



## India powers ahead

**E**NERGY-STARVED INDIA is becoming a vibrant market for renewable energy. This bodes well for a country that has often seen its industrial and economic growth inhibited by a truncated supply of conventional power.

Grid-connected renewable power today accounts for as much as 20.2 GW – or 11% – of India’s 182.3 GW of installed power capacity. The majority share – 55%, or 99.8 GW – is still accounted for by coal-based thermal power. Gas-fired thermal power, totalling 17.7 GW, contributes an additional 10%, while the 38.7 GW of hydropower accounts for 21%, and nuclear 2.6% with 4780 MW.

Solar, wind and biomass are finding increased favour, with burdensome coal and gas supplies denting capacity targets. Only 52 GW of the 78.6 GW originally envisaged under the *11th Five Year Plan* that ended March 2012, has been added, at a cost of US\$145 billion. The *10th Plan* (2002-07) also saw a meagre 21.2 GW capacity added, against a target of 41.1 GW. The *12th Plan* (2012-17) now aims for a capacity addition of 103.3 GW at a combined investment of US\$223.7bn, which includes commensurate transmission and distribution capacities.

The continuing trend of missed targets has widened peak demand deficit in the country to 12%. This has clearly undermined the Government’s avowed mission of *Power to All by 2012*.

### Incentive-fuelled

Incentive-laden policies have fuelled growth in India’s renewable energy sector. Wind power is the fastest growing with a record 3,163 MW of wind energy capacity added in the financial year 2011/12, bringing the country’s total wind capacity to 17.4 GW. This marks a steady rise, from 2,350 MW the

previous year, 1,565 MW in 2009/10 and 1,485 MW in 2008/09. India thereby retains third place, behind China and the U.S., in terms of new installations. The addition of 3,500 MW of wind capacity now appears within reach in 2012/13, foreseen or unforeseen drawbacks notwithstanding.

Grid-connected solar capacity also surged from 18 MW in 2010 to 277 MW in 2011, again making 500 MW of capacity seem attainable this year. Solar photovoltaic (PV) power plants totalling over 180 MW were set up in the country and off-grid installations of over 50 MW were completed as well.

Renewable power has been particularly beneficial for an enormous, (3.28 million km<sup>2</sup>) over-populated (1.2bn) country like India. Hundreds of thousands of solar lights, solar water heating systems and biogas plants have been installed in the country, illuminating over 9000 remote and inaccessible villages so far.

### Soaring investment

Clean energy investments in India reached a record US\$10.3bn in 2011, up 52% from the US\$6.8bn invested in 2010, according to **Bloomberg New Energy Finance (BNEF)**: “This was the highest growth figure of any significant economy in the world, the country accounting for 4% of global investments in clean energy,” says Ashish Sethia, Head of Bloomberg’s India research. “The large growth was driven by a 7-fold increase in funding for grid-connected solar projects: From US\$0.6bn in 2010 to US\$4.2bn in 2011, almost the same level of investments as wind, which totalled US\$4.6bn.”

Hundreds of thousands of solar lights, solar water heating systems and biogas plants have been installed in the country, illuminating over 9000 remote and inaccessible villages so far.

Sethia mentions that while there was concern at the beginning of last year that increasing lending rates might hit investment, policy measures like the *Jawaharlal Nehru National Solar Mission (JNNSM)* and renewable energy's increasing cost competitiveness eventually made 2011 a record year.

While an addition of 15 GW of wind capacity has been proposed for the 12<sup>th</sup> Plan, the *National Solar Mission* of the **Ministry for New and Renewable Energy (MNRE)** aims at adding 20 GW of solar power capacity by 2022. The Ministry estimates the potential for solar energy for most parts of the country to be around 20 MW/km<sup>2</sup> of open, shadow-free area - covered with 657 GW of installed capacity.

Asset financing for utility-scale projects remains the main type of clean energy investment in India, with US\$9.5bn in 2011. Venture capital and private equity investments also revived, with US\$425 million invested in 2011, over four times the 2010 figure. A stock market slump, however, dampened equity-raising via the public markets last year, with only US\$201m raised compared with a record US\$735m in 2010.

BNEF chief executive Michael Liebreich deems India's record performance in 2011, and the momentum it is carrying into 2012, as one of the bright spots in the clean energy firmament: "With support mechanisms falling away in the U.S., the ongoing financial crisis in Europe, and China already going flat out, it is gratifying to see some of the world's other major potential markets coming alive," he remarks. "India is firmly in the lead group and we are seeing interest around the world in being part of what is unfolding there."

