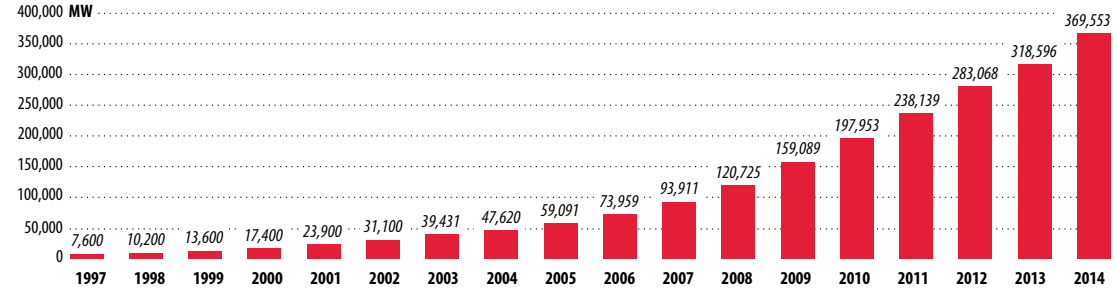
**** Projects fully commissioned, grid connection pending in some cases**

GLOBAL ANNUAL INSTALLED WIND CAPACITY 1997-2014



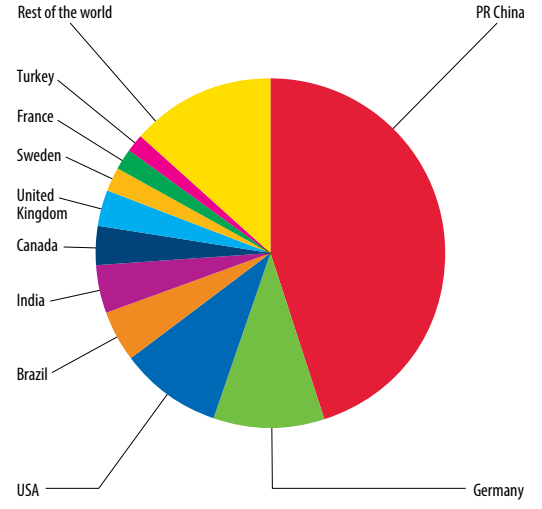
Source: GWEC

GLOBAL CUMULATIVE INSTALLED WIND CAPACITY 1997-2014



Source: GWEC

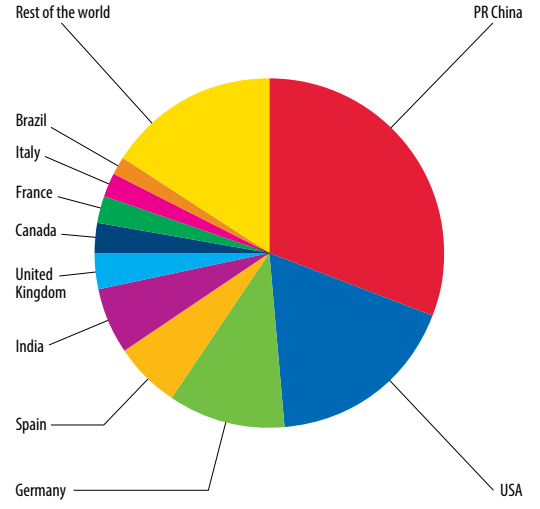
TOP 10 NEW INSTALLED CAPACITY JAN-DEC 2014



Country	MW	% SHARE
PR China*	23,351	45.2
Germany	5,279	10.2
USA	4,854	9.4
Brazil**	2,472	4.8
India	2,315	4.5
Canada	1,871	3.6
United Kingdom	1,736	3.4
Sweden	1,050	2.0
France	1,042	2.0
Turkey	804	1.6
Rest of the world	6,702	13.0
Total TOP 10	**44,775**	**87**
World Total	**51,477**	**100**

Source: GWEC

TOP 10 CUMULATIVE CAPACITY DEC 2014



Country	MW	% SHARE
PR China*	114,763	31.0
USA	65,879	17.8
Germany	39,165	10.6
Spain	22,987	6.2
India	22,465	6.1
United Kingdom	12,440	3.4
Canada	9,694	2.6
France	9,285	2.5
Italy	8,663	2.3
Brazil**	5,939	1.6
Rest of the world	58,275	15.8
Total TOP 10	**311,279**	**84.2**
World Total	**369,553**	**100**

Source: GWEC

* *Provisional figure*
** *Projects fully commissioned, grid connections pending in some cases*

Courtesy: Global Wind Energy Council

Re-Wind – Repower the Old Wind Power Projects

Mr. Ankan Datta, Private Sector Expert
Indo-German Energy Forum (IGEF) – Support Office, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in India ankan.datta@energyforum.in

1. Introduction

As of January 2015, the total installed generation capacity based on wind energy resource in India was 22597 MW as per the Indian Wind Turbine Manufacturers Association (IWTMA). Currently, the generation capacity based on wind accounts for more than 66% of the total generation capacity (grid connected) based on renewable energy resources. The development of generation based on wind in India started around the late 80s, however the major thrust has been witnessed after the announcement of the Electricity Act, 2003, and thereafter went on to have the highest growth rates in the world. This also resulted in the development of one of the largest domestic wind turbine manufacturing industries in the world with a production capacity exceeding 10 GW per annum.

The total installable potential for power generation from wind energy resource in India has been estimated by the Government of India's National Institute of Wind Energy (NIWE) at 80 m hub height (given a land availability of 2 % barring a few areas) to be approximately 100 GW. This is much higher at hub heights of 100 m or more. It is estimated that nearly 5 GW or more of the current installed capacity in the country is using the turbines that may be of 500 kW or lower capacity with hub heights of 25 to 50 m installed before 1990 to mid-90s at sites that are classified as the premium wind zones. Most of these turbines have lived their service lives and have operating efficiencies that are very low compared to the current models. These existing wind turbines are resulting in the capacity utilisation factor of around 12% or lower. The newer turbines, that could be of capacities 1.5 to 2 MW or even higher, are installed at hub heights of 100 m or more given the rotor diameters of more than 100 m and blade lengths of nearly 50 m. This results in much higher capacity utilisation factor to the tune of at least 35 to 50%. The additional generation from such turbines, after repowering, shall also aid in meeting the demand and supply gap of electricity in India.

The schemes following the financial benefit namely Accelerated Depreciation (AD) and the Generation Based Incentive (GBI), were mainly responsible for the proliferation of the wind power in India apart from the Feed-In-Tariffs (FIT) through the Power Purchase Agreements (PPAs) with the state utilities. The Ministry of Finance had withdrawn the accelerated depreciation benefit from FY 2012; however, to encourage generation capacity based on wind energy resources; the Ministry has reinstated accelerated depreciation scheme in FY 2014. Repowering, if implemented successfully, shall provide additional thrust to the Indian wind energy sector. However, the supply chain systems, grid integration, restructuring of PPAs (Power Purchase Agreements) and revenue distribution among local communities also need to be closely examined to identify any and all issues before introducing such concept. In fact, the Indian Government through the proposed National Wind Energy Mission has already expressed its willingness to consider repowering as an important policy instrument.

2. Basics of Repowering

Need for Repowering: Development of the wind power projects in India started off more than two decades ago, and thousands of mega-watts of new capacities are being added on every year. Thus one can find plenty of wind farms that have operated for more than 12 years by now. The turbines that have been installed in these old farms have either already completed their service lives or are nearing the end of it; however generation should continue further and possibly increase in the future. Given the worn out turbines, the generation is likely to drop, and thus, the project developers are now facing with end-of-life decisions. Now during these decades technology has gone ahead big time, and today not only has the hub heights, but also the efficiencies of the turbines doubled. The old PPAs also have either ended or are nearing the end dates. The solution to this issue is repowering.

Definition of Repowering: The replacement of old and inefficient turbines by the new and more efficient ones in an attempt to increase not only the installed capacity but also the power generation can be referred to as the classical definition of repowering. There are several methods in which this replacement can happen, but generally the increase in installed capacities for most repowered projects around the world is typically below 25%, although the net power generation can go up by more than 300% given the higher hub heights and the higher turbine efficiencies.

History of Repowering: The history of repowering goes back to the early 1990s with the older American (Californian) and the Danish projects, followed by the German and the Dutch projects. As of today, Germany has the biggest market for repowering in the world at 6000 MW (as per the German Wind Energy Association in 2011) followed by the Dutch and the US.

3. Methods of Repowering

The following are the ways in which an old wind farm can be repowered.

1. 1-to-1 up-scaling of solitary wind turbines
2. 2-to-1 replacement, replacement of two smaller wind turbines by one large wind turbine
3. Clustering of wind turbines in a farm, e.g. replacement of 20 solitary wind turbines by clustering 6-10 wind turbines at one location
4. 1-to-1 replacement of wind turbines with similar rates but with newer machines
5. 1-to-1 up-scaling of wind farms

Each of these alternatives has its own advantages and disadvantages. Alternative 1 has the largest electricity production and alternative 4 the lowest. For alternatives 1-3 and 5, grid capacity can be a problem and investment for the grid connection may be required, while for alternative 4 it is not necessary. For each alternative there is a positive impact on the landscape: the best one being alternative 3.

4. Key Considerations in Repowering

The following could be some of the key considerations for a project developer before deciding on repowering as well as for the policy makers to come out with a detailed repowering policy for a country.

- **Issue of Turbine Ownership –** Repowering will reduce the number of turbines and there may not be one-to-one replacement.
- **Issue of Land Ownership –** Multiple owners of wind farm land may create complications for repowering projects.
- **Modifications to PPA –** 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. The financial health of the utilities also need to be considered since that could be a pivotal factor in revising the existing PPAs.
- **Feasibility of Power Evacuation Infrastructure –** The current grid facilities are designed to support present generation capacities, and may subsequently require augmentation and upgradation post repowering.
- **Disposal/ Market of Used Turbines –** There are various options such as scrapping, buy–back by the government or manufacturer, or export, but for which local capacity may need to be developed.
- **Regulatory Treatment of Additional Capital Cost -** One of the primary barriers to re-powering is the general lack of economic incentive to replace the older turbines. In order to compensate for the additional cost of repowering, appropriate incentives are necessary. 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. A new policy package should be developed to cover the additional project costs, and an add-on tariff by the State Electricity Regulatory Commissions (SERCs) and include a repowering incentive (on the lines of the Generation Based Incentive (GBI) and Accelerated Depreciation (AD) scheme by the MNRE.

5. Advantages of Repowering

Repowering has several advantages that can be broadly categorised into four main categories as listed below.

Technical Advantages

- Efficient utilization of premium wind resource rich sites. Increasing the energy yield by several times from current levels
- Higher Plant Load Factors (PLF)

Operational Advantages

- Maintenance (O&M) costs of the new turbines are much lower than the previous ones
- Modern wind turbines make integration with the grid easier

Financial Advantages

- Achieving better LCOE for the repowered farm
- Reduction of the ratio of land area to per MW of installed capacity
- Increase in the opportunities of the states to achieve Renewable Purchase Obligation (RPO) targets, and thereby the national targets in National Action Plan on Climate Change (NAPCC).
- Increase in the number of issued Renewable Energy Certificates (RECs)

Social and Environment Advantages

- Increase the visual appeal of the farm
- Lowering the incidents of the collision of birds

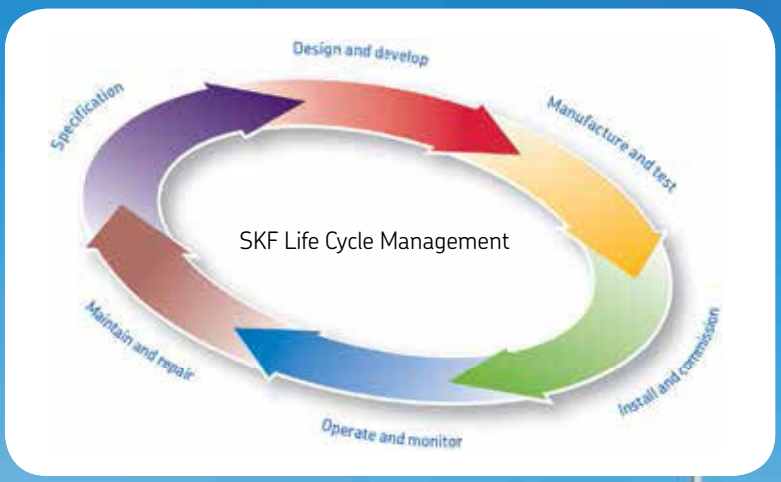
SKF Life Cycle Management

Reduce total cost of ownership at every stage of your turbine life cycle

Life Cycle Management is a proven approach for maximizing productivity while minimizing the total cost of ownership for machinery over every stage, from specification and design to operation and maintenance.

