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Wind Energy Trend

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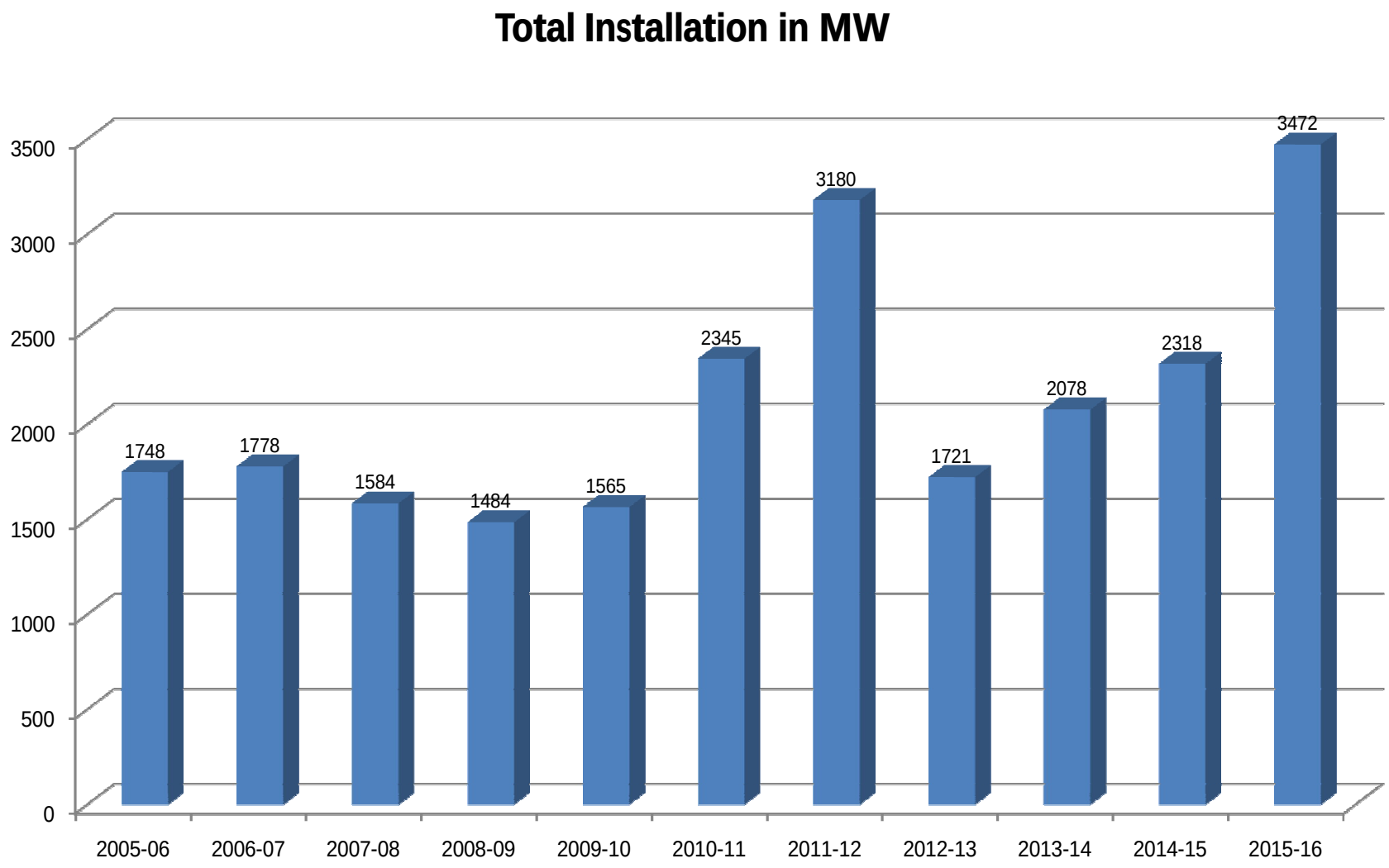
- **Indian Wind Energy Sector – Overview**
- India Market – Dynamics & Framework
- Suzlon Group – Overview
- Technology and Products

