



# Wind Power In India

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Mahesh Vipradas  
Senergy Global Ltd.



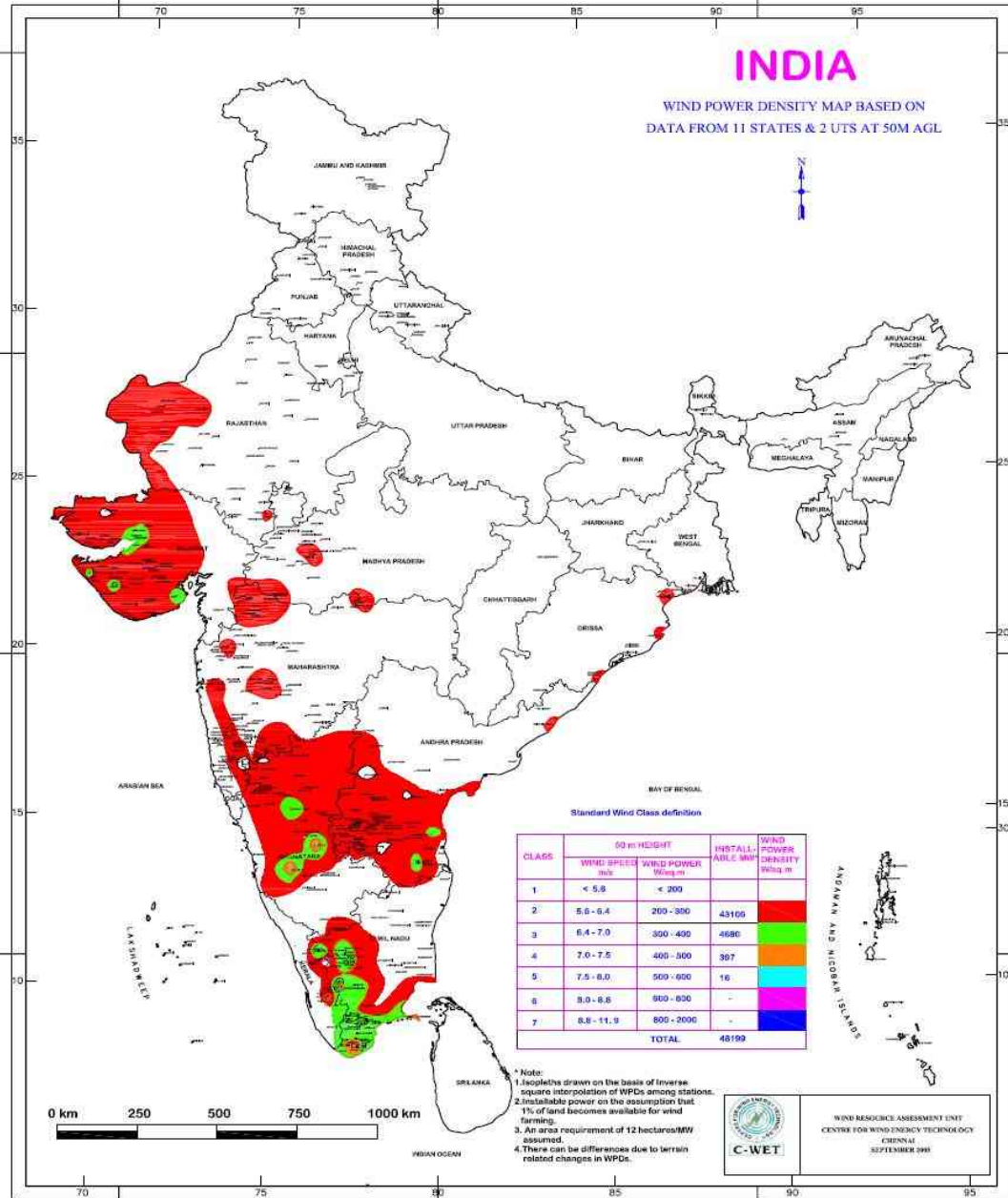
# Wind Power in India

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- The wind power development is shaped by
  - Technology
    - Wind resource assessment
    - Wind turbines
    - Other technological developments
  - The Policy and Regulatory push / response

# INDIA

WIND POWER DENSITY MAP BASED ON  
DATA FROM 11 STATES & 2 UTS AT 50M AGL



Standard Wind Class definition

CLASS	WIND SPEED m/s	WIND POWER W/m <sup>2</sup>	INSTALL- ABLE MW	WIND POWER DENSITY W/m <sup>2</sup>
1	< 5.8	< 200		
2	5.8 - 6.4	200 - 300	43105	
3	6.4 - 7.0	300 - 400	4580	
4	7.0 - 7.5	400 - 500	397	
5	7.5 - 8.0	500 - 600	16	
6	8.0 - 8.8	600 - 800	-	
7	8.8 - 11.9	800 - 2000	-	
TOTAL			48199	

- \* Note:
1. Isopeleths drawn on the basis of inverse square interpolation of WPDs among stations.
  2. Installable power on the assumption that 1% of land becomes available for wind farming.
  3. An area requirement of 12 hectares/MW assumed.
  4. There can be differences due to terrain related changes in WPDs.