SKF Life Cycle Management can help you to increase profitability through:

- Minimized maintenance
- Improved reliability and safety
- Improved energy and resource efficiency
- Reduced total cost of energy
- Extended asset service life
- Maximized productivity
- Optimized designs
- Reduced time to market
- Reduced total cost of ownership



For these and more solutions, visit www.skf.com/wind or contact

Abhijit Kulkarni
Head, Renewable Business India
abhijit.kulkarni@skf.com

Vinay Gaonkar
Manager, Application Engineering
vinay.gaonkar@skf.com

The Power of Knowledge Engineering

➢ Quality of landscape also improve as number of turbines is much less per unit area.

➢ New turbines also produce lesser noise

6. Details of a Repowering Project Planning/ Policy Preparation

To achieve this target, the following is the detailed scope of work that needs to be undertaken by the country or by a project developer:-

1.1 Overview of the repowering scenarios in India and international experiences in repowering

- Details of the current wind farms, the equipment manufacturing scenarios and the policies in India
- Various repowering scenarios and the global wind energy repowering scenario
- Need for repowering in India and international best and worst practices examples of policies and case studies favouring repowering

1.2 Overview of major factors influencing decisions of repowering by project developers and the relationship between the various factors

- Details of the economic, financial and technical factors
- Factors relating fragmented turbine ownerships in a single wind farm, grid integration, PPA restructuration, revenue distribution among local communities etc.

1.3 Detailed report on all the financial requirements of repowering

- Details of the project costs and the O&M expenses thereafter
- Details of costs for grid integration enhancements and the Levelised Cost of Energy (LCOE) thereafter
- Details of the costs for redistribution of lands/ project ownerships and PPA restructuration
- Details of the subsidy burden and the models for community sharing of revenues
- Possible financial impact on the government if the repowered capacity is implemented following accelerated depreciation benefit or generation based incentive

1.4 Detailed report on all the policy and regulations needed to pursue repowering in India

- Details of the policy and fiscal incentives and/or mechanisms to project developers, equipment suppliers and, also if possible, potential EPC contractors
- Details of any modifications of the existing policy and fiscal incentives (such as AD, GBI, FIT etc.) to proliferate the repowering market in India
- Recommendations on the policy changes to be incorporated into the policies of the Indian states

1.5 Detailed report on the total market potential of repowering in India

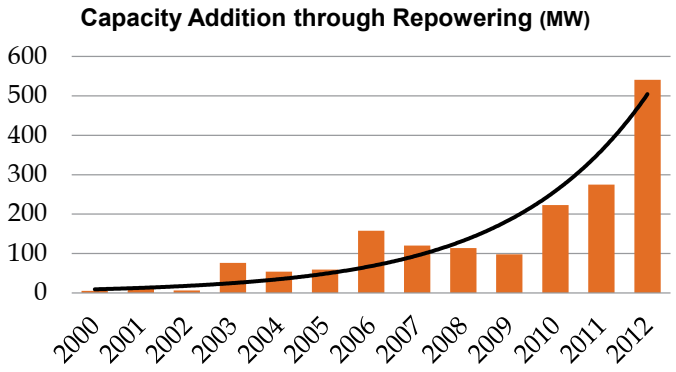
- Detailed assessment of the repowering potential in India and the supply chain impacts
- Detailed assessment of the potential private sector investment per unit of government subsidy provided, and the equity/debt financing needs
- Detailed methodology and calculations to show potential job creations and the benefits of revenue sharing among community members
- A list of all wind power projects with the relevant details to analyse the suitability for repowering to be put as an annexure in the final report

7. International Experience from Germany

Historically Germany entered the wind sector later than some of its other European neighbours. Repowering is expected to constitute a major part of the wind market in the years ahead, especially as available new sites for wind development diminish. Repowering was considered at a policy level in 2004, and the first policy had issues including local government restriction on hub height or total turbine height, and setback requirements between installations and residential areas. Before 2004, German feed-in tariffs provided some encouragement for wind repowering, by offering new wind projects a higher payment than existing projects that had been operating for some time. Since 2004, the feed-in tariff has offered a longer and higher payment level to wind turbines that replace/modernise existing project built before Dec. 1995 and that are at least three times the capacity of the repowered turbine.

Despite this incentive, repowering had just begun and, given the regulations on siting and the barriers to repowering identified above, the wind industry argued that without the feed-in tariff repowering incentive is insufficient. With amendments in 2009, more attractive conditions for repowering projects were brought in by the policy makers, including additional increase in initial tariff for wind turbines by 0.5 cents/ unit above the initial feed in tariff of 9.1 cents/ unit. This resulted in the huge expansion of the repowering market in Germany, including conversion of 59.3 MW of old turbines into 168.5 MW with a repowering factor of 2.84.

As per the data published by the German Wind Energy Institute (DEWI), the capacity added through repowering at the end of 2013 was 1742 MW.



From 2007-2012, WTG capacity addition through repowering has achieved CAGR of 32% as against 6.2% CAGR for green field wind projects.

Major learnings from German and other European experiences:-

- Spacing requirements and height limits result in the loss of enormous economic potential for wind energy
- Spacing requirements and height limits make small turbine areas completely unsuitable for modern wind turbines, given the current state of technology
- The repowering incentive offered has no effect, since the spacing requirements and height limits make it impossible to achieve the required tripling of installed nominal capacity;
- If yields cannot be increased by a factor of 2.5, then repowering turbines before their technical service life ends (usually 20 years), no longer offers an economic advantage to wind farm operators. It should be noted here, that more than 50 percent of the wind power capacity in Germany was installed after 2000. Maintaining the current spacing requirements and height limits actually preserves the number of existing wind turbines.

From the above it is obvious that the repowering of wind energy in any country needs to be supported by the government. To encourage repowering it seems that feed-in tariffs are in favour, and strict height and spacing limitations should be limited, otherwise the necessary increase in installed power cannot be achieved.

8. Indian Wind Power Scenario

The Indian wind scenario can be described through the chart below that gives the details of the wind turbines that have been installed in India till 31st March 2014.

Break-up of All India installed WTGs (as on 31-Mar-2014)
(source : India Wind Power Directory 2014), (all fig. in kW)

STATES	<=500 kW	501 to 1000 kW	1001 to 1500 kW	1501 to 2000 kW	>2000 kW	SUM
Andhra Pradesh	88,240	267,400	54,000	144,400	184,800	738,840
Gujarat	199,705	1,295,250	1,179,750	317,200	413,700	3,405,605
Karnataka	62,745	1,099,250	778,950	295,850	94,500	2,331,295
Kerala	225	33,600	-	-	-	33,825
Maharashtra	297,345	922,960	1,775,500	748,650	280,200	4,024,655
Madhya Pradesh	26,700	200,200	103,750	-	25,200	355,850
Rajasthan	52,725	1,049,050	929,000	264,000	514,650	2,809,425
Tamil Nadu	1,731,155	2,310,950	2,204,600	775,650	232,250	7,254,605
Total Installed Capacity	**2,458,840**	**7,178,660**	**7,025,550**	**2,545,750**	**1,745,300**	**20,954,100**

Getting deeper into this data, one can actually find out the wind farms/turbines that could be the correct candidates for repowering. All over the world, the typical candidates are the ones that have completed at least 12 to 14 years of their service life. Considering this fact, in India, given the major landmark of the Electricity Act coming into force in 2003, the turbines/farms that have been installed prior to at least 2002 would be the right candidates. Based on this, the following chart shows the detailed state wise installation of the turbines prior to 2000.

It must be noted that these turbines are installed in the most premium locations that are known to have the best wind resources, and thus with more modern and higher wind turbines, the installed capacity may also increase tremendously, with the net energy generation going up several times. It might be the case that the substations that are responsible for connecting the farms to the grid may have to be upgraded in case repowering is undertaken.

Break-up of All India installed WTGs (COD prior to 31-Mar-2000) (source : India Wind Power Directory 2014), (all fig in kW)						
STATES	**<=500 kW**	**501 to 1000 kW**	**1001 to 1500 kW**	**1501 to 2000 kW**	**>2000 kW**	**SUM**
Andhra Pradesh	84,390	-	-	-	-	84,390
Gujarat	143,745	1,600	-	-	-	145,345
Karnataka	24,525	-	-	-	-	24,525
Kerala	-	-	-	-	-	-
Maharashtra	63,715	2,250	-	-	-	65,965
Madhya Pradesh	21,100	-	-	-	-	21,100
Rajasthan	2,900	-	-	-	-	2,900
Tamil Nadu	717,050	37,900	-	-	-	754,950
Total Installed Capacity	**1,057,425**	**41,750**	**-**	**-**	**-**	**1,099,175**

From both the above tables it can be seen that of all the turbines installed till 31st March 2014, more than 10 percent have capacities of less than 500 kW, while nearly all of the turbines installed before 31st March 2000 are of similar capacities. Also more than 45 percent of the turbines installed till 31st March 2014, have capacities below 1 MW - this then highlights the fact that the rest of the turbines with capacities above 1 MW have all come up after this date. In time, it can foreseen that the market for repowering in India will grow tremendously with nearly half of the turbines having the potential to go up beyond 1 MW. Obviously with this increase in capacity, the hub heights will go up and the resultant PLFs would also go up several times from the current 10 to 15 percent levels – thereby strongly bringing into the horizon the fact the generation from wind energy in India is likely to go up several times in the near future.

9. Focus on the Wind Resource Rich Indian States

As can be seen from the above charts, the major Indian wind resource rich states that can be considered for repowering at the very beginning are Tamil Nadu, Gujarat, Karnataka, Maharashtra, Andhra Pradesh and Madhya Pradesh.

Tamil Nadu: Tamil Nadu has the highest wind installed capacity of 7255 MW at the end of the 31st March 2014 in India. The state has some of the world's best wind energy sites, including Muppandal, Tirunelveli, Chittipalayam, Kethanur, Gudimangalam, Poolavadi, Mrungappatti, Sunkaramudaku, Kongal Nagaram, Gomangalam and Anthir with average wind power density ranging between 200-25 W/sq.m.

Gujarat: Gujarat is one of the leading states in India in wind power development. It has a total wind installed capacity of 3406 MW as of 31st March 2014. Ministry of New and Renewable Energy (MNRE), Govt. of India estimates a gross potential of 10,645 MW of wind power in the state. Bhavnagar, Rajkot, Kutch and Jamnagar are the four major districts in Gujarat which are blessed with rich wind energy potential. Jamnagar and Rajkot are two district where wind farming started in early 1990s. Lamba, Dhank, Kalyanpur, Nevada and Pransla in the two districts provide an exciting opportunity for the investors to take up for repowering projects for the existing wind plants.

Andhra Pradesh: Wind energy development programme started in early 1990s. The state has a total wind energy installed capacity of 739 MW as of 31st March 2014 with majority of the plants located in Ananthpur district.

Madhya Pradesh: Madhya Pradesh has a total installed capacity of 355 MW as of 31st March 2014. The major wind energy hubs are in the districts of Devas, Ratlam and Shajapur.

Karnataka: Karnataka too is a leading wind power developing state with a total installed capacity of 2331 MW as of 31st March 2014. However most of these wind mill farms have been developed after 1997, and thus the relative potential for repowering is low.

The theme of the next issue of "Indian Wind Power" is "Policy and Regulatory Affairs".

We invite relevant articles to the theme.

We solicit your cooperation.

Editor

Repowering of Wind Farms: Issues and Proposals in India

Dr. S. Gomathinayagam
Director General, National Institute of Wind Energy, Chennai dg.niwe@gov.in

India has entered in the wind energy sector in the mid eighties and the technology of wind turbine generators available at that time has been with 30-40 m tall turbine towers and rotor diameters in the range of 20 to 30 m involving WTGs of 55 to 400 kW capacities. The required machines were many per MW installation and the needed land was 10 to 12 acres unobstructed, based on the spacing between wind turbines as 5D x 7D, where 5D is the distance within a row between adjacent wind turbines and 7D is the distance between two rows of wind turbines with "D" as Diameter of the Rotor in meters. Except for a small fraction of investment by Government of India in the demonstration wind farms, the entire investment in the wind industry has been from private investors owing to the then policy of accelerated depreciation to the extent of 80 to 100%, in the very first year of investment in wind energy. Over the three decades of operation of these small capacity machines there has been considerable area of land occupied having best windy conditions, producing low generation or even no-generation of wind power. The high technology WTGs with multi mega watt capacities, if they are deployed in these best sites by partially or fully replacing the old ones, would promise excellent new capacity addition apart from several fold increase in energy generated from WTGs.