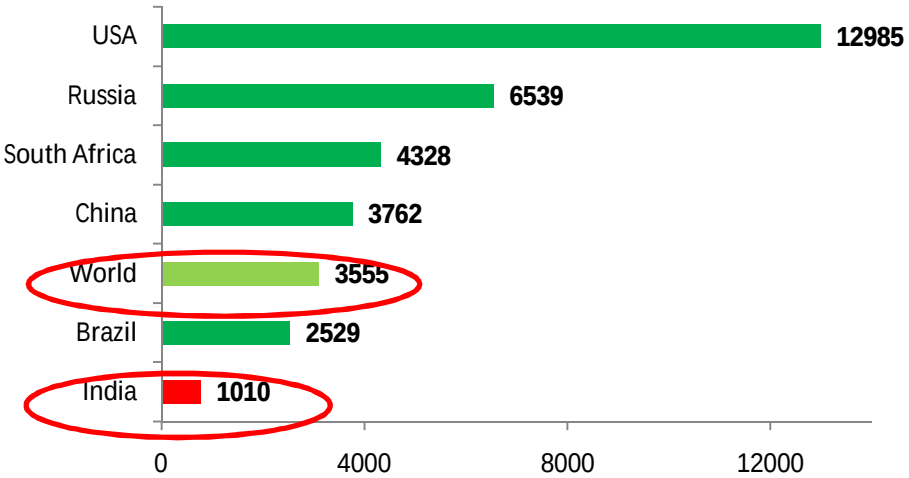
Wind Power Project Installation YOY



India : Power Sector Highlights

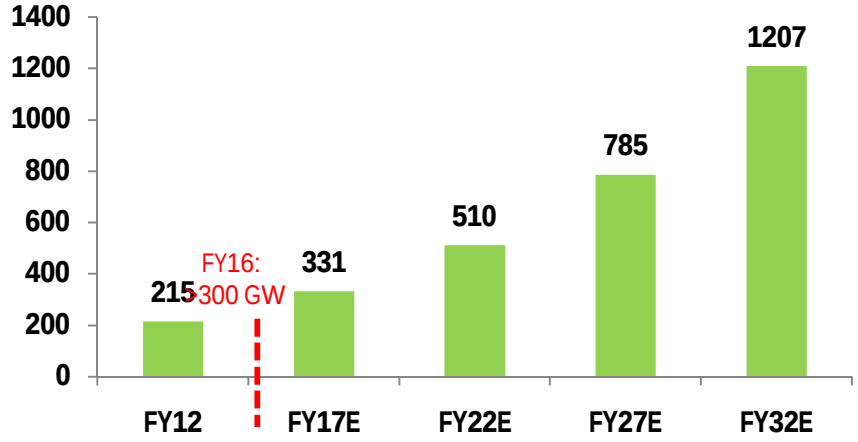
- World's third largest producer of electric power, yet one of the lowest per capita access & consumption
- India's GDP growth seen accelerating to 7.6% in FY 16. Estimated 9% Y-o-Y increase in power demand
- Peak power shortage (3.2%)
- Total installed capacity of more than 300 GW with very high dependence on fossil fuel (local coal, imported coal, oil & gas)
- Increasing participation of private players in power sector
- Sustained focus of government and emerging interest of investors in renewable energy

Per Capita Power Consumption (kWh per head)



Source: World Bank

Demand to grow at 9% over next 20 years (GW)



Source: CEA

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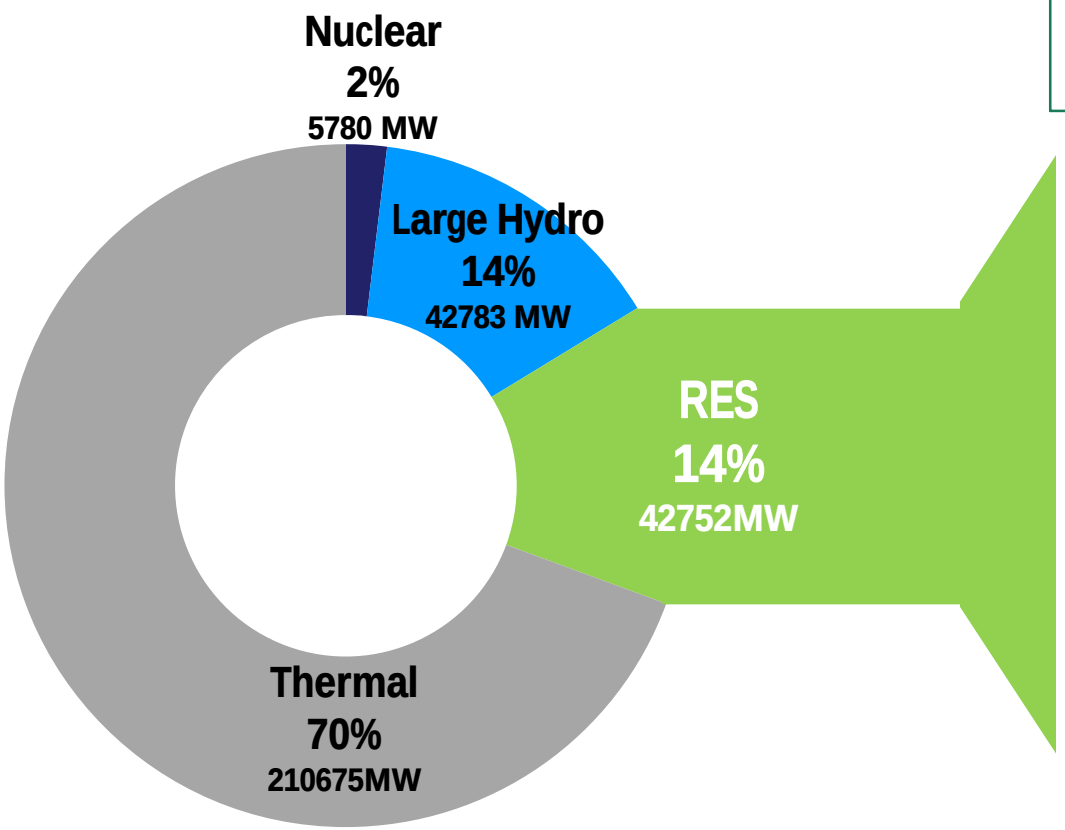
Share of Wind Energy in India



Wind Energy has proven and successful track record of over 20 years in India

- 63% Wind 26,769 MW
- 16% Solar 6,763 MW
- 11% Bio Power 4,831 MW
- 10% Small Hydro 4,274 MW
- 0.27% Other 115 MW