WIND RESOURCE ASSESSMENT UNIT  
CENTRE FOR WIND ENERGY TECHNOLOGY  
CHENNAI  
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# Wind Resource

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- Wind resource
  - Low wind regime
    - Wind class 3 or lower
  - The wind turbines adjusted for low wind regime
    - Higher rotor diameter



# Wind Resource

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- Wind resource assessment and analysis techniques
  - Improved and wide spread wind resource assessment
  - Wind turbine micro-siting
    - Detailed simulation techniques for micro-siting and energy generation projections
    - Use of satellite imagery for micro-siting
    - Accuracy levels of projections increasing

# Wind Turbine

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- Higher capacity turbines
  - From 250kW to 2MW
    - Avg. size of 359 kW in 2001 to more than 850kW in 2007
    - Lower land requirement
    - Lower O&M costs
    - Faster commissioning
  - Higher rotor diameter and hub heights
    - Rotor diameter 88m, Hub height 80m
- Advanced controls and sensors
  - Centralized monitoring and control systems
  - Higher machine availability 95-97%



# Wind Turbine

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- Materials

- Composite materials for blades
  - Lower weight to swept area ratio
  - Concrete towers

- Other developments

- Power electronics for better grid integration
- Load flow studies



# Wind Power

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- Upcoming developments
  - Wind generation forecasting
    - Better grid integration and management
  - Grid integration techniques
  - Off shore wind assessment



# Policies and Regulation

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- Guidelines by MNRE
- Fiscal Incentives
  - 80% accelerated depreciation allowed in the first year, under Section 32 of Income Tax
  - Companies can avail the derived tax shelter
- Section 80IA benefits on energy sales/savings
- The recent Generation Based Incentive scheme

# Policies and Regulation

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## ○ Policies and Regulation

- Electricity Regulatory Commissions Act 1998
  - The state commissions became the key player for determining tariff
- Electricity Act 2003
  - Section 86(i)e: The State Commission shall discharge the following functions,
    - Promote power generation from renewable sources of energy
    - Provide suitable measures for connectivity with the grid
    - specify a percentage of the total consumption of electricity to be procured from renewable sources



# Policies and Regulation

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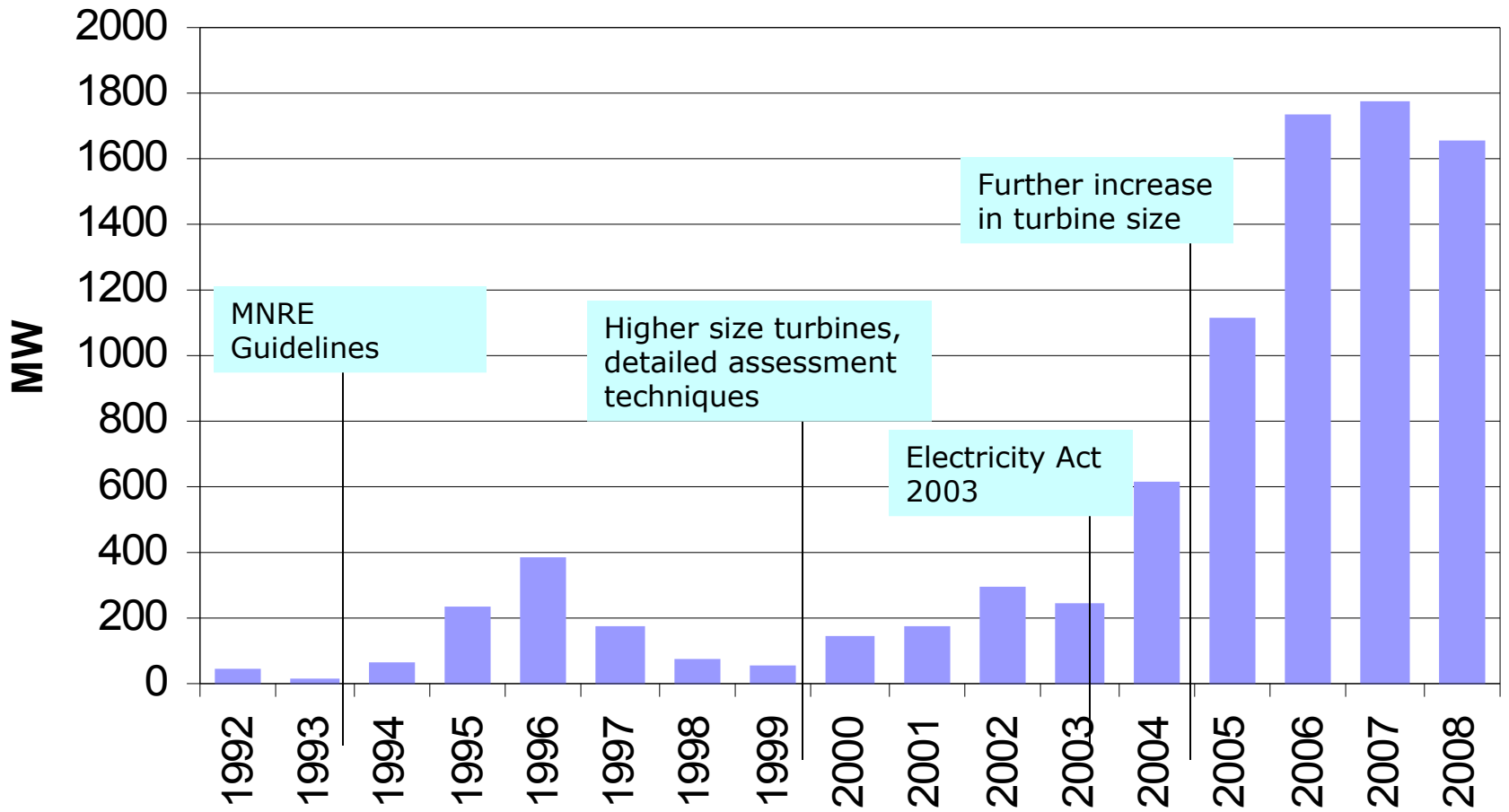
- The national electricity policy
  - Need for promotion of renewable energy
- National tariff policy
  - Step by step introduction of competition
    - Preferential tariff
    - Competition within same technology
    - Competition within renewables
    - Competition with other sources