Foot Print or entire land ownership in wind farms has different issues for repowering

The process of transforming the old WTGs to new state-of-the-art WTGs is the repowering, which needs a policy to attract the older owner/investors to reinvest in wind power, or attract new investors to repower older WTGs/ wind farms. The possible issues and solutions in the form of proposals are discussed in this feature article. Wind farm repowering need not be only from that of addition of new WTGs but also with solar PV or any other renewable form of energy including even energy storage systems.

Denmark, Germany and USA who were pioneers in installing wind turbines quite early, ahead of many countries have already repowered many old wind farms with short-term policies to attract the investors. Repowering as of now is quite slow in most countries. A study in USA points that the repowering market will be hundreds of MWs till 2020 and may go to 1-3 GWs beyond 2020 as the expected life of Wind Turbines are usually in the range of 20-25 years. A study in Ireland points out that almost 90% of the wind turbines installed onshore before 2020 would be repowered by 2050. However, it is more than evident that with ever increasing rotor diameter and hub height of wind turbines ensuring higher energy production in the same site, repowering is an ongoing potentially growing business in the wind energy sector all over the world.

Indian Status

Several studies have been carried out in India and it is estimated that over 25% of the turbines in India have rating below 500 kW which is the indicative scope for repowering in India. A fraction of those machines which were installed till 1997 will amount to 686 MWs with 2663 turbines. After 1997 the additional numbers of WTGs (less than 500 kW) are 2572 with a total capacity of 694 MW. Considering only WTGs which have crossed beyond 15 years of operation in India there is very huge potential for repowering in India. Tamil Nadu, which has already the highest wind installed capacity accounts for most of the repowering capacity having one of the best favorable wind conditions in India. The advantages of higher annual energy generation and meeting of NAPCC targets of renewable power deployment and the extent of CO_2 reduction would certainly outweigh the challenges and hence needs a clearly defined policy support for repowering.

Existing (Old) Wind farm (6.25 MW, PLF 14.3%)

Repowered Wind farm (10 MW, PLF 21.7%)

A typical case study carried out by WRA team of NIWE by Mr. K. Boopathy brings out an installed capacity increase of over 60% with energy increase in the range of 52 to 57 % based on a "WindSim" and "Wasp" application softwares.

Issues

i. Financially the challenges are compounded by the need for decommissioning of old turbines involving heavy machinery and removal of the same from site, grid capacity enhancement and loss of generation from the old wind turbines which have residual life.

ii. Single Wind Turbine Repowering:

There are several single wind mill owners in India due to the AD-based investors/developers. An individual requiring repowering of a single WTG at the same location needs to obtain clearance from the consenting authority from the State/Centre with regards to the effect of such repowering to the neighboring wind turbines/wind farms. While replacement of same capacity WTG of modern technology would mean not a great increase in Annual Energy Production (AEP), use of higher capacity instead would need policy for intercropping.

iii. Multi-Owner Wind Farm Co-operative for Repowering:

A group of WTG owners can join and form a wind farm co-operative and request for permission to repower together with the concerned State or Central Authority so that a large area will be repowered and the profits would be shared on the basis of individual investments in the co-operative.

iv. Wind farm (more than 2 WTGs) repowering with single or multiple ownership of WTGs/land:

There are cases where the land ownership is based on foot-print basis for the WTG and hence the ownership of land and WTG are likely to be different in a given wind farm. This is also possible in the case of IPPs (Independent Power Producers) repowering a cluster of WTGs in a particular Region. It is assumed this case of repowering would involve complete removal of all the old wind turbines, grid capacity enhancements and repowering with higher capacity WTGs, involving appropriate scientific micrositing.

v. Distribution companies repowering old/non-performing wind turbines:

High reliability and grid stability is of primary concern for distribution companies (mostly State or Central owned) which need low PLF (WTGs with low Capacity Utilization Factors-CUF) generators to be decommissioned at a point of time thus can invite the old investors to participate in repowering of their WTGs with one time additional financial incentives to facilitate the best use of high windy sites. This would also envisage complete removal of WTGs beyond 20-25 years from the operating GRID and replacing with modern high performance WTGs.

vi. The fore-closure of PPA and to have a new PPA for the repowered WTGs and consequential deemed loss compensation.

vii. Issue: Double payment of Infrastructure Development Charges (IDC) in some of the states.

viii. Spare capacity availablity in the grid for power evacuation with higher capacity repowered wind farms.

ix. An AD based wind farm developer, the land value would have increased manifold, and a break even of capital investment would have been financially closed. To attract such an investor to repower needs lot of policy push and political and societal will.

x. As the energy price cost/kWh has been always increasing a captive user would be reluctant to reinvest unless his business demands of energy is increasing.

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xi. Wind power is highly seasonal and in India it's only for 5 months, the evacuation capacity is a dead investment for almost 7 months in a year. This may bring up issues of evacuating other renewable power with the grid infrastructure.

Proposals:

i. The regulatory requirement of consenting the repowering project proposals such as turbine and land ownership, PPAs and the influence of micro-siting of new wind turbines on the neighboring wind farms and WTGs.

ii. It is suggested the spacing of wind turbines, generally practiced as 5Dx7D, as discussed earlier needs to be waived in repowered WTGs cases on the justification that the new wind turbine is much taller and is "inter croppable" within the old wind farms with a win-win situation.

iii. If all the WTGs in the Region could not form in the group it would amount to having both older WTGs as well as new repowered WTGs which needs suitable agreement and generation loss (wake class) compensation for the retained old WTGs in the Region.

iv. Based on limited studies by IREDA, CECL-Bhopal, WISE-Pune & C-WET and experience of some of the Indian Wind Turbine Companies, the suggested promotional measures are based on the possible repowering ratio (repowered installed capacity/ existing installed capacity) and the uncertainties of field level micro-siting in contrast to the generally practiced spacing (5Dx7D or 3Dx5D and so on) of wind turbines by various State Regulatory Authorities. A study indicates for a range of repowering ratios from 1.2 to 3.2 in various projects in India the effect of changing spacing of 5Dx7D to 3Dx5D results in an increased total generation of electricity to the extent of 70% to 130% for a typical increase in capital cost of repowering in the range of 3% to 8% per kWh generated. In suggesting the promotional measures, the following observations are recorded which form the basis for justification.

v. Eligibility for repowering:

A cut off date for WTGs operational life should not be preferred for repowering as the machines are fairly new and have more than 50% of their residual design life of 20 years. Instead an annual average capacity utilization factor (20% or less) may the criteria for encouraging repowering.

vi. Limiting Repowering Ratios:

Worldwide repowering ratios have been in the range of 1 to 6.4 in specific projects repowered so far. In India, the installed capacity to be repowered cannot exceed 5 times the existing installed capacity or maximum available evacuation capacity at the site whichever is lower. The above will be applicable both for single wind turbines replaced or a cluster of wind turbines (wind farm) repowered.

vii. Evacuation Enhancement:

If the repowering is not more than 40% of the installed capacity (repowering ratio < 1.4) the existing evacuation infrastructure may be utilized without any additional cost of Infrastructure Development Charges (IDC). However, while planning the repowering project a thorough load flow analysis at the site may be carried out and recorded. For cases where repowering ratio is beyond 40% needing additional evacuation infrastructure to be ensured for the project to take-off, such expenses borne by the repowerer may be reimbursed from National Clean Energy Fund or specially created Green Energy Fund from all tax payers. This would mean complete waiver of Infrastructure Development Charges (IDC), for repowering projects.

viii. Accelerated Depreciation:

In view of the proven nature of bankability of wind power in the existing sites, and due to the ready availability of land with high cost at the best windy sites accelerated depreciation benefits may be extended for all repowering projects wherever the tax holiday of 10 years for wind energy production has been completed.

ix. The State regulatory authorities may adopt scientific micro-siting for each site on a case by case basis without strictly following standard spacing of wind turbines for the repowering projects as the site is already proven and the owner is already willing to proceed with repowering.

x. Permission of Inter-cropping:

To allow partial repowering in a wind farm or in a windy site inter-cropping of taller WTGs whose heights are more than double that of average tower heights of old WTGs having shorter towers would be permitted.

xi. Enhanced GBI & REC for repowering:

To account for the increased cost of repowering and to attract old wind farm developers who have already availed accelerated depreciation and having wind farms with low or no performance but with highly appreciated land value, it is suggested that the additional cost per MW of repowering (decommissioning, grid enhancement & loss of revenue from old WTGs) be compensated with suitable increase in GBI as well as additional RECs per MWh.

xii. Multipurpose repowering projects to evacuate renewable power from solar as well, when wind power is not available. When wind and solar power at a location is co-existing then smart grid management techniques should be encouraged with low interest financing for hybrid repowering.

xiii. A hybrid tariff policy for effective utilization of wind farm land where repowering is done with solar PV plants.

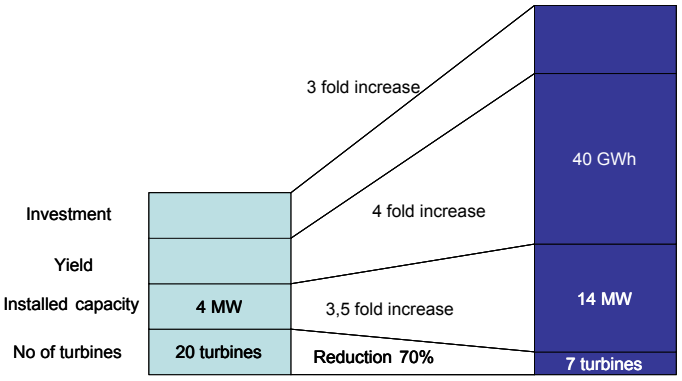
xiv. In the case of foot-print based ownership of WTGs an enabling act may be required to facilitate right of way and enter upon permissions for access to WTG site by neighbourhood land owners for seamless operation and maintenance of WTGs.

Lessons from International Experience

Learning from the international experience, the repowering needs to start now in India, since we are a leading market in the world with targets for wind revised to 60GW by 2022. When one looks at the German experience and American studies reproduced for the sake of global interest in green powering with wind in this section, the financial, technical, and energy mix advantages are more than clear. If we start stimulus policies, promotional measures, this is one way to ensure make in India, clean India, generate skill and employment opportunities in India through this matured renewable energy sector.

Courtesy Web Source reference, Ack: Leonardo Energy Report, Walter Hulshorst, April 2008

Improved environmental visibility impacts along with enhanced power and land use.