Wind And Solar Poised To Contribute To India's Sustainable Energy Architecture

Source : CEA & MNRE Website, Data as on March, 2016

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Government Support for Wind Sector

- Aggressive target set by the government to achieve 60 GW of wind energy capacity *i.e.* 5 GW annually by 2022
- MNRE announces Draft Guidelines for Development of Onshore Wind Power Projects
- Recently launched policy for unlocking the offshore wind potential
- Commitment of renewable energy capacity building underlined in NAPCC and mandated under the Renewable Purchase Obligation (RPO) across the states
- Wind-Solar Hybrid draft policy in process
- Investor friendly, long term and sustainable framework of policies and encouraging incentives and facilities provided. Key incentives include;
  - Long term committed feed-in-tariff mechanism
  - Generation based incentive scheme
  - 10 years tax holiday for wind power projects under S80-IA
  - Allowance for ECB as well as 100% FDI for financing the wind projects

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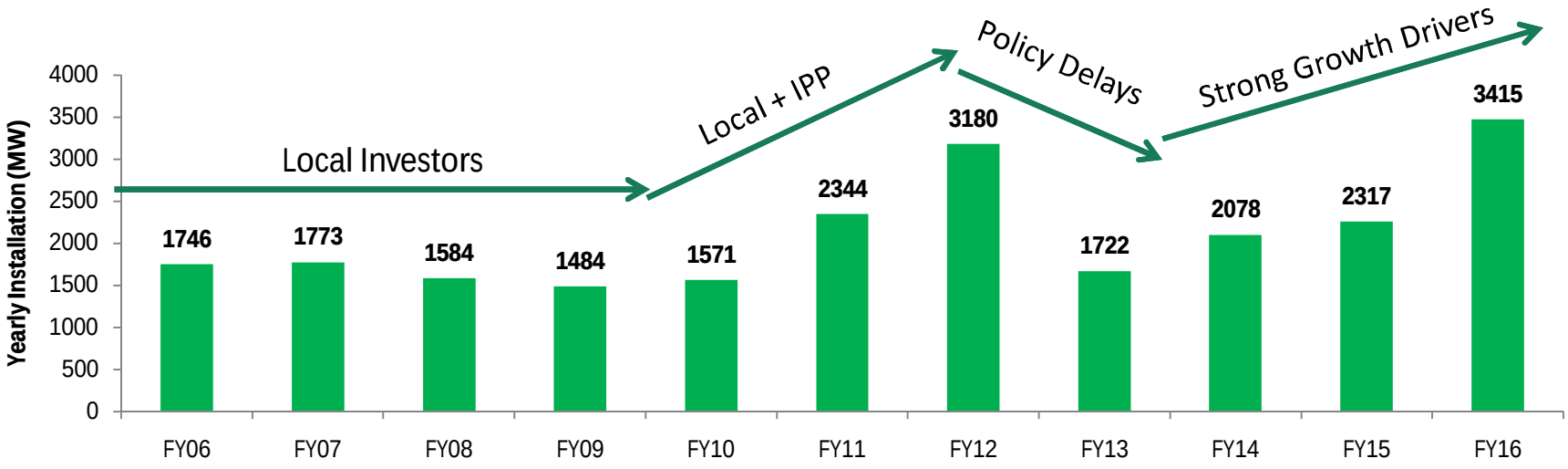
Wind Energy Development Trend



- ✓ Continued momentum in Wind Market in India primarily driven by:
  - Stable Policy outlook at both State and Central Level
  - Healthy mix of both Global and local players (contributing to both Retail and IPP segment)
  - Abundant resource availability with huge untapped potential @302GW
  - Availability of Capital (both debt and equity side)
- ✓ Market likely to continue its northward march with expected installations likely to exceed 4GW in FY17
- ✓ In sync with the Government Target of 60 GW installed wind power capacity by 2022