# Policies and Regulation

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- New initiatives
  - National Renewable Purchase Obligation
    - Mentioned in the action plan on Climate change
  - Renewable energy certificates
  - Generation based incentive



# Case study of success story : SUZLON

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# About Suzlon

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- Asia's largest wind power company
- World-wide No. 1 Company in terms of Market Capitalization.
- 5<sup>th</sup> Largest manufacturers in the world
- Market Leader in India for past 8 years
- Presence in Asia (India, China & South Korea), Europe, Australia, South & North America
- Technology development centers in Europe – Netherlands , Germany, Belgium & India.
- Manufacturing facilities for wind turbine generators, rotor blades & other critical components in India, China & USA

# Case study: Suzlon

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**#1 Leveraging Best of All Worlds - Technology, Manufacturing and Market Opportunities**

**#2 Total Wind Energy Solutions Provider**

**#3 Backward Integration to Control Supply Chain, Reduce Costs and Quality Control**



# Case study: Suzlon

## Leveraging on key locales for Technology, Manufacturing and Market

### # 1 – R&D in Europe

- Aerodynamics in Netherlands
- Product Engineering in Germany



### # 2 - Manufacturing facilities in India to leverage on:

- Process engineering and field R&D
- Skilled manpower availability at low cost
- Backward integration leading to significant cost advantages and quality control

### # 3 – Focus on High Growth Markets with Onshore Potential:

- Global HQs in Denmark
- Key Markets in:
  - Asia – India and China
  - US
  - Australia
  - Europe- Italy, France and Portugal



# Product Portfolio



<b>Model</b>	<b>Capacity (kW)</b>	<b>Hub Height (Meters)</b>	<b>Rotor Diameter (Meters)</b>
<b>S 33</b>	<b>350</b>	<b>60 / 70</b>	<b>33</b>
<b>S 52</b>	<b>600</b>	<b>74</b>	<b>52</b>
<b>S 64/66/70</b>	<b>1250</b>	<b>56 / 65 / 74</b>	<b>64 / 66 / 69.1</b>
<b>S 82</b>	<b>1500</b>	<b>78.5</b>	<b>82</b>
<b>S 88</b>	<b>2100</b>	<b>80</b>	<b>88</b>

# End to end wind energy solution provider in India

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# Backward Integration



Location	Facility
Daman	Turbine, Rotor blades & Control Systems
Pondicharry	Turbine, Rotor blades & Control Systems
Gandhidham	Tubular Tower
Pune	Generator – JV with Elion
Dhule	Rotor Blade, Tubular Tower
Vadodara	Tooling & Testing
China	Turbine, Rotor Blades
USA	Rotor Blades
Belgium	Gearbox