Web Ref Ack: Leonardo Energy Report, Walter Hulshorst, April 2008, German Experience on Repowering

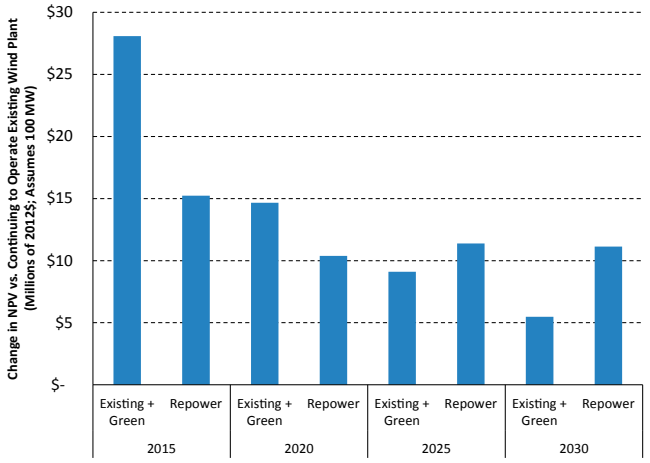


Figure 1. Value added to a 1999 wind plant as a result of investing in a new greenfield or full repowering

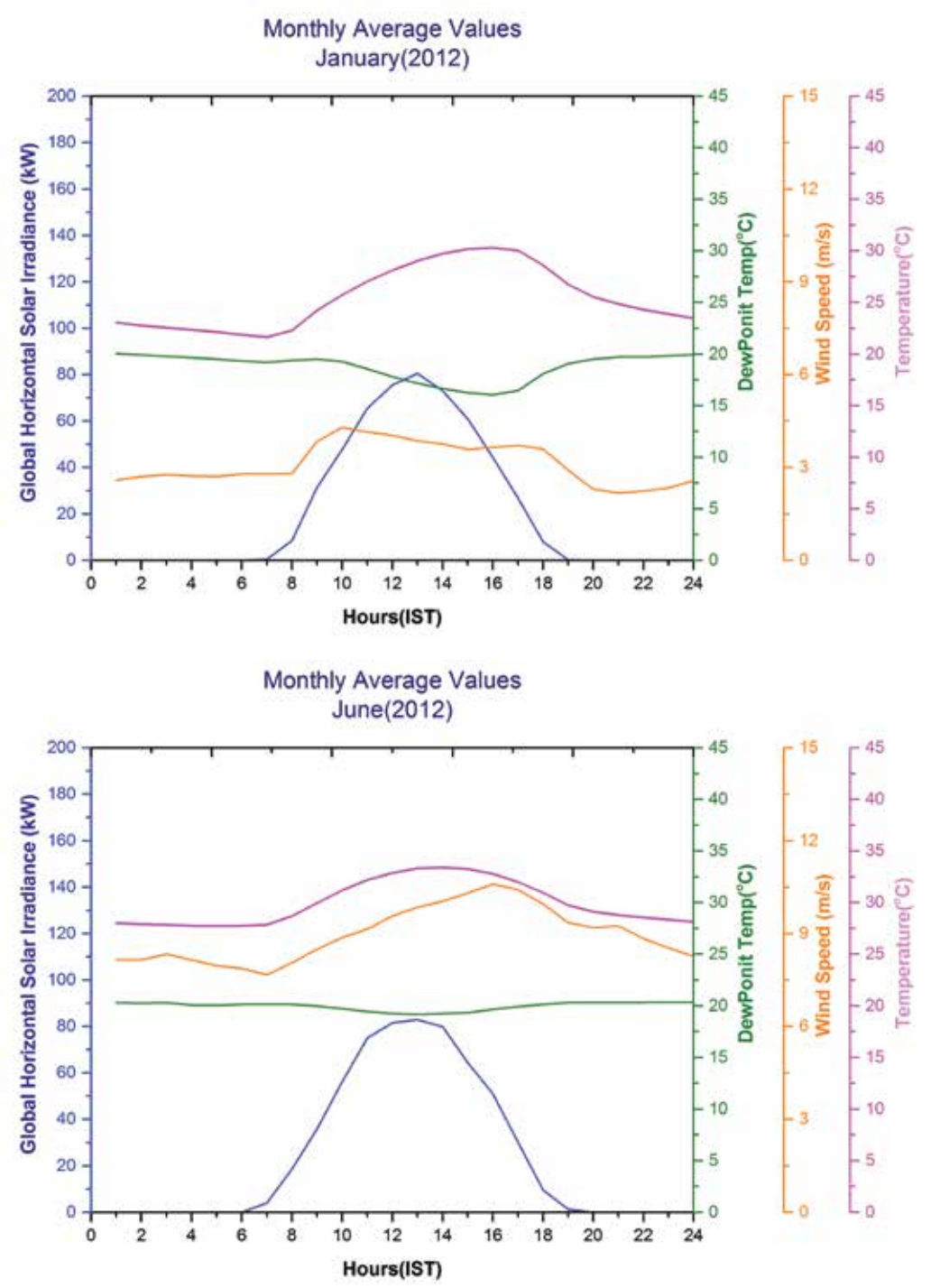
Note: Assumes common reference plant size of 100 MW

Web Ref. Ack: Technical report NREL/TP-6A20-60535, December 2013 www.nrel.gov

Right time to start repowering in India to sustain the Net Present Value of wind farms.

Why repowering should be inclusive of Solar ?

Wind is infirm; solar resource in India is over 300 days leaving the adverse tropical climate in contrast to Europeon weather conditions which may have marginally lower efficiency in solar when compared to the cold regimes in the world. If one analyses the diurnal (24 hours) typical variations wind and solar are complementary, repowered wind farm uses lower foot print making area with grid and other infrastructure for solar both in wind season as well as during low wind months as shown in the figures below.



Diurnal (24 hours typical day) variations of wind and solar in low wind and seasonal wind months

In summary

Repowering the old WTGs, and old non-performing wind farms, is need of the hour as the best windy sites house very low CUF operation of wind farms. Socio-economic, financial, geo-political, techno-economic and regulatory issues are quite complicated for repowering wind farms with newer WTGs or additional solar PVs. For long term sustainability repowering should steadily be providing the needed larger energy mix of Renewable power in India's Energy Mix. Little drops makes the rivers, repowering is like the rain to provide proven business for all making in India to have their pie to achieve the 60GW wind and 100GW solar targets. The author welcomes critical remarks and suggestions for providing a well laid out workable scheme for repowering renewable in a big way. (dg.niwe@gov.in)

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Towards Repowering

Mr. Srikaanth Sarangapani
Country Manager - India, Nayxa Energy Services, Spain, srikanths_2k1@yahoo.com /ssrikaanth@nayxa.com

Repowering is replacing old and underperforming wind turbines with modern ones that could offer better returns and more power than before. The "Repowering" opens up a productive opportunity in wind power sector. Wind turbine installations started in India during 1990s and in the early years most of these turbines were installed in Class I and II locations and were of smaller capacity. These turbines have to pave the way for repowering and thus better utilization of the available wind resources.

Replacement of first-generation small-capacity wind-turbines with advanced higher capacity wind-turbines to increase the installed capacity and electricity output with a decrease in the infrastructure requirement is known as Repowering of Wind Turbines.

Why Repowering?

There are two main reasons which triggered the idea of repowering.

A) Acute Power Shortages

Per capita consumption of electricity in India (2.02 kWh) is very low compared to Canada (51.5 kWh), USA (39.25 kWh) and other developed countries. Despite this there is a large gap in meeting the demand.

All India Installed Capacity of Power Stations as on 31.01.2015

Source		In MW
Thermal	Coal	156190.89
	Gas	22971.25
	Diesel	1199.75
Total Thermal		180361.89
Nuclear		5780.00
Hydro		40867.43
Renewable Energy	(Dec. 2014)	33791.74
Total		**260801.06**

RENEWABLE ENERGY - GRID - INTERACTIVE POWER (CAPACITIES IN MW) AS ON 31st December 2014).

Wind Power	22465.03
Small Hydro Power	3990.83
Biomass Power & Gasification	1365.20
Bagasse Cogeneration	2800.35
Waste to Power	107.58
Solar Power	3062.68
Total	**33791.74**

Source: MNRE

Most of the states in India are facing acute shortage of power especially during summer months.

Power Supply Position (Demand & Availability) in Jan. 2015

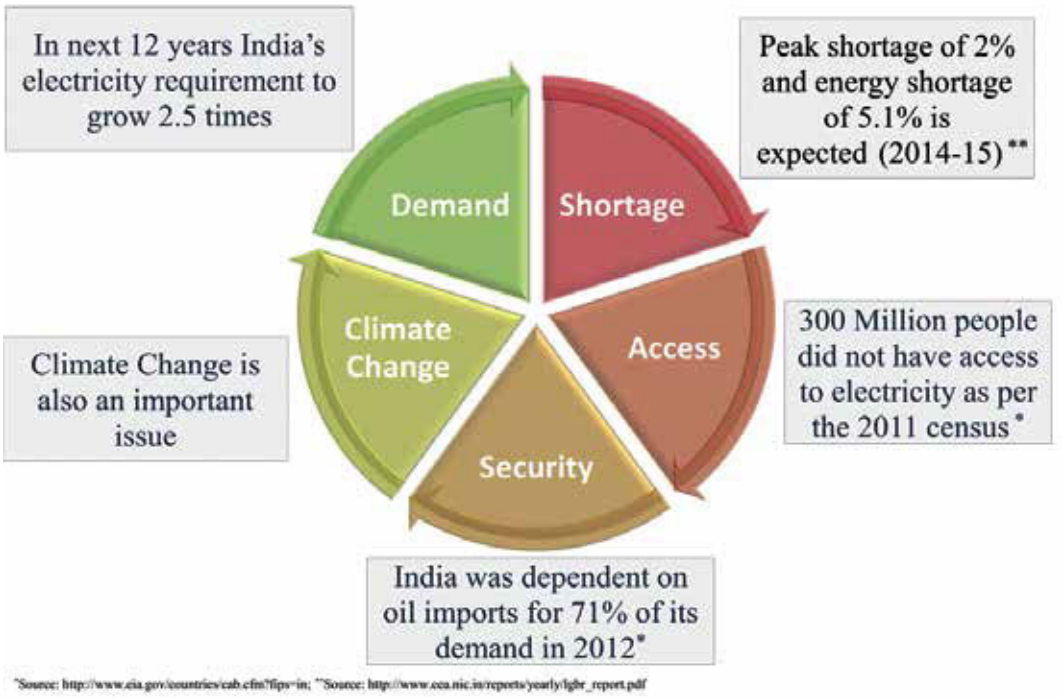
Region	Energy (MU)				Deficit (%)	
	Demand		Availability			
	Jan.14	Jan.15	Jan.14	Jan.15	Jan.14	Jan.15
Northern	25116	25858	23738	24100	-5.5	-6.8
Western	25383	26216	25037	26093	-1.4	-0.5
Southern	24082	23599	23186	23058	-3.7	-2.3
Eastern	8913	9337	8820	9191	-1.0	-1.6
North Eastern	1080	1246	1004	1117	-7.0	-10.4
All India	84574	86256	81785	83559	-3.3	-3.1

Peak Demand / Peak Met in Jan. 2015

Region	Power (MW)				Deficit (%)	
	Peak Demand		Peak Met			
	Jan.14	Jan.15	Jan.14	Jan.15	Jan.14	Jan.15
Northern	40300	42381	38,227	40774	-38.0	-38.0
Western	41097	42247	39731	41553	-3.3	-1.6
Southern	37096	36992	34129	35446	-8.0	-4.2
Eastern	14265	15370	14082	15209	-1.3	-1.0
North Eastern	2096	2455	1925	2202	-8.2	-10.3
All India	134854	139445	128094	135184	-5.0	-3.1

Courtesy: CEA Report

India's Energy Challenge



Repowering will help to solve this problem to some extent.

B) Insufficient / Inefficient Utilization of Potential Windy Areas

Apart from just being an obvious opportunity to increase the installed capacity and electricity output, repowering is also an economically viable solution. This is because, there is no need to acquire new land and the costs associated with siting related activities. Secondly, the maintenance costs of the aging WTGs can be avoided. And lastly, the advanced design of the new WTGs have resulted them into a taller, efficient turbine which allow obstruction free wind flow to WTGs and also rotation in low-wind speeds; hence generating more electricity.

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.
- Smaller wind turbines required higher cut in speed in the range of 5 m/s but the new turbines have ability to cut in at lower wind speed around 3 – 3.5 m/s. There is a significant improvement in the wind power density leading to positive power law index, which will subsequently yield higher PLF.

Proposed Incentive for Repowering

Many of the wind turbines in the State have lived their life and are perhaps due for replacement. The old turbines which are of lesser capacity occupy the best windy sites and the efficiency of these turbines has come down because of its age. These need to be replaced with newer higher capacity turbines by way of repowering. We, suggest the Hon'ble Commission could provide an incentive for such repowering by prescribing a tariff which would be 50 paisa or one rupee more than the tariff to be decided for the normal turbines.