### Powering ahead

Renewable energy is central to India's climate change mitigation efforts. The country's vast market potential and industrial, financing and business infrastructure have made it a favourable destination for *Clean Development Mechanism (CDM)* projects, with renewable energy projects having the major share. There have been 727

Leading solar market IPPs* / Developers					
Moser Baer Projects Private Ltd	46 MW				
Adani Power Ltd	40 MW				
Tata Power Ltd	29 MW				
GMR Power Corporation Ltd	25 MW				
Visual Percept Solar Projects Private Ltd	25 MW				
Azure Power India Private Ltd	22 MW				
*Independent Power Producers					
Competitor share in India's wind energy market					
Company	2011-12		2010-11		Year-on-year growth
	MW	%	MW	%	%
Suzlon Energy Ltd	1,148.55	36.3	954.6	40.6	20.3
Enercon (India) Ltd	767.2	24.3	503.2	21.4	52.5
ReGen PowerTech Private Ltd	415.5	13.1	118.5	5.0	250.6
Gamesa Wind Turbines Private Ltd	312.35	9.9	232	9.9	34.6
Vestas Wind Technology India Private Ltd	260.1	8.2	216.75	9.2	20.0
Others	259.73	8.2	324.95	13.8	(20.1)
<b>Total</b>	<b>3,163.43</b>	<b>100.0</b>	<b>2,350</b>	<b>100.0</b>	<b>-</b>
Wind additions in wind energy-friendly states					
State	2011-12		2010-11		
	MW	Market share (%)	MW	Market share (%)	
Tamil Nadu	1,086.73	34.4	997.68	42.4	
Gujarat	790	24.9	311.89	13.3	
Rajasthan	545.65	17.2	436.43	18.6	
Maharashtra	408	12.9	233.05	9.9	
Karnataka	178.65	5.6	257.25	10.9	
Madhya Pradesh	100.4	3.2	46.11	2.0	
Andhra Pradesh	54	1.7	64.15	2.7	
<b>Total</b>	<b>3,163.43</b>	<b>100</b>	<b>2,350</b>	<b>100</b>	

**"India is firmly in the lead group and we are seeing interest around the world in being part of what is unfolding there."**

**Michael Liebreich, Bloomberg  
New Energy Finance**

registered CDM projects in India, accounting for a fifth of such projects worldwide. Of these, 520 are renewable energy projects, of which wind accounts for 225, followed by 6 for solar energy and 82 for hydropower.

India has hitherto established 3,056 MW of power capacity based on

biomass/bagasse co-generation, with a further 2,600 MW targeted for the 12<sup>th</sup> Plan period. Incentives such as concessional customs duty on machinery and component imports, excise duty exemption, accelerated depreciation on major components, and relief from taxes and capital subsidy

## Gamesa's India adventure

Ramesh Kymal, chairman & managing director of **Gamesa Wind Turbines Private Ltd**, a wholly owned subsidiary of Spain's **Gamesa Corporación Tecnológica SA**, talks to Sarosh Bana about Gamesa's plans for India.

### What is Gamesa's business strategy to keep itself competitive? Is repowering a sound business proposition?

Gamesa India, from its inception two and a half years ago, has been focusing on independent power producers (IPPs) in the wind sector. The products being offered by us are hence extremely competitive in terms of the cost per kilowatt hour. We have also been the first to do repowering of wind turbines, and we initiated this activity in the southern state of Tamil Nadu where most of the small and low plant load factor turbines are located. We believe we can replace about 2,500 MW of these small turbines with our more efficient and larger capacity wind turbines, improving the power output by at least two times.

### How do you view the Indian wind market, currently and prospectively?

The Indian wind market has attained levels of about 3,000 MW every year. However, considering the acute shortage of power and the grossly inadequate and exorbitant coal supplies, I feel the market will go up to 5,000 to 7,000 MW every year from the next financial year (2012-13). This can only happen if proactive steps are taken at the policy level to make this sector interesting for investors to get reasonable returns on their investments. For instance, the generation based incentive (GBI)

are being provided for the set up of biomass power projects. A preferential tariff is also provided for the sale of power from biomass power plants.

The *National Solar Mission* aims at promoting grid-connected solar power to a level that will bring the cost of solar power generation

should be enhanced to Rs1.20/kWh (US\$0.00024) and extended further. The *Renewable Purchase Obligation (RPO)* should be increased and enforced more stringently so that the *Renewable Energy Certificate (REC)* market picks up properly.

### What is Gamesa's profile in the country?

Gamesa has installed more than 800 MW in India in the last two years. Over this period, we have invested about Rs7500 million (US\$150m) in manufacturing facilities and another Rs5000m (US\$100m) in building up a Megawatt pipeline. Our manufacturing facilities are located in Chennai, in the state of Tamil Nadu, and Baroda, in the state of Gujarat, and our R&D facility is located in Chennai as well. We have about 1000 employees in India.