Best market scenario to accelerate growth to soon attain 5GW / per year size

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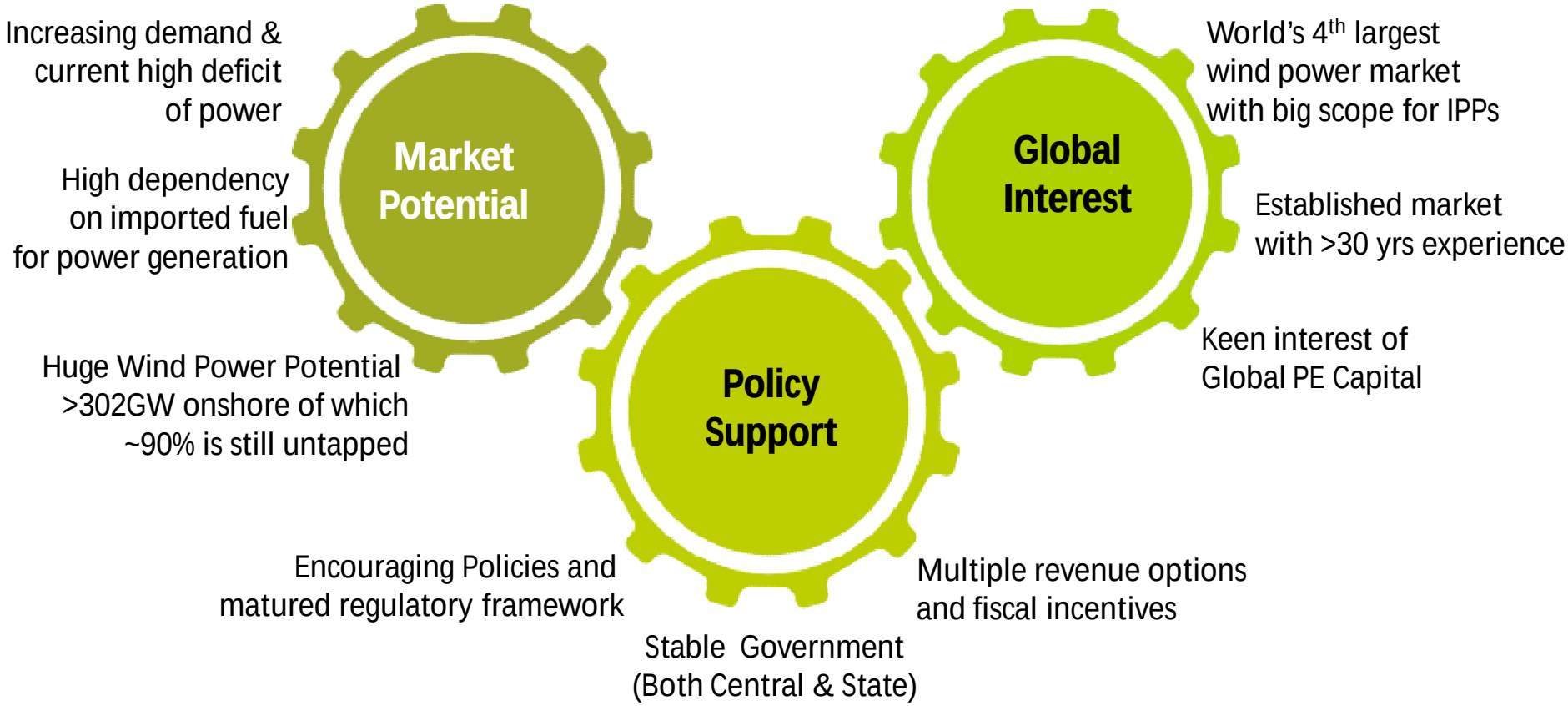
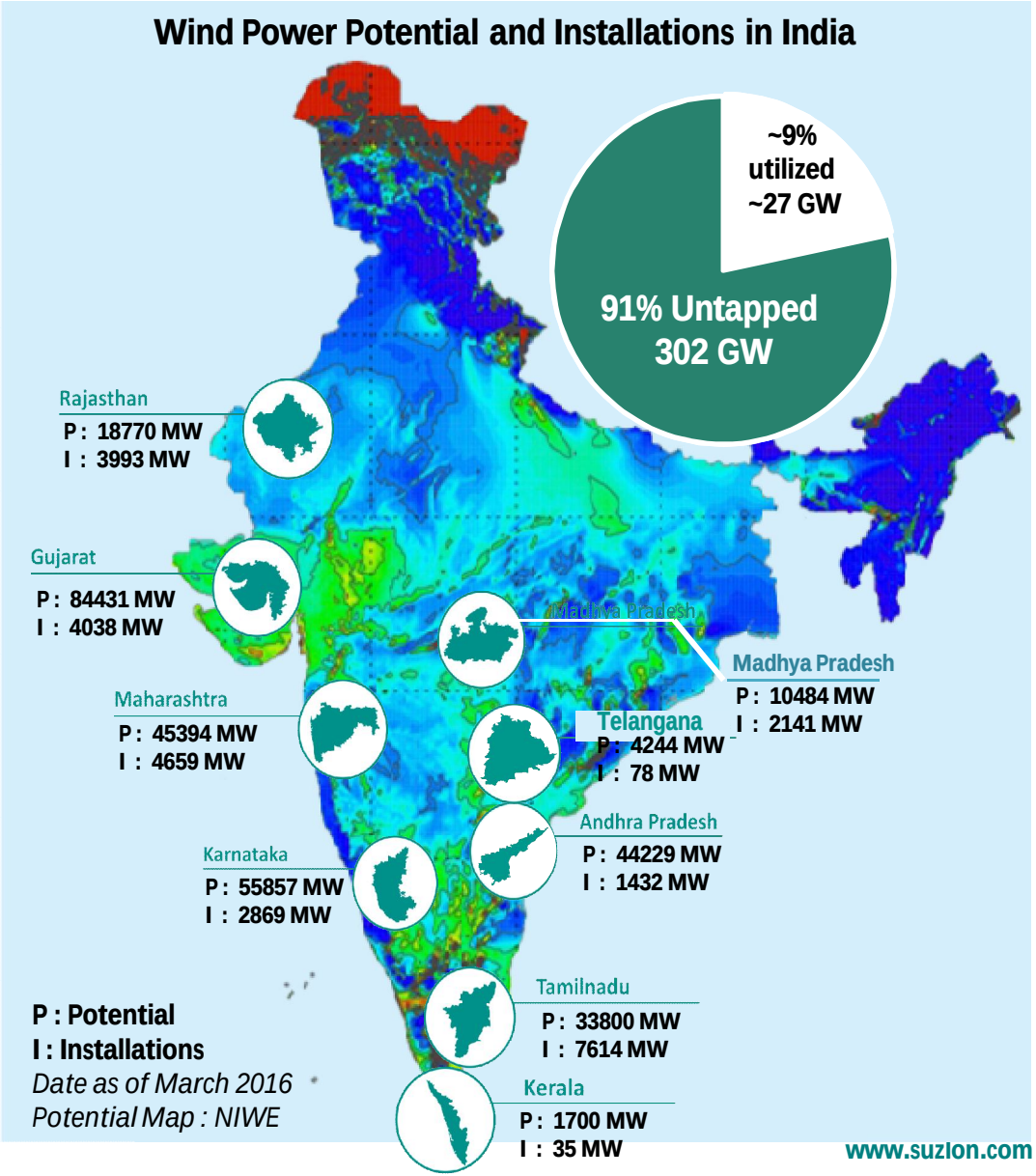
Drivers of Renewable Energy in India