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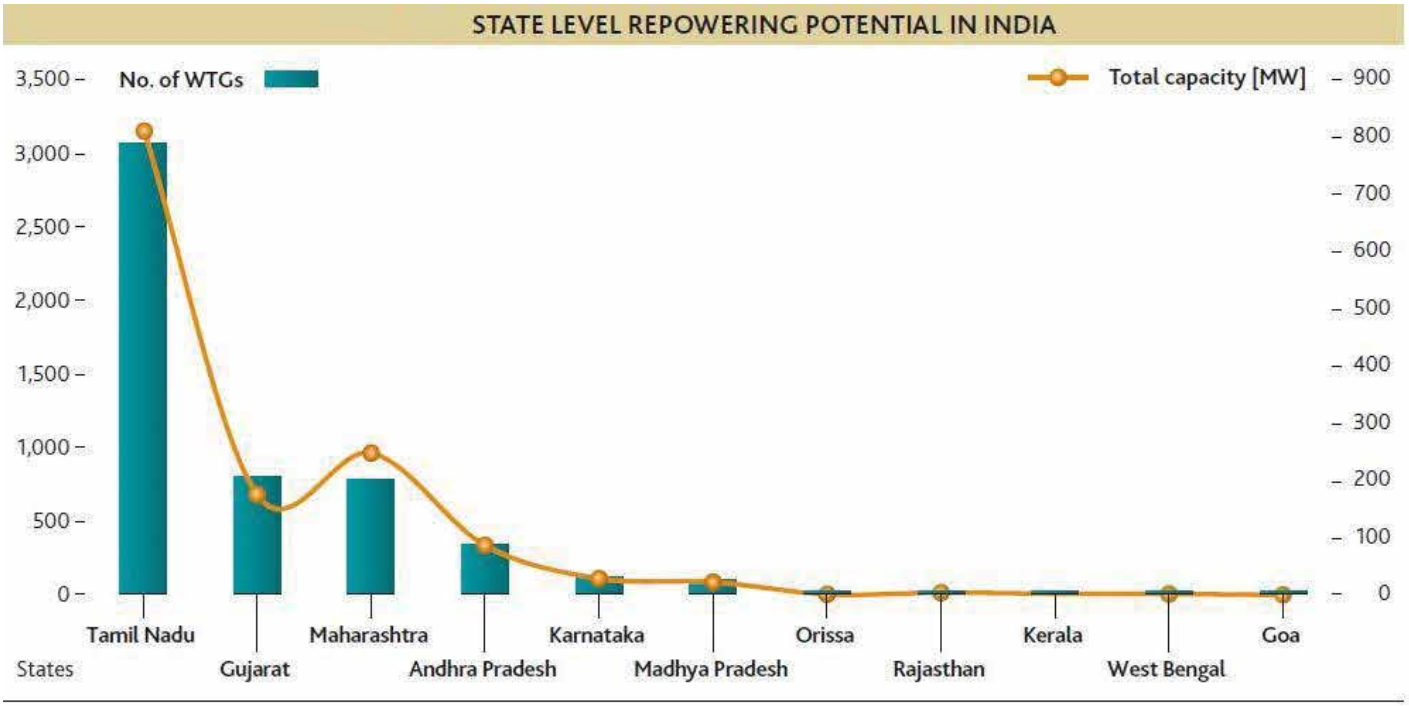
State Level Repowering Potential in India – till March 2009



Source: WISE

Recently Repowering Project Done in Tamil Nadu

Sample Repowering Projects

At **Aralvoimozhi in southern Tamil Nadu,** a leading wind turbine manufacturer completed replacing 11 old wind mills of 225 kW capacity each, with three of its own 850-kW machines. The capacity remains roughly the same, but the new machines, with their ability to rotate even in low-wind speeds, are up longer, generating more electricity.

WINDS OF CHANGE		
	Existing wind farm	**After repowering**
Capacity	8.1 MW	8.5 MW
Estimated annual generation	104 lakh units	220 lakh units
Plant Load Factor	14.7%	29.5%

Illustrative Example for Repowered Projects (Micro-Siting)

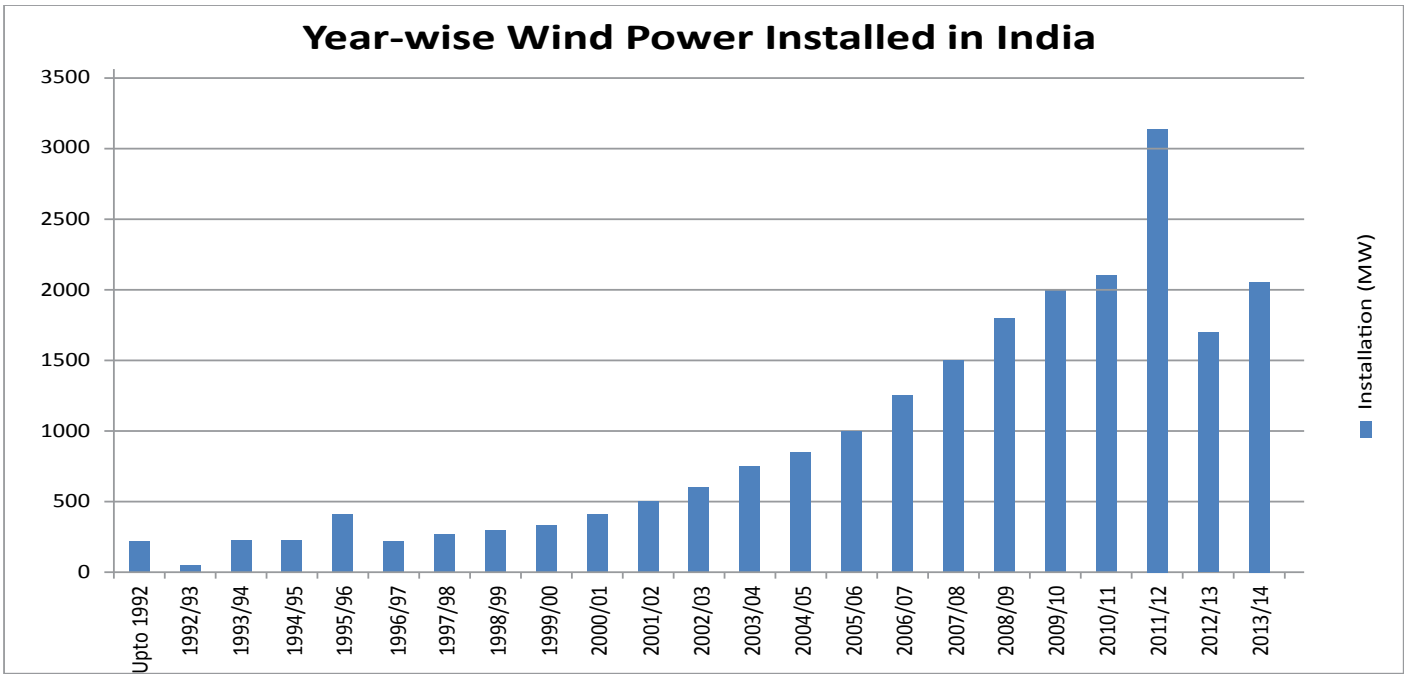
XXX CUSTOMER EXISTING WIND FARM				
Hill No.	**No. of Existing WTGs**	**Existing WTG**		**Generation**
		Site Capacity	**PLF**	
Hill A	4	0.92 MW	22.7%	1.83 GWh/y
Hill B	13	2.99 MW	29.4%	7.7 GWh/y
Hill C	16	3.68 MW	26.6%	8.58 GWh/y

Total Site Capacity 7.59 MW

ORIGINAL PROPOSED TURBINE LOCATIONS			
No. of Proposed WTGs	**Proposed WTG**		**Generation**
	Site Capacity	**PLF**	
2 WTG	4 MW	26.0%	9.12 GWh/y
6 WTG	12 MW	28.9%	30.33 GWh/y
6 WTG	12 MW	28.8%	30.24 GWh/y

Total Site Capacity 28.00 MW

Variations in Turbines Size in India



Already Executed Repowering Projects in Europe

Before **After**

Turbine Installed Trends in India

Rating	2004			2005			2006		
	%	Qty	MW	%	Qty	MW	%	Qty	MW
< 300 KW	57	4886	1112	50	5375	1226	44	5757	1317
300 KW - 600 KW	28	2419	1113	25	2752	1274	25	3297	1576
600 KW - 1 MW	8	714	570	12	1293	1026	15	1983	1575
> 1 MW	7	627	799	13	1405	1815	15	2021	2646
Total	100	8646	3594	100	10825	5341	99	13058	7114

Additional Cost for Repowering

Existing Turbines

- De-erection Cost
- Cranes
- Transportation
- Man Power
- Scrap Cost

New Turbines

- Erection Cost
- Cranes
- Transportation
- New Tower, Nacelle, Rotor & Transformer Cost
- Statuary charges like NOC, CEIG approval
- Man Power
- Foundation Cost
- Relocation of Existing HT Lines.
- Sites Feasibility and wind resource Cost.

Challenges in Repowering

Technical Issues

- O & M of old WTGs
- Underutilization of wind resource site
- Electrical grid and substation
- Rating of WT for repowering
- Micro sitting
- Options to dispose off
  - Scrap
  - Exporting to other countries
  - Buy back by the WTG manufacturer / intermediaries

Financial Issues

- De-erection & Transportation Cost
- Salvage value of old project
- Discounting factor
- Sale to EB v/s Captive Power Projects
- Tariff and incentives for repowering

Policy and Regulatory Issues

- PPA Issue
- Mode of sale of electricity
- High open access charges to new captive wind projects

Other Issues

- Many old WTs manufacturers do not exist
- In a given wind farm, there are many owners of individual wind turbines, for repowering to succeed, all owners in the wind farm must agree to repower. Getting unanimous agreement on the same terms is a difficult task. Many in the wind farm could be locked into a PPA, which has no termination clause.
- We should find out innovative ways to microsite the repowering site due to the presence of existing turbines in and around the site.
- Economic feasibility /viability is an important factor which need to be considered in deciding the capacity and quantity of older machines to be removed based on the repowering factor.

Cost of Repowering & Incentives

- Repowering project costs are always more than that of Green Field Projects
- Repowering wind-power project costs: Need consideration for future revenue loss from the existing functional projects over its balance life.

Specific policy on repowering wind sites: A national repowering policy is very essential for ensuring rapid nationwide implementation and the industry strongly believe the government is taking adequate steps to promote this initiative.

International Experience on Repowering

As per Jeff Anthony, Director of the Energy Innovation Center at Midwest Energy Research Consortium Manchester, UK – "By 2020, swapping aging wind turbines with more powerful modern units will have raised annual electricity generation at refurbished sites from 1,524 GWh to 8,221 GWh. A 2-MW wind turbine coming off the production line with a rotor diameter of 80 meters can generate four to six times as much electricity as the 1-GWh annual yield of a 500-kW wind turbine with a 40-metre rotor built in 1995. This is the fundamental thinking behind wind repowering."

Replacing old machines with fewer, larger and taller modern units that are quieter, far more reliable, and capable of producing vastly more electricity is an activity that has increased significantly during the last five years, according to Global Data's 2012 Wind Repowering Report. The report says the value of the world's repowering market will grow massively in the next five years. In 2011 wind farms producing around 183 GWh annually were replaced with turbines capable of generating 774 GWh. But by 2020, repowering will drive an increase in annual power generation at repowered sites from 1,524 GWh to 8,221 GWh.

The older wind farms located in the windy terrains of Muppandhal, Panakudi and Kayathar in the southern

districts of Tamil Nadu- Tirunelveli, Thoothukudi, Nagercoil, Kanyakumari and Coimbatore offer huge opportunity for repowering in India. There is also growing interest among independent power producers (IPPs) to buy old wind farms at attractive valuations, keeping in mind the land and existing infrastructure, vindicates the belief that repowering business is geared up to witness significant growth in India.

Suggestions and Recommendations

- Wind power projects having less than 400 kW turbine capacities may be taken up for repowering.
- Stringent micro-siting criterion as followed in few states (e.g. Tamil Nadu) should be relaxed to develop full repowering potential.
- All captive, third party sale and sale to SEB projects should be considered for successful repowering programme, since above 65% of the investors are in captive mode.
- For permitting repowering, old existing project <400kW turbine rating which had completed operational life between 10-15 years and remaining 10 years period left shall be considered.
- New customers /Power producer who go for repowering should have the freedom to choose the mode of PPA either Group captive, third party or sale to board at power producer's discretion. This would enable the investor to consider repowering as a viable option.
- Process of approval /procedure for repowering project should be simple and fast in order to save time.
- Repowering incentives.
  - Uniform higher Feed-in tariff support in all states where repowering potential is available.
  - Generation linked repowering incentive for minimum 5 years.
  - Accelerated Depreciation (AD), bonus (additional) tariff for repowered projects for fixed period.
  - Incentive to Discom for accepting power from repowered projects.
  - Provision of funds for Infrastructure Development Charges (IDC) by MNRE on the basis of increased capacity.

Conclusion

- Repowering benefit- "With half the infrastructure, double the capacity and triple the energy, this is the Repowering mantra or thumb rule".
- Apart from the economics, other important challenges for implementing repowering and associated issues like-technical, financial and policy & regulatory etc. need special attention.