### Which are the more major projects you have executed to date in India, for which customers and at what cost?

Our major projects have been for customers that have included **TVS Energy**, **Oil India**, **Gas Authority of India Ltd (GAIL)**, **Oswal**, **Sterling Agro Industries Ltd**, **Lakshmi Machine Works Ltd** and **Shanmugavel Spinning Mills Group**, to mention a few. The cost has been about Rs65-70m/MW (US\$1.3-1.4m) for the *G-58/850 kW*.

### Which Indian state has been most progressive with regard to wind energy and why?

Tamil Nadu has been the most progressive by way of wind energy policies, mainly because these policies were pioneering in scope.

to grid parity. December's competitive bidding for projects totaling 350 MW witnessed some of the lowest quoted tariffs in the world. They averaged Rs8.77/kWh (US\$0.0018/kWh), the lowest having been Rs7.49/kWh (US\$0.0015/kWh). Tariffs exceeded Rs18/kWh

(US\$0.0036/kWh) at the start of the Mission two years ago. All indications are for further decreases in solar PV, though costs have not come down this fast for concentrated solar power (CSP), where they are still in the range of Rs12-13/kWh (US\$0.0024-0.0026/kWh).

Wind too is competitive as an electricity resource. There is no competitive bidding in wind so far, the tariffs ranging Rs3.5-4.5/kWh (US\$0.0007-0.0009/kWh): "Barring China, India has the lowest cost-per-MW for wind energy in the world – up to 60% cheaper than Europe," notes Tulsi Tanti, founder, chairman and managing director of the Pune-headquartered **Suzlon Energy Ltd**. "It has absolutely no fuel costs, providing a stable pricing visibility for over 20 years – a huge competitive advantage to corporate India, particularly to SMEs." The billionaire entrepreneur estimates wind energy to have saved India 67m tonnes of coals imports, translating to savings of US\$6bn.

### Technology development

While Suzlon and many of its competitors in India provide full turnkey solutions through their domestic production centres, solar energy too is attaining sophisticated levels, with research being given special focus by the **New and Renewable Energy Ministry**. 36 R&D projects in solar thermal and PV technologies are under implementation, and a **Centre for Solar Thermal Research** has been set up in the arid state of Rajasthan. Among the innovations yielded is that of a 30 tonne solar air conditioning system using concentrating parabolic troughs and triple effect vapour absorption. It is a stand-alone diurnal system that can take care of intermittent clouds through small storage.

India's generally high temperatures render thin-film technologies like amorphous silicon, copper indium gallium (di)selenide (CIGS) and cadmium telluride (CdTe) more suitable than crystalline silicon-based solar PV technologies.

The country has also produced space grade solar panels. These were manufactured by India's largest public sector engineering firm, **Bharat**

Heavy Electricals Ltd (BHEL), and deployed on the *GSAT-8* (geo-stationary satellite) of the state-owned Indian Space Research Organisation (ISRO). Each of the four 5 m<sup>2</sup> panels comprises multi-junction solar cells in series and parallel combinations, yielding a cumulative capacity of 4.5 kW. So far, BHEL has supplied 51 such panels to ISRO and these are used to charge the batteries and provide electricity for various systems in the satellites.

### Tax breaks

Ashwin Gambhir, Senior Research Associate at Pune-based Prayas energy consultancy, says the establishment of renewable energy capacity in India has been helped by incentives such as the mandated *Renewable Purchase Obligation (RPO)* for each utility, captive plant and open access consumers, coupled with feed-in tariffs (FiTs). *Accelerated Depreciation (AD)* and

### Movers and Shakers:



Kameswara Rao, Price-waterhouseCoopers



Tulsi Tanti, Suzlon Energy Ltd.



Ramesh Kymal, Gamesa India

*Renewable Energy Certificates (RECs)* have been other enabling regulatory instruments.

The AD benefit for wind power, however, lapsed on 31 March and there is a fear that this may lead to a fall in capacity additions for 2012. However, with independent power producers (IPPs) slowly gaining a foothold in the

Indian market, the wind industry will see a revamp in the next two years. From 1 April this year, wind farms can claim only the standard 15% depreciation of the cost of equipment, down from 80% previously. BNEF forecasts a consequent decline in demand for wind turbines this year by almost 400 MW, or about US\$540m of orders.