Right scenario for global wind IPPs and Utilities to invest in India

Wind Power Potential

- NIWE (Government's nodal agency for wind power) assessed India's wind energy potential of 302 GW at 100m HH.
- Potential is primarily concentrated in the 9 states
- Current cumulative installed base : Over 27.76 GW
- Current five year plan aimed to add 15GW of wind energy between 2012-17
- New government has recently enhanced the target to 60 GW by 2022



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Prevailing State-wise Policy & Untapped Potential

	Maharashtra	Karnataka	Gujarat*	Rajasthan*	Tamil Nadu	Madhya Pradesh	Andhra Pradesh	Telangana*	Kerala
FIT (Rs/kWh) W/oAD	INR 5.56	INR 4.50	INR 4.68*	Upto INR 6.02	INR 4.16	INR 4.78	INR 4.84	-	INR 5.07-6.34
FIT (Rs/kWh) With AD	INR 4.94		INR 4.19*	Upto INR 5.74	INR 3.70		INR 4.25		
Duration of PPA	13 years	20 years	25 years	25 years	20 years	25 years	25 years	-	25 years
RPO Target	10%	11%	8.25%	8.9%	9%	6.50%	4.75%	-	4.5%
GB Incentive	INR 0.5 per kWh, Cumulative cap of INR 10 mil per MW (Federal incentive, independent of FIT)								
Total Potential** MW	45394	55857	84431	18770	33800	10484	44229	4244	1700
Installed Capacity MW	4659	2869	4038	3993	7614	2141	1432	78	35
Untapped potential	**90%**	**95%**	**95%**	**79%**	**77%**	**80%**	**97%**	**98%**	**98%**

* For FY16 new tariff likely shortly. ** Potential at 100 M Hub Height as per NIWE

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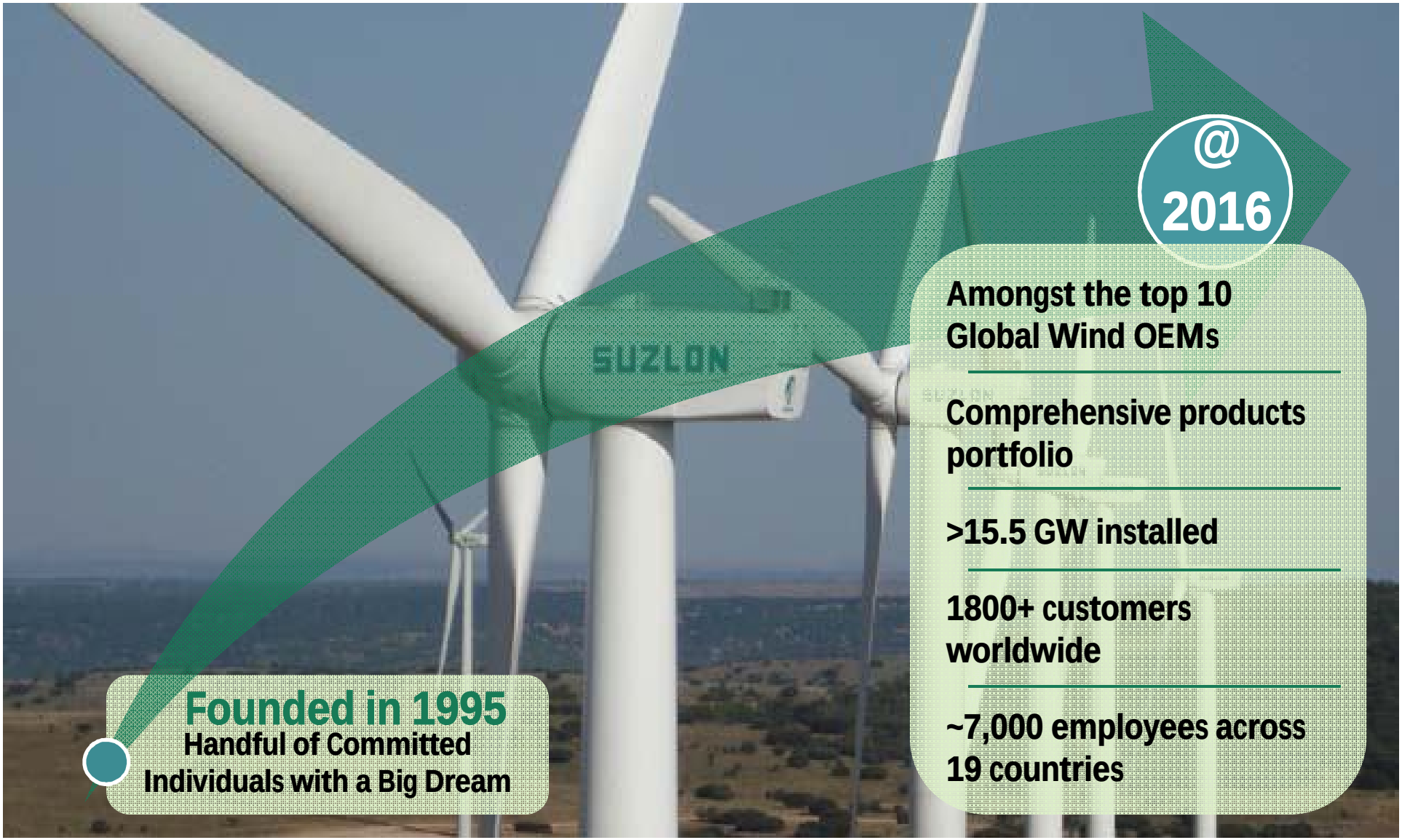
Suzlon Journey