Snippets on Wind Power

Andhra Pradesh Wind Power Policy 2015 Unveiled at RE-invest 2015

Andhra Pradesh Solar and Wind Power Policies for 2015 were released jointly by Sri Piyush Goyal, the Union Minister of State (IC) and Andhra Pradesh Chief Minister Sri N Chandra babu Naidu at the Global Investors Summit in Vigyan Bhawan, New Delhi on 15th February 2015.

Draft Onshore Wind Policy by MNRE

MNRE has put up the draft Onshore Wind Policy on the web on 9th February 2015 and has invited the comments up to 9th April 2015. Government of India through introduction of this Policy, envisions to work in close collaboration with the State Governments towards large scale deployment of wind power in the country so as achieve the target of 60,000 MW (cumulative) by 2022. The Government also recognize the importance of wind energy in achieving energy security for the country, and the role that wind power development may play in reducing trade deficit and also keeping up with environmental commitments of the Governments towards society.


GOVERNMENT OF INDIA

CERTIFICATE OF REGISTRATION

IWTMA is happy to inform that its Magazine **'INDIAN WIND POWER'** name has been registered by the Registrar of Newspapers, Govt. of India vide registration No. TNEG/2015/60605 dated 5th March 2015 under the Press and Registration of Books Act, 1867.

Budget Highlights 2015-16 : Wind Power

Finance Minister Mr. Arun Jaitley presented the Union Budget proposals for 2015-16 on 28th February 2015. The following provisions have been made in the Budget proposals for 2015-16 relating to Wind Power:

MNRE has revised the target for renewable energy to 175000 MW by 2022, which comprises 60000 MW of wind power.

Following changes will be effective from 1st March 2015.

- Tariff rate of BCD on iron and steel and articles of iron or steel has been increased from 10% to 15%. The effective rate remains the same.
- For claiming BCD and CVD exemption on import of goods for mega power projects, bank guarantee will now be required to be submitted for an extended period of 66 months instead of earlier 36 months.
- Effective median excise duty rate increased from 12.36 % to 12.50 %.
- Education Cess and Secondary and Higher Education Cess exempted on all goods.
- Excise Duty exemption granted on Pig iron SG grade and Ferro-silicon-magnesium for manufacture of cast components of wind operated electricity generators, subject to approval by MNRE.
- Basic Customs Duty on Active Energy Controller (AEC) for use in the manufacture of Renewable Power Systems (RPS) inverters is being reduced to 5 % subject to certification by MNRE.

Following changes will be effective from the date of enactment of Finance bill.

- Increase in clean energy cess from Rs. 100 to Rs. 200 per ton on coal, lignite and peat.
- Effective Service Tax proposed to be increased from 12.36% to 14%.
- An enabling provision proposed to be incorporated in Finance Act for imposition of 2 % Swachh Bharat cess on the value of service on specific services.

GST: Commitment to introduce GST in April 2016 reaffirmed.

Snippets on Wind Power

Wind Energy Mission Addition Awaits Nod

The government is to introduce a 'Wind Energy Mission' drafted by MNRE in April 2014 in the National Action Plan for Climate Change (NAPPC) and the formal induction is awaited for the consent from the Prime Minister. Under the proposed action plan, MNRE would strengthen grid infrastructure for wind power, identify high wind power potential zones, ease land clearances for the projects, regulate wind power rates and incentivise investment in the sector. MNRE also plans to extend the 'Generation Based Incentive' for project developers for five years. This would amount to a total expenditure of ₹ 18,000 crore.

Source: Business Standard

Online Approval of ODC and OWC on Movement on National Highways

A web portal for online approval of movement of over dimensional (ODC) & over weight cargo (OWC) by modular hydraulic trailer on national highways was inaugurated on 6th January, 2015 by Shri Nitin Gadkari, hon'ble Minister for Road Transport & Highways and Shipping. However, the State and local authorities will have to be approached for approval on State and local highways/roads. The requirement of wind industry in respect of the movement of blades, nacelle and tower to the remote locations was also discussed at the conference organized by the Ministry of Road Transport & Highways jointly with Hydraulic Trailer Owners Association (HTOA) on 6th January 2015. The point on hassle free movement of these items from factory to the point of use and the expectations of the government on increased capacity addition was also mentioned.

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Gujarat Office:
222, Orange Mall, Chandkheda, Ahmedabad - 382 424
Tel : +91-79-3295 9955, Mobile : 078784 69955, 081413 81955, Email : sarwjeet@pioneerwincon.com

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Revisiting RE-Invest 2015

Prime Minister Sri Narendra Modi inaugurating RE-Invest

A view of Onshore Wind Session sponsored by IWTMA

The 1st Renewable Energy Global Investors Meet and Expo (RE-Invest) 2015 was conducted at New Delhi from 15th to 17th February 2015. The three-day conference was inaugurated by the Prime Minister Mr. Narendra Modi at Vigyan Bhavan. Inaugurating the conference, Mr. Modi said that the solar, wind and biomass sources of energy are the way forward and the government is working towards making solar power more viable. There should be thrust on equipment manufacturing under the 'Make in India' plan as it will go a long way in job creation. He added that there is a need to develop hybrid plants as well for optimum utilisation of available land. Prime Minister emphasized the need for change from Mega Watt to Giga Watt.

Green Energy Commitments

At the inauguration, 293 companies committed to generate 266 GW of renewable energy in the next five years under the government's ambitious RE-Invest programme by setting up renewable power plants and manufacturing the equipment as well. The commitments made for wind energy was for 45296 MW by power producers, and 36350 MW from manufacturers.

The UN Secretary General's Special Envoy for Cities & Climate Change Mr. Michael Bloomberg delivered the special address at the Plenary Session on 16th February 2015.

202 speakers from 29 countries deliberated at the conference which attracted 2860 delegates from 42 countries representing 578 Indian and 124 international companies. Senior representatives from the renewable energy industry, equipment manufacturers, global financial institutions, public sector enterprises, regulatory authorities, central and state governments, research institutions and academia participated in the conference & expo. The media coverage was good with 164 representatives from 88 publications/agencies. 118 exhibitors exhibited their products and services attracting 2040 visitors over and above the conference delegates. Germany, UK, Italy and UAE had their country pavilions at the exhibition.

IWTMA and RE-Invest 2015

Green Energy Campaign by IWTMA:

IWTMA's Indian Wind Power Magazine, badges with "Wind Power Works" and brochure on "Winds of Change" were distributed to the delegates at the conference.

Session on Onshore Wind Energy on 17th February 2015 sponsored by IWTMA:

As a part of Re-Invest, IWTMA sponsored a session on Onshore Wind on 17th February 2015 from 2.30 to 4.00 pm at the Banquet Hall of Hotel Ashok. The session focussed on policy, regulatory, financing and other major issues concerning wind power business in India and concentrated on building a comprehensive roadmap for achieving our targets. The event was coordinated by Mr. Dilip Nigam, Director, Ministry of New and Renewable Energy, Government of India. A structured, theme-based discussion took place on the currently most relevant issues for achieving the revised target of 60 GW of wind power by 2022. The opening remarks were given by Chair & Moderator Mr. V Subramanian, Former Secretary, MNRE, GoI and Chief Executive Officer and Chairman, Indian Wind Energy Association.

Initial Remarks were made by panellists Dr. S. Gomathinayagam, Director General, National Institute of Wind Energy; Mr Steve Sawyer, Secretary General, Global Wind Energy Council and Ms. Varsha Joshi, Joint Secretary, Ministry of New & Renewable Energy, Government of India.

The grid integration issues were discussed by Dr. Jami Hossain, Chief Mentor & Co-founder, Wind Force Management Services Pvt. Ltd; Mr S. K. Negi Managing Director, Gujarat Energy Transmission Corporation Ltd; Mr V K Agrawal, Chief Executive Officer, Power System Operation Corporation (POSOCO) and Mr. Y. K. Sehgal, Executive Director, Power Grid Corporation of India Limited.

The manufacturing issues were discussed by Mr. Madhusudan Khemka, Chairman, Indian Wind Turbine Manufacturers Association; Mr. Chintan Shah, President, Suzlon Energy; Mr. Jorn Hammer, Country Head, Vestas and Mr. Rakesh Bakshi, Managing Director, RRB Energy Ltd.

The developer issues were discussed by Mr. Sumant Sinha, President, Indian Wind Energy Alliance; Mr. Mahesh Makhija, Director - Business Development, China Light Power (CLP) Group and Mr. U. B. Reddy, Managing Director, Enerfra Projects (India) Pvt. Ltd.

Financing issues were deliberated by Mr. K. S. Popli, Chairman & Managing Director, Indian Renewable Energy Development Agency and Mr. Rajat Misra, Vice President, SBI Capital Markets Ltd.

The speakers at the session emphasized on the following:

60 MW Target:

With an ambitious target of 60 GW by 2022 set by Government of India, the wind energy sector is poised to achieve 10 GW per annum installation in the next 5 years. This will require focusing and solving the following issues:

1. **Continuation of AD**

   Continuation of AD should be there till critical mass is achieved. This will encourage more IPPs and PSUs to invest in the RE projects. Power intensive corporate are showing the interest to use Wind Energy for captive use.

2. **Funds for GBI**

   Adequate funds should be made available for Generation Based Incentive.

3. **Supply Chain Development**

   To achieve 'Make in India' for renewable energy, the government should endeavour for developing the entire supply chain. This will bring down the cost of raw materials, lower clean energy prices, and reduce the foreign exchange outgo.

4. **Creation of Demand**

   Together with the focus on supply, attention would have to be paid to creating demand. This can be done by strengthening RPO and ensuring its compliance by States by introducing Energy Law and making RPO compliance mandatory.

5. **Funding of Wind Power Projects**

   Funding of wind power Projects should be done by public sector banks like State Bank of India is doing now. The government should allocate funds from the National Clean Energy Fund to meet the critical viability gaps. A new escrow fund may be created to provide a payment security mechanism for developers. A separate category of RE financing may be created to encourage the banks and priority sector lending status to RE financing will also encourage the banks. Financing for working capital to developers, financing multi axel vehicles and cranes for project execution are needed to achieve the desired target.

6. **Report of Wind Industry**

   a. Wind turbine technology should be upgraded to suit Indian conditions. pumped storage, wind-solar hybrid, LVRT & HVRT capabilities etc. need to be upgraded and integrated with wind farm development.

   b. Scheduling and Forecasting should be there to help Load Dispatch Centres but it should be at macro level.

   c. Repowering to bring multiplier effect in PLF given the higher hub heights and the better turbine technology.

   d. Wind Solar Hybrids should be developed for maximum generation.

   e. The companies putting up the manufacturing facilities and developing wind farms are taking up the CSR initiatives not for rural employment alone but for concern for health for pre-school and schooling children in cooperation with State Govt in special nutrition and applied nutrition programme.

   f. Wind energy storage solution is needed to absorb wind variability and achieve grid stability. Given the recent push for additional wind deployment by Indian Government and a target of reaching 100 GW of wind within next decade, even the high case scenario may turn to be an under estimate.

g. Strengthening and expansion of Interstate transmission lines from high wind zones to high load centres is a must which also interstate network.

h. The Government should come out about with a policy on export of wind turbines with incentive in various forms to encourage the exports.

i. There is a need for imparting training in soft skill development for better performance at work.

j. Skill Development by development of apprenticeship courses, engineering degrees and building industry-academia linkages for creating the demand pipeline is needed.

k. The Indian wind sector has the potential to generate much needed rural employment for the growing workforce, up to 183,500 FTE jobs (excluding manufacturing) if India achieves its targeted 60 GW of wind power capacity by 2022 in semi-skilled and unskilled roles in rural areas.

l. An investor-friendly environment with stable policies at central and state level, infrastructure ramp-up for evacuation and grid stability, bringing state utilities on board to ease approvals, PPAs, timely payment, assured land availability by making available Govt. land, standardisation of various approvals, continuation of feed-in-tariff, security at local level etc. will help deliver the vision.

Session on Grid Connected Wind Power with Focus on Offshore

The session discussed the progress made in the wind power segment in India in terms of capacity installations and manufacturing and evaluated the prospects of new technology solutions like offshore wind. Mr. G. Upadhyay, Director, MNRE, coordinated the programme. Mr. Steve Sawyer, Secretary General, GWEC moderated the session. The panellists were Mr. Allan MacAskill, Director, MacAskill & Associates & Director, Pilot Offshore Renewables; Mr. Andy Oldroyd, Technical Director & Co-Founder, Oldbaum Services Ltd; Mr. Charles Yates, FRSA Managing Director, CmY Consultants Ltd; Mr. Huub Den Rooijen Head - Offshore Wind, Crown Estate; Dr. Mark Leybourne, Senior Engineer, IT Power, United Kingdom and Mr. Norbert Giese Vice President, Agency and Government Relations.