## “Barring China, India has the lowest cost-per-MW for wind energy in the world – up to 60% cheaper than Europe.” Tulsi Tanti, Suzlon

The tax break drove 70% of installations last year, according to MNRE, which is lobbying the **Finance Ministry** to reinstate the incentive introduced in 2009. Its revocation may hit Suzlon particularly severely, the wind turbine major currently beset with the challenge of repaying its Rs30,000m (US\$600m) debt between June and October. The company nonetheless hopes to meet its obligations through an increasing order inflow, recovery of dues, and by selling non-core assets, comprising wind farms and land.

The Government also grants income-tax exemption on all earnings generated from a power project for any single 10-year period during the first 15 years of the project's life. IPPs, which set up units to sell electricity to state distribution companies, can avail of generation-based incentives (GBIs) that give them a benefit of Rs0.50 (US\$0.0001) for every unit of electricity. The introduction of GBIs in 2009 was aimed at attracting large IPPs and foreign direct investors to the wind power sector.

Solar energy generation is also incentivised. JNNISM, for instance, subsidises standalone solar PV and CSP systems as a combination of 30% subsidy and/or a soft loan bearing 5% interest. Power producers in the special category states of the North-East, Himachal Pradesh and Uttarakhand can avail of a 90% capital subsidy. Innovative applications of solar systems can, in fact, secure subsidies that represent 100% of the real cost.

### Hurdles

Kameswara Rao, **PricewaterhouseCoopers'** Hyderabad-based Executive Director and India Leader for Energy, Utilities & Mining, says

assessing wind resources is more complex and it can take over two years to assess the best possible sites for wind power. As regards the likelihood of some to foray into solar power only to benefit from the incentives for pecuniary gains, he believes the incentives are not that attractive, given the high risks and costly finance. “In fact, some projects are more of a CSR (corporate social responsibility) or pilot project format rather than purely commercial.”

In the Indian context, land acquisition and consents can prove cumbersome for setting up projects, says Rao. Transmission too is often a hurdle, as existing transmission lines may not measure up to new projects sanctioned. Besides, while there is a surfeit of secondary data – from meteorological offices and satellite studies – there is very limited primary data. “This can help [us to] perform high level analysis but we need correlation with the actual ground-level data,” notes Rao. “This is now happening with the installation of 50 measuring stations.”

Prayas's Gambhir says investments in India have averaged Rs50-60m/MW (US\$1-1.2m/MW) for wind power, while they have been around Rs100m/MW (US\$2m/MW) for solar. “Wind power is far more prevalent in India than solar power,” he points out. “In 2011, it was nearly 7 times that of solar.” He adds that issues of fluctuation and cyclical variations that affect on-grid solar and wind power generation are manageable with good planning and forecasting. EU countries have far higher penetration of wind power and are able to manage it well, he says.

### Repowering potential

Repowering is another segment of wind power that holds out much promise in India. **Gamesa Wind Turbines Private Ltd**, a wholly owned subsidiary of Spain's **Gamesa Corporación Tecnológica SA**, sees market potential of over US\$3.8bn in repowering (see *interview opposite*). Gamesa, Suzlon, **Vestas** and **Kenersys** are among those companies upgrading ageing turbines in Indian wind farms.

**GE** and **Siemens** are other overseas entrants to India's renewable energy market, but have a marginal presence. **Siemens India**, however, has aggressive plans for the wind sector. Its Managing Director Armin Bruck says his company is in the process of setting up a factory for wind turbines with capacities of up to 2.3 MW. The Rs5bn (US\$100m) facility will be located in Vadodara, in the industrialised state of Gujarat, and will commence production in 2013. “It will have an annual capacity of 250 MW, which will be scaled up to 500 MW by 2015 to meet market demand,” he says.

Renewable energy is destined to take its place alongside coal and gas in India and penetrate ever deeper into the country. Its unexploited resource availability has the potential to sustain its growth for years to come. After all, the nation's – and its 1.2 billion population's – energy security depends on it.

e: [Sarosh.Bana@REF.contributor.com](mailto:Sarosh.Bana@REF.contributor.com)

**Online:** [renewableenergyfocus.com](http://renewableenergyfocus.com)

India saw US\$10.3bn of clean energy investment in 2011

<http://tinyurl.com/cbue6k9>

Gamesa opens wind turbine blade factory in India

<http://tinyurl.com/cysscnu>

Siemens supplies CSP parabolic trough receivers to India

<http://tinyurl.com/c8fc74c>

India gets a solar plant in 100 days

<http://tinyurl.com/c83ljw7>

India to become renewable energy powerhouse

<http://tinyurl.com/d8bunmr>

India's solar market to reach 9 GW by 2016

<http://tinyurl.com/d38g93z>