Founded in 1995
Handful of Committed Individuals with a Big Dream

@ 2016

- Amongst the top 10 Global Wind OEMs
- Comprehensive products portfolio
- >15.5 GW installed
- 1800+ customers worldwide
- ~7,000 employees across 19 countries

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20 YEARS OF REVOLUTIONIZING WIND ENERGY

1996 First WTG commissioned

2001 Goes global with subsidiaries in USA and Europe

2004 First Asian OEM to feature in Top 10 Global list

1995 Suzlon formed

2000
- Crossed 100MW
- Launched India's first MW class WTG

2003 First project in USA

2005 Crossed 1GW of installations in India

2007 Launched India's first multi-MW class WTG S88:2.1MW

2011 Launched India's first Low Wind technology WTG platform S9X:2.1 MW

2014 Launched world's tallest 120 m hybrid tower with innovative lattice-tubular design

2006 Set-up world class Rotor Blade Test Facility, only 2nd such globally

2010 Crossed 5GW installations in India

2012 Suzlon's Jaisalmer Wind Park crossed 1GW installations, first in Asia of this scale

2015
- Completed 20 years
- Launched Suzlon's biggest new S111:2.1MW WTG

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India – The Key Global Hub of Suzlon

Global HQ

- Global HQ at Pune India
- LEED Platinum rated GREEN BUILDING complex
- 100% powered by renewable energy

Manufacturing Hub

- Manufacturing capacity of 3600 MW in India
- Three fully integrated WTG assembly facilities and various units for components manufacturing across India
- Supplying to ALL global project destinations of Suzlon

Technology Hub

- New Products Design, Engineering & Proto Testing team at Pune
- Asia's first and only blade testing facility at Gujarat
- Global Domain Expertise in Wind Resource Analysis
- Global SCADA center at Pune

Largest Market

- India is Suzlon's home market and also the largest one globally
- Sustained market leadership for 17 years
- Wind parks and active projects pipeline in all 9 windy states
- Vast experience, end-to-end capabilities and proven performance

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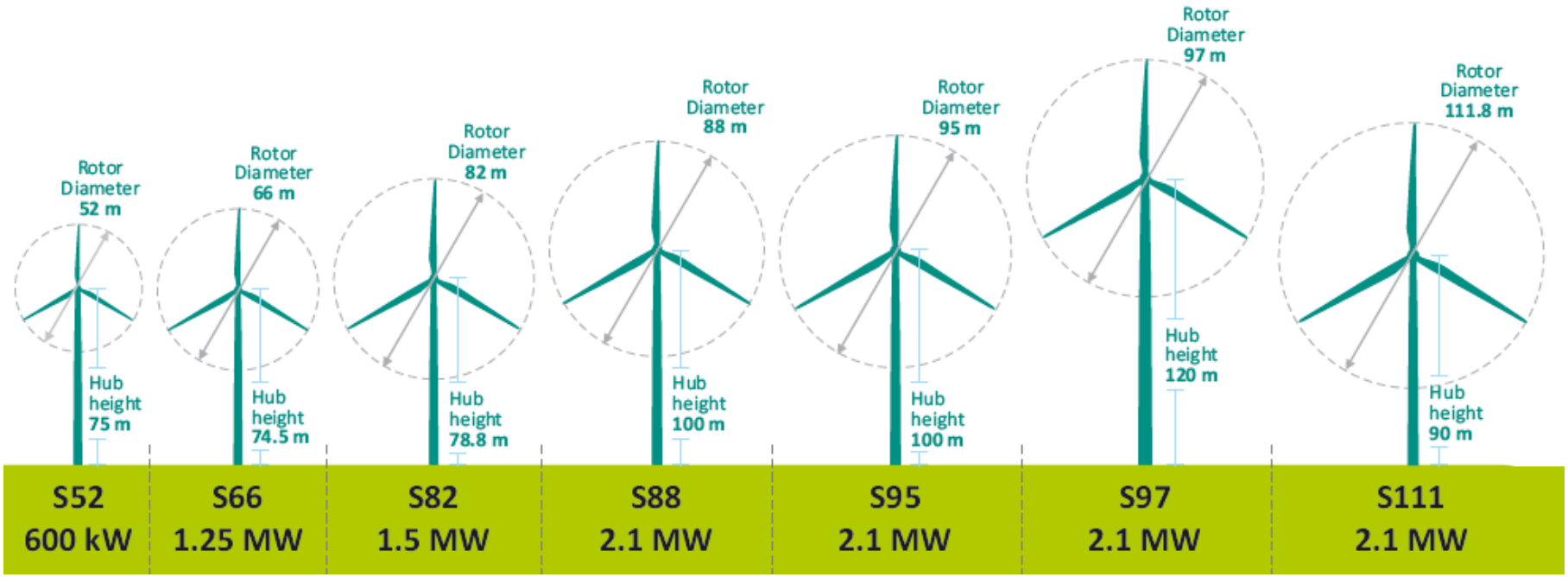
Comprehensive Range of Products