Snippets on Wind Power

Wind Power Sector Confident of Achieving Targets

The wind power industry is confident of achieving the ambitious target of 60 GW of electricity by 2022 on the back of Narendra Modi's "Make in India" campaign. "We fully support the 'Make in India' campaign with our turbines of state-of-the-art technology which has almost 70 per cent localisation. We also aim at creating rural employment both direct and indirect during the project stage and employment for manufacturing. Addressing these key challenges and issues, we are confident of achieving 60 GW target," IWTMA Chairman Madhusudan Khemka said. He said the estimated number of people employed in the sector will be around 160,000 by 2022.

IWTMA, formed to promote and harness wind energy in India, strives towards achieving high efficiency in energy generation through technologies and cost efficiency in the clean energy drive. To achieve the aim of 60 GW, the challenges and opportunities discussed at Re-invest including grid integration based on forecasting and scheduling of wind power to ensure seamless grid connectivity.

IWTMA says wind-solar hybrid systems need to be promoted in the near future so that there is optimisation of the energy sources as well as reduced land requirement, which will maximise output and cut costs. The association highlighted the challenges in the coming year that need to be addressed to help achieve India's ambitious renewable energy goals. These include availability of land with good wind resource and the need for transmission planning, which takes into account future capacity expansion, energy storage solutions and a policy on wind-solar hybrids. Varsha Joshi, Joint Secretary of the Ministry of New and Renewable Energy, said all the discussions with the stakeholders are part of the national wind power policy.

Source: Business World

TNERC Finalised APPC for 2014-15

Tamil Nadu Electricity Regulatory Commission (TNERC) has finalized APPC for FY 2014-15 vide notification dated 4th Feb 2015 as ₹ 3.38 per unit or 75% of the preferential tariff fixed by the Commission to that category / sub category of NCES generators, whichever is less. The APPC for FY 2014-15 has increased by 8.6% compared to APPC of FY 2013-14.

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LM WIND POWER

Repowering of Old Wind Farms

M.K. Deb
Managing Director, Consolidated Energy Consultants Ltd.

1. Wind Power Programme in India started with Demonstration Projects using 55 kW/ 90 kW Turbines. Private sector Investment in wind power projects started in early ninety's. Till 2000-02 the Wind Electric Generator (WEG) ratings were from 225 kW to 600 kW.

   These WEGs had rotor diameter varying from 30 meter to 40 meter and hub height of 30 meter. A large number of WEGs were stall regulated.

   The Capacity Utilization Factor (CUF) was generally in the range of 15%.

   Except one make of Wind Electric Generator (WEG) rated for 800 kW – the other commonly used models-now a days are rated 1.5 MW to 2.1 MW and even higher.

   These higher rating WEGs have rotor diameter of 90-100 meters and hub-height of 80-100 meter. The type of Generator and rotor are of advanced design ensuing higher CUF.

   Typically a MW range WEG has CUF of 20% in low wind area and 25-30% in high wind sites.

   The old WEGs are incidentally located in reasonably good wind sites. The WEGs are inherently less efficient and over the years there has been sufficient de-rating.

   If new generation WEGs with higher rotor diameter and taller hub-height are installed at sites now occupied by old WEGs, the MW installed capacity would increase marginally but generation would increase substantially.

   It is therefore a matter of national interest to repower the old inefficient wind farms and meet target of NAPCC.

2. Several demonstration wind farm projects of small capacity were installed with total capacity of 73 MW and these can be readily available for repowering.

   The other wind farms which can be considered for repowering are those commissioned till 2002 and having WEG of rating up to 600 kW.

   These wind farms are mostly located in the State of Tamil Nadu and partly in Gujarat.

3. The wind farms suitable for repowering can be broadly classified in two options:

   Option-A: Where PPA has expired

   Option-B : Where PPA is still in force

   In Gujarat – the PPA was signed for a period of 5 years initially and subsequently extension has been provided.

   In Tamil Nadu – initially no time limit was mentioned in the PPA and the WEGs can legally continue to operate for indefinite time to come.

   Under Option-A, the owner is now under obligation to replace the old WEG but there are no possibilities in either Gujarat or Tamil Nadu.

   Under Option-B, the owner would agree to replace only if attractive financial benefit is available.

4. Since higher rating WEGs of 750/800 kW were installed after March 2002, the cut-off date for repowering may be considered as 31.03.2002.

   Based on this cut-off date and unit rating of WEG up to 600 kW, the total potential for repowering is 178 MW in Gujarat, 311 MW in Maharashtra and 838 MW in Tamil Nadu.

5. The Demonstration wind farms installed capacity has been 63 MW on 31.03.2002 which is now total 73 MW.

   These WEGs can easily be replaced with consent of State and Central Govt.

   Already one Wind farm in Maharashtra is being repowered.

6. Electricity Act and consequently rational Feed-in-Tariff came into existence in year 2003. Earlier to that – Electricity Boards declared a power purchase rate which was quite low and very few Investor's opted for sale to Electricity Board.

Most of the Private Sector Investors – opted for captive consumption. Over the years the H.T. tariff has increased substantially and consequently the WEG owners are enjoying higher benefit and cash gain – which will be lost if they opt for repowering.

7. The windfarms suitable for repowering can be broadly divided in two categories:

   Category - 1 : Wind farm of capacity 2 MW and above in well connected continuous land area.

   Category - 2 : Single WEGs installed in foot-print area.

   It is comparatively easy to repower the wind farms of Category – 1 but it is quite difficult to deal with WEGs in Category-2 where several nearby WEGs have to be clubbed together and replaced to install a large size – WEG.

8. Since it is almost impossible to avail depreciation through fragmented ownership of WEG, the solution for Category -2 would be to :

   — either – an Entrepreneur/Investor buys out several single WEGs in nearby area.

   — or – form a cooperative/ a new company and allot shares to owners of old WEGs.

9. To cut down the initial investment, the infrastructure development charges payable to Electricity Board may be paid through Green Energy Cess fund.

10. Electricity Board shall have to relax the norm of 5Dx7D separation distance.

11. Electricity Board may be compensated through mandatory sale to Electricity Board of equivalent energy now being purchased by them for a period of maximum 10 years.

12. Unless attractive financial incentive is provided, the owners of old WEGs shall not agree for repowering till their old WEGs are operational.

    While the existing benefit of A.D. or GBI is in any case available, something extra incentive needs to be provided to motivate.

    One of the options could be to offer Interest subsidy of 5% for a period of 5 years up to a ceiling of ₹ 4 Crores per MW for Category-1 and ₹ 5 Crores for Category-2.

We need your Feedback

Dear Reader,

It is our endeavour to make IWTMA magazine Indian Wind Power, "THE MAGAZINE" for the Indian wind Industry. Your feedback on the general impression of the magazine, quality of articles, topics to be covered in future, etc. will be of immense value to us. We are thankful to your response. Kindly address your mail to "associatedirector@indianwindpower.com".

Thank You,

The Editor - "Indian Wind Power"

Indian Wind Turbine Manufacturers Association
4th Floor, Samson Tower, 403 L, Pantheon Road,
Egmore, Chennai - 600 008.
Tel : 044 43015773 Fax : 044 4301 6132
Email : associatedirector@indianwindpower.com

www.indianwindpower.com

Know Your Wind Energy State - Karnataka - A Snapshot

Compiled by **Mr. Nitin Raikar,** Suzlon Energy Limited, Mumbai
(rnitin@suzlon.com)

Topography & Climate

State brief:

The State of Karnataka in western central India is approximately within latitudes 11°31' and 18°45' North and longitudes 74°12' and 78°40' East. Karnataka is situated on a tableland where the Western and Eastern Ghat ranges converge into the Nilgiri hill complex. Karnataka's total land area is 191,791 sq. km. It accounts for 5.35% of the total area of the country and ranks eighth in size among major States. For administrative purpose the State is divided into 27 districts, which are sub divided into 175 taluks. Karnataka is divided into 10 agroclimatic zones, considering texture, depth and physiochemical properties of soil, rainfall, elevation, topography, major crops and type of vegetation. The zones are (1) Northeastern Transition, (2) Northeastern Dry, (3) Northern Dry, (4) Central Dry, (5) Eastern Dry, (6) Southern Dry, (7) Southern Transition, (8) Northern Transition, (9) Hilly zone, and (10) Coastal.

Overall Power Scenario

(as of 31 Jan 2015 & figures in MW)

Total installed capacity (all energy sources)	14545.77
Thermal (Coal+Gas+Diesel)	6484.98
Nuclear	475.86
Hydro	3599.80
RE Capacity (Grid connected)	3985.13
Peak Demand (MW)	10,001 (Apr 2014-Jan 2015)
Peak Met (MW)	9503 (Apr 2014-Jan 2015)
% Deficit	(-) 5%

Wind Resource

(data as on 30 Nov 2014)

Installable Potential as per CWET Wind Atlas	8591 MW @ 50m HH/ 13593 MW @ 80m HH
Total Nos of established Wind Monitoring stations	72
Number of operational wind monitoring stations	13
Stations with recorded Annual Average WPD > 200 W/sq m at 50 m height	19
Wind belts	Sogi, Kappathgudda, Jogimatti, BB Hills
Windy Districts	Tumkur, Bellary, Davangare, Gadag, Shimoga, Belgaum, Hassan, Madkari, Raichur, Chitardurga

Wind Statistics

(as of 31 Dec 2014)

Cumulative installed capacity (MW)	2548.80
Govt Demonstration Projects (MW)	7.075
Private & PSU Sector Projects (MW)	2541.73
State Ranking	# 5
% of Wind Installations w.r.t all energy sources	17.52%
% of Wind Installations w.r.t RE sources	63.96%

Green Statistics

(Data as of 31 Dec 2014)

Million tonnes of CO_2 emissions offset by Wind power projects in the state (p.a)	5.6 million tonnes
Million tonnes of Coal savings by Wind powered projects in the state (p.a)	4.0 million tonnes
No of households tentatively powered	1.5 Million homes

Wind Policy - Salient Features

Feed-in-Tariff (Sale to EB)	Rs 4.50 per unit kwh
PPA/WBA Tenure	20 years (Tariff validity for 10 years)

Captive HT Tariff

Within Bangalore Corporation limits			
HT2a (Industrial) ₹/unit		HT2b (commercial) ₹/unit	
1 lacs units	5.9	First 2 lacs units	7.55
Above 1 lac units	6.3	Above 2 lacs units	7.85
Other than Bangalore Corporation limits			
1 lacs units	5.85	First 2 lacs units	7.35
Above 1 lac units	6.15	Above 2 lacs units	7.65

Cross Subsidy surcharge for Open Access

Cross Subsidy surcharge for open access		
Voltage level	**HT-2a**	**HT-2b**
66 kV & above	97.91 paise	194.29 paise
HT level - 11 kV/33kV	62.96 paise	159.35 paise

Banking	Banking of Energy allowed within the financial year only. Unused energy will be sold to ESCOMs at 85% of the generic tariff.
Wheeling Charges (for captive)	5 % + 2% banking charges
Reactive Power Charges	Flat 40 paisa /KVArh on net KVArh drawl from Grid
APPC Rate for REC trading	Rs 3.11 per kWh
Renewable Purchase Obligation	BESCOM (10%), MESCOM (10%), CESC (10%), HESCOM (7%), GESCOM (7%), Hukkeri Society (7%)

Regulatory Agencies & State Utilities

Govt Nodal Agencies	KERC - Karnataka Electricity Regulatory Commission (www.kerc.org) KREDL - Karnataka Renewable Energy Limited (www.kredl.kar.nic.in)
State Utilities	KPTCL - Karnataka Power Transmission Corporation Ltd (www.kptcl.com) Bangalore Electricity Supply Company (BESCOM) Mangalore Electricity Supply Company (MESCOM) Hubli Electricity Supply Company (HESCOM) Chamundeshwari Electricity Supply Corporation Ltd (CHESCOM) Gulbarga Electricity Supply Company (GESCOM) Hukeri Rural Electric Co-operative Society (HRECS) -- India's first rural electricity cooperative society and distribution licensee of the KERC

Miscellaneous Factoids

Project Commencement Year	The first wind Power Project from the Private sector was commissioned on 28 March 1996 by Victory Glass & Industry. This 1.350 MW project comprised of six machines of 225 KW rating (NEPC MICON make).