0.6 MW	1.25 – 1.5MW	2.0 –2.25MW



Technology Bandwidth to Meet Varied Market Requirements

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	S52 600 kW	S66 1.25 MW	S82 1.5 MW	S88 2.1 MW	S95 2.1 MW	S97 2.1 MW	S111 2.1 MW
	SUZLON						
Wind class	II A	III A	III A	II A	II A	III A & II B	III A
Hub height	75 m	64.5 m, 74.5 m	78.8 m	80 m, 100 m	80m, 90m, 100m	80m, 90m, 100m, 120m	90 m
Swept area	2124 m²	3421 m²	5281 m²	6082 m²	7088 m²	7541 m²	9817 m²
Rotational speed at rated power	24.19 rpm	20.62 rpm	16.3 rpm	15.47 rpm	15.83 rpm	15.47 rpm	13.0 rpm
Max. rotational speed	-----	-----	-----	-----	-----	-----	-----
Power regulation	Active pitch regulated						Electric blade pitch control
Special features of product	-----	-----	STV, LTV, SFS control	STV, LTV, PIT, SFS control	HTV, Lightning protection class-I, Lift, PIT, compliance to international standards like CE, UL, CSA	HTV, Lightning protection class -I, Lift, PIT, compliance to international standards like CE, UL, CSA	HTV, Lightning protection class-I, Lift, PIT, compliance to international standards like CE, UL, CSA
Product Presence:	**Asia**	**Asia, North America**	**Asia**	**Asia, North America, South America, Europe**	**Asia, South America Australia**	**Asia, North America, South America, Australia**	**Asia**

Pioneer in Platform Evolution For Low Wind Markets

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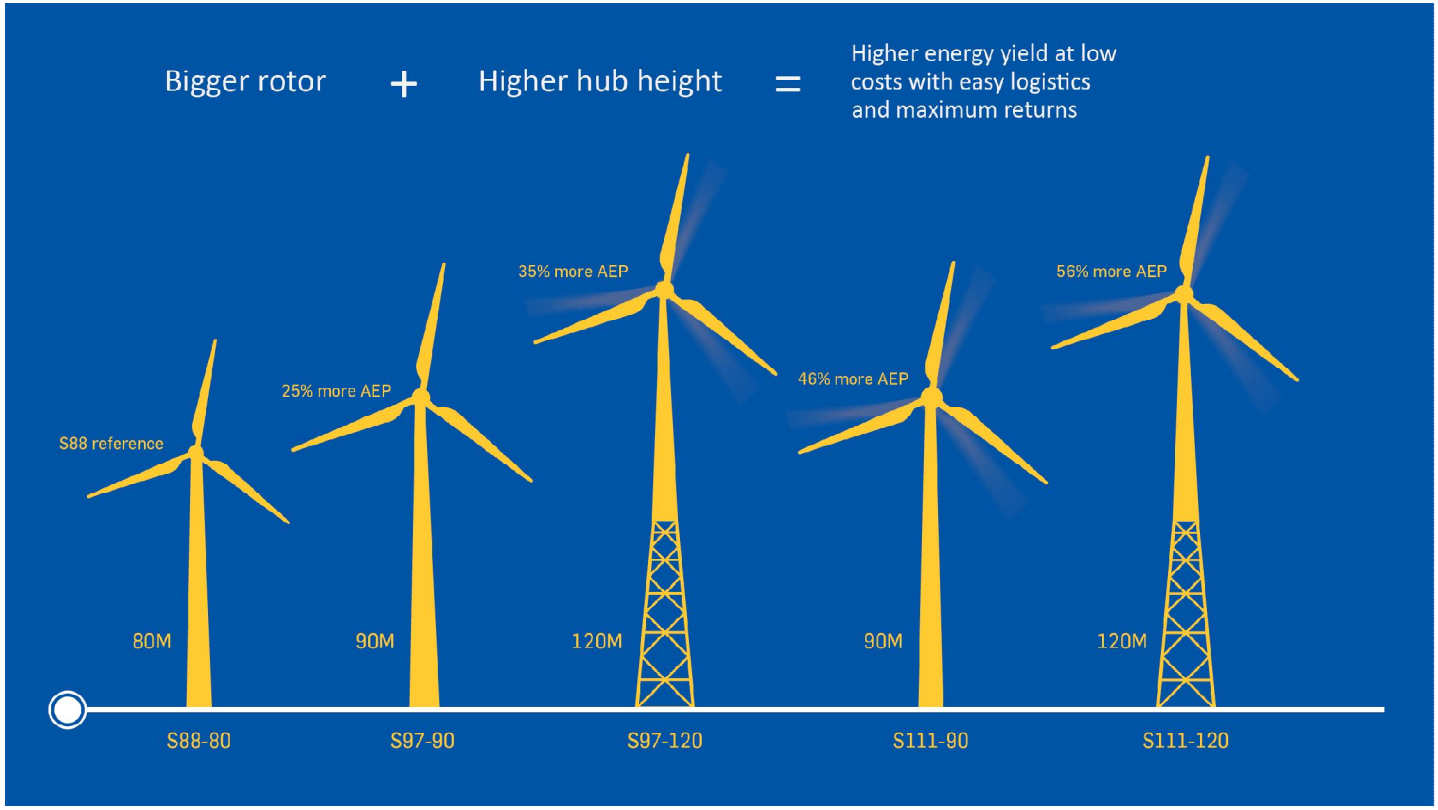
Class III: Low Wind Sites