Snippets on Wind Power

RBI Moots Priority Sector Tag for Renewable Energy

A Reserve Bank of India working group has proposed new guidelines for lending to the priority sector with loans to medium enterprises, sanitation and renewable energy sectors coming under the umbrella of the priority sector. The panel has submitted the report to the RBI on March 1, 2015.

Nalco to Add 100 MW Wind Power Capacity at a Cost of ₹ 700 Crore

State-owned aluminium maker Nalco has devised a plan to double its wind power generation capacity to 200 MW with an investment of ₹ 700 crore. The company has already floated an open tender seeking expression of interests from project developers. The developer would be finalised in a couple of months.

Source: Economic Times

GERC Order on RPO Compliance

The Gujarat Electricity Regulatory Commission (GERC) in its orders Dated 16th Jan. 2015, has given relief to the state distribution companies against their RPO compliance for the year 2013-14.

Environmental Benefits Calculator - Wind Energy Project

Figures on per annum basis

Project Capacity in MW		10.00
Assumed PLF (%)		25.00
Estimated Generation (kWh)		21,900,000
Estimated Generation (MUs)		21.90
Per Capita per annum Household Consumption (kWh)		3,535
No of Households tentatively powered		6,196
Emission reductions in terms of CO_2 (tonnes)		20,367
Estimated Coal savings in tonnes		15,768
Estimated Specific Fuel Oil savings in litres		40,077
Equivalent Number of Trees absorbing per annum CO_2		1,697,250
Equivalent measure of Energy in Terra Joules (TJ)	Image courtesy: http://oztypewriter.blogspot.in	78.84

Notes:

1. The per capita per annum Electricity Consumption for FY 2011-12 is 883.63 kWh (Source : MoP)
2. Emission reduction has been calculated in terms of tonnes of CO_2e (Carbon Dioxide equivalent)
3. Roughly 1000 kwH of wind energy would offset emissions to the tune of 0.93 tonnes of CO_2e (Combined Margin Emission Factor - All India) - Source : CEA : CO_2 Baseline Database for the Indian Power Sector, Version 8.0, Jan 2013
4. CDM methodologies for calculating Emission Factors vary and is very Grid specific to the Project.
5. The savings in coal and oil have been calculated based on reference indicators taken from CEA Report- Performance Review of Thermal Power Stations 2011-12
6. The Specific coal consumption in Thermal Projects in India are on an average of 0.72 kg/kWh (CEA Report- Performance Review of Thermal Power Stations 2011-12)
7. The Specific Oil consumption in Thermal Projects in India are on an average of 1.83 ml/kWh (CEA Report- Performance Review of Thermal Power Stations 2011-12)
8. In one year, an average tree inhales 12 kilograms (26 pounds) of CO_2 and exhales enough oxygen for a family of four for a year - UNEP (http://www.unep.org/Documents.Multilingual/Default.asp?ArticleID=5417&DocumentID=485&l=en)
9. Please note that this data does not factor the Product Carbon Footprint (PCF) of the WTG Project.

*Created & Compiled by **Nitin Raikar,** Suzlon, Mumbai (rnitin@suzlon.com)*

Readers interested in getting the calculator (it is an excel programme) may write to the Mr. Nitin Raikar at his e-mail address to get the programme directly.

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Snippets on Wind Power

US Agencies Commit $4 bn for Indian Renewable Energy Sector

In one of the biggest deals for the growing energy sector in India, US federal agencies have committed a total $4 billion for both projects and equipment sourcing. The officials at the 'US-India Business Summit' said three US federal agencies have made separate commitments to pump money in the Indian clean energy sector. US Trade and Development Agency (USTDA) has decided to leverage $2 billion loan to renewable energy projects. In another association, US Overseas Private Investment Corporation (USOPIC) will lend $1 billion to clean energy projects in India.

Source: Business Standard

REC's Green Energy Loans to Cost Less, have Longer Tenures

In sync with the National Democratic Alliance (NDA) government's attempt to bring down the borrowing costs for green energy projects, state-owned Rural Electrification Corp. Ltd (REC) has revised its lending guidelines. Loans for solar and wind energy projects will now be priced 75 basis points (bps) below those for projects fuelled by conventional sources of energy. These loans can also repaid over 15 years, compared with the earlier 12 years, and will come with relaxed criteria on collaterals and security.

Source: Live Mint

Wind Energy to be in Thick of Acquisitions

The Indian wind energy sector would witness heightened acquisition in the next 12-18 months, with operators having a portfolio of 100-300 MW generation capacity likely to dominate the buyers' interest. "These players are having a pipeline of 2,000–3,000 MW in their portfolio. There are around 10 such companies, each having 100-300 MW projects in the implementation stage. All these companies slowly would be acquired or merged. Big deals would happen in the next 12-18 months," said Madhusudan Khemka, Chairman of Indian Wind Turbine Manufacturers Association (IWTMA) and Managing Director of ReGen Powertech Private Ltd. Khemka noted that the investors have started looking at the Indian renewable energy sector more aggressively. Some of the measures like re-introduction of accelerated depreciation (AD), renewable purchase obligation (RPO), proposed introduction of RGO (Renewable General Obligation) would draw greater investments in the sector.

Source: Business Standard

Wind Industry's Pitch to India Inc: 18% IRR

Wind turbine manufacturers in India want to create a new market by enticing large companies to start wind power businesses. Their pitch to them: 18 per cent IRR. A recent White Paper produced by the rating agency, CRISIL, supports the wind industry's claim that wind farms can give up to 18 per cent IRR. (Internal Rate of Return) which is a measure of the profitability of an investment, arrived at by bringing all the future cash flows from the project to their today's value and comparing the total value with the investment.

CRISIL's report speaks of an "attractive IRR in the range of 16.5-18.5 per cent", thanks to the favourable tariffs that State-owned electricity distribution companies pay for the wind power as well as the 50-paise-per-unit 'generation-based incentive' paid by the Centre.

The Chairman of the Indian Wind Turbine Manufacturers Association, Madhusudan Khemka, says the Association is making the "high returns" pitch to large Indian companies. Now that the mood in the industry is buoyant and companies are looking at investment opportunities, the time is ripe for the wind industry to make its pitch.

Source: Business Line

AP govt gives 'Powerful' Policy Push to Solar, Wind Energy

Single window system, easy permissions and treatment like industries for according clearances are some of the salient features of the solar and wind energy policies approved by the Andhra Pradesh Cabinet.

Source: Business Standard

MPERC Proposes RPO Target

The Madhya Pradesh Electricity Regulatory Commission (MPERC) on 30th Jan. 2015 has proposed new Renewable Purchase Obligation (RPO) target for FY 2015-16 as follows and has invited comments and suggestion from stakeholders by 22nd Feb 2015.

Financial Year	Cogeneration and other Renewable Sources of Energy		
	Solar (%)	Non Solar (%)	Total (%)
2015 - 16	1.00	6.00	7.00

Snippets Compiled by:

Shri Abhijit Kulkarni
General Manager, SKF India Ltd. Pune
and **IWTMA Team**

Photo Feature

IWTMA Members Meet

dated 28th January 2015

A Meet of all IWTMA Members was conducted on 28th January 2015 at Hotel Le Meridian Chennai, which was attended by the members. The meeting discussed about WTG Standard, GST, Re-invest 2015, achieving 60 GW target by 2022, Indian Wind Energy Alliance, Wind Power India 2016, Indian Wind Power magazine etc. During the deliberations many matters came for discussion and were noted for the actions at various platforms.

Knowledge Forum on Virtual Simulation for Wind Energy

Left to Right: Mr. P. Kanagavel, Additional Director, NIWE; Dr. S. Gomatinayagam, Director General, NIWE; Dr. Rishi Muni Dwivedi, Associate Director, IWTMA and Mr. Senthil Balu, Area Sales Manager, MSC Software

Delegates at the Knowledge Forum on Virtual Simulation for Wind Energy

IWTMA in partnership with NIWE (CWET) organized a Wind Knowledge Forum on "Virtual Simulation for Wind Energy" on Wednesday, 28th January 2015 at National Institute of Wind Energy, Chennai auditorium.

The Knowledge Forum had Mr. Ramesh B, Mr. Shripathi, Mr. Naveen, and Mr. Raghavendra as speakers from MSC Tech team, who introduced MSC Software's CAE solutions, provided an overview of Structural & Fatigue Life Analysis solution using MSC NASTRAN and deliberated about System Level MBD simulations for wind turbines using Adams and composites and Multiscale modelling for blades. The event was a platform to educate & create awareness about the importance of simulation amongst the industry. About 45 delegates from over 14 companies attended the forum. The sessions were very interactive and a good number of questions were raised.

Know Your Member

ZF Wind Power

Mr. Suresh KV
Executive Director
ZF Wind Power
Coimbatore

ZF is a global leader in driveline and chassis technology with 122 production companies in 26 countries. In 2013, the Group achieved a sales figure of presumably EUR 16.8 billion with 72,643 employees. ZF is among the top 10 companies on the ranking list of the largest automotive suppliers worldwide.

The company was founded in 1915 for the development and production of transmissions for airships and vehicles. Today, the group's product range comprises transmissions and steering systems as well as chassis components and complete axle systems and modules. As stockholders, the Zeppelin Foundation - which is administered by the City of Friedrichshafen, Germany- holds 93.8 percent and the Dr. Jürgen and Irmgard Ulderup Foundation Lemförde holds 6.2 percent of shares.

The ZF Group invests about 5 percent (2013: EUR 836 million) of total revenue in research and development every year.

Mr. Suresh K.V. Executive Director, ZF Coimbatore Ltd. is a graduate engineer from REC, Calicut (presently NIT, Kozhikode) and a PGDMM from SP Jain Institute of Management, Mumbai. He started his career in 1989 with Bajaj Auto Limited and his rich professional exposure includes stints with Asian Paints, Visteon India and Philips. He joined the ZF (called Hansen Drives Ltd. till October 2011) in 2007 as General Manager – Operations Centre and became the Executive Director in November 2010. He is an adept in strategy, operations and people management processes and practices. His family consists of his wife and two sons. Hailing from central Kerala, he is passionate about the traditional dances and enjoys listening to classical music.

At ZF, the Group's structure is aligned with the market and customers. The business units are assigned to the four divisions: Car Powertrain Technology, Car Chassis Technology, Commercial Vehicle Technology, and Industrial Technology.

Overview about ZF Wind Power, which is part of Industrial Technology

In 2011 ZF Friedrichshafen AG acquired Hansen Transmissions International, one of the leading global manufacturer of gearboxes for wind turbines with a capacity of producing 10,500 MW from 4 plants in Belgium - Lommel, India - Coimbatore, China – Tianjin and USA – Gainesville.

a. ZF Wind Power develops and produces wind turbine gearboxes in the power range 0.85 MW to 6,15 MW for the use in Onshore and Offshore projects

b. Current customer base represents more than 50% of gear driven market in 2013.

Overview about ZF Wind Power, Coimbatore - India

ZF Wind Power was established in 2006 and started the production in 2008 with current employee strength of 578 in Coimbatore, Tamilnadu.

This plant is vertically integrated with state of art facility of heat treatment, machining, assembling and testing of Gear boxes with a capacity of 3,000 MW. The company boasts of a robust supply chain & a dedicated design center. As for the quality systems, it is equipped with ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007.

Strategic focus is on long-standing relationships with leading wind turbine manufacturers and further diversifying of customer base.

ZF Wind Power Coimbatore Plant

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Editor: Dr. Rishi Muni Dwivedi

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Samson Tower, 403L, Pantheon Road, Egmore, Chennai – 600 008. Tel: +91 44 3023 0200, Fax: +91 44 30230298/99.

Email: marketing@regenpowertech.com • www.regenpowertech.com

Chennai: +91 98401 61228, Delhi: +91 98112 27535, Mumbai: +91 98190 63836

Factories :

Andra Pradesh: Survey No.182 to 188, APIIC Industrial Park, Mambattu Village, Tada Mandal, Nellore District 524121, A.P.

Udaipur: NH-76 Udaipur – Chittorgarh Road, Village – Bhatewar, Tehsil – Vallabh Nagar, Dist.Udaipur (Rajasthan), Pincode: 313601, Opp. Sir Padampath Singhnia University.

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