- Increasing rotor diameter and hub height
- Innovative "hybrid tower" option available
- Increasing energy yield and lowering the energy cost
- Higher RoI for Customers
- Expanding market size by opening-up more sites for viable development

Technology Optimized For Maximizing RoI At Low Wind Sites In India

Note: AEP increase are approximate and under certain conditions

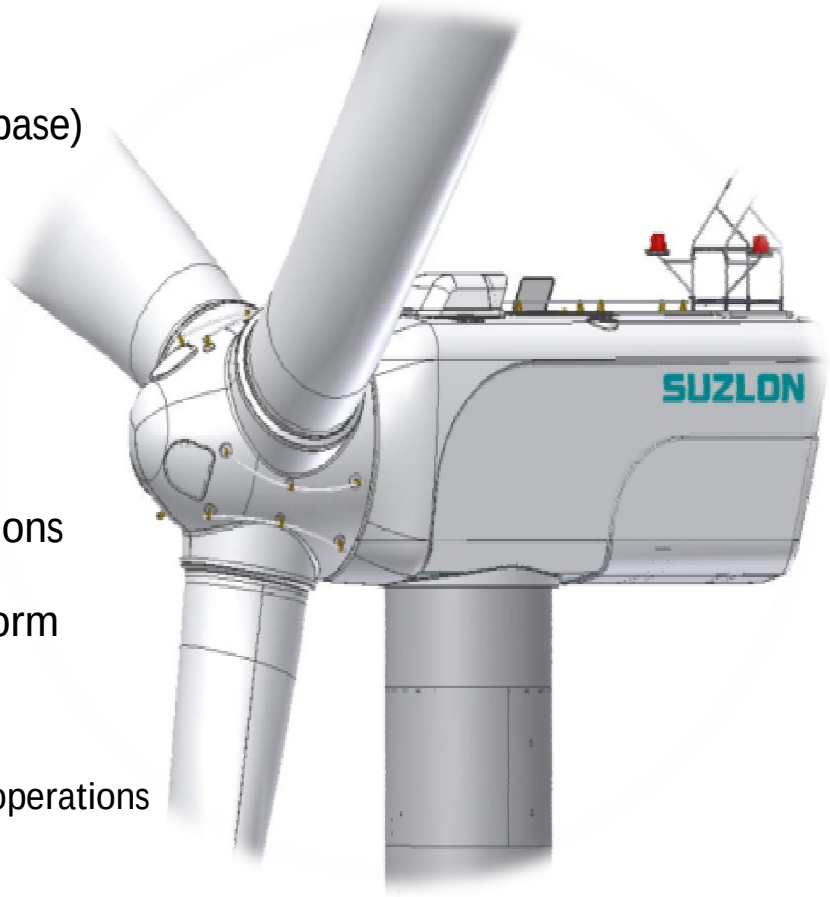
Hybrid Tower: The Game Changer

- 120 m Hub Height (33% higher w.r.t. S97-90)
  - ~ 3-4% more wind speed at higher height
  - 12-15% increase in energy generation (AEP)
- Hybrid Tower (lattice base + tubular top)
  - Reduces weight, Easy on logistics
- Increased RoI for customers
- Suzlon has 3-4 years head start in this technology
- Leadership in innovative application of technology for maximizing the RoI from the project
  - Available for S97 and S111 WTGs
  - Prototype commissioned in June 2014
  - Orders received in the USA and India

Note: AEP increase are approximate and under certain conditions

New S111 : Doing More With Less

- Latest addition to our successful 2.1 MW Low Wind Technology Platform
- Builds on the success of S9X (>1.3GW operating base)
- Bigger rotor diameter (111.8 m) & option of 90 meter & 120 meter hub heights
- **Delivers 20% higher AEP w.r.t. S97**
- Suzlon manufactured rotor blades with airfoil and design to suite low wind speed conditions
- 2.1 MW asynchronous induction generator platform
  - Proven on over 3750 WTGs (7875 MW) globally
  - 6 poles design with DFIG for 30% variable speed operations and grid compliance in India & other markets
  - 6 yaw drives for better stability & operational efficiency



Way Forward

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- Wind :
  - Increase Yield by technology improvement.
    - Larger Rotor Diameter & higher Hub height
    - Change in turbine technology platform
- Wind -Solar Hybrid system :

  optimization of transmission infrastructure.

  Wind CUF 25% & Solar CUF 22% cumulative ~50%

  Reduction in variability of Generation.

  Generation pattern of Wind & Solar will supplement.
- Smart Grid :
  - To Help Proper distribution of power.


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Thank you
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Suzlon wind farm in Paracuru, Brazil