

# Renewable Energy in India

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# Outline



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- Key drivers
- Rationale for renewables
- Enabling environment
- Investments & growth
- India's strength
- Conclusions

# Key drivers



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- Energy scenario
  - The demand for energy in the country has been growing rapidly
  - Electricity supply suffering from huge shortages
  - Over 289 million people without access to electricity
  - Electricity supply situation is generally poor even in electrified villages
  - Over 80% of rural India dependent on traditional fuels for cooking
- Security of energy supply
  - The import dependency in 2031 could reach
    - Oil: 88%
    - Coal: 72%
- Environmental concerns
  - Macro level
  - Micro level

# Rationale for renewables



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- India is endowed with good renewable energy resources like solar, wind, small hydro, and biomass.
- Renewables energy technologies can work equally well in
  - Centralized, large power generation
  - Decentralized, distributed energy generation
- Renewable energy markets
  - Utility-scale electricity
  - Off-grid or distributed electricity systems
  - Decentralized energy systems

# Enabling environment



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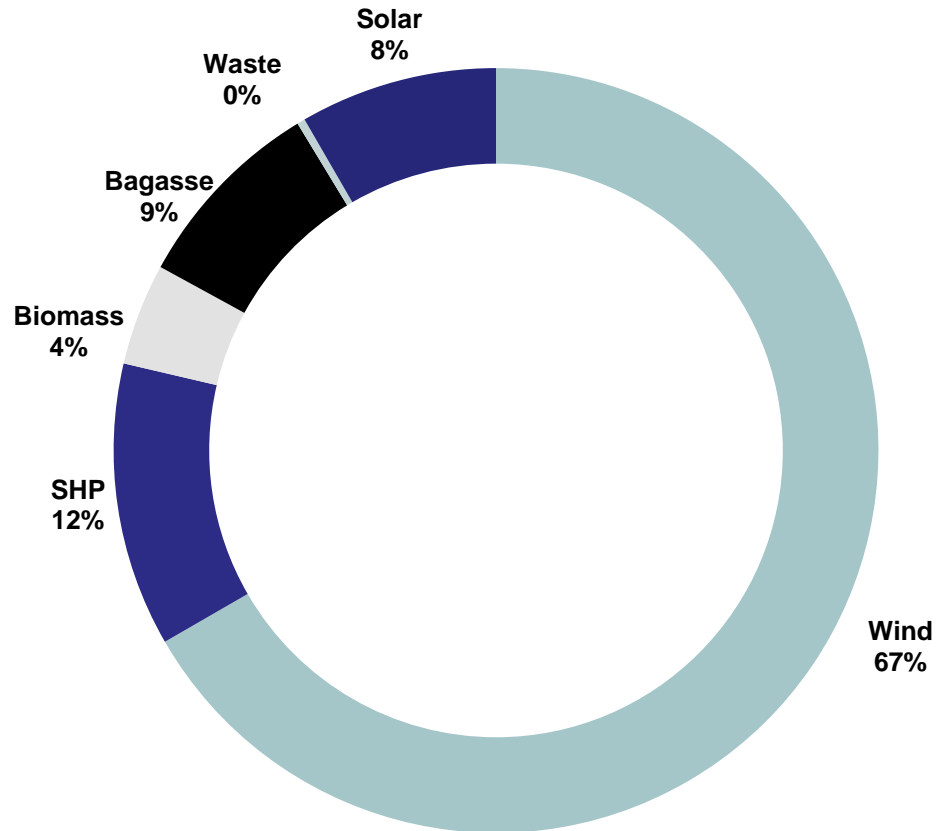
- Policy frameworks
  - Electricity Act 2003
  - National Electricity Policy 2005
  - Rajiv Gandhi Grameen Vidyutikaran Yojna (RGGVY) 2005
  - National Tariff Policy 2006
  - Integrated Energy Policy 2006
  - National Action Plan on Climate Change 2009
    - Jawaharlal Nehru National Solar Mission 2010
  - 12th Five Year Plan
  - State-level RE/Solar policies

# Grid connected RETs

(as on March 31, 2014)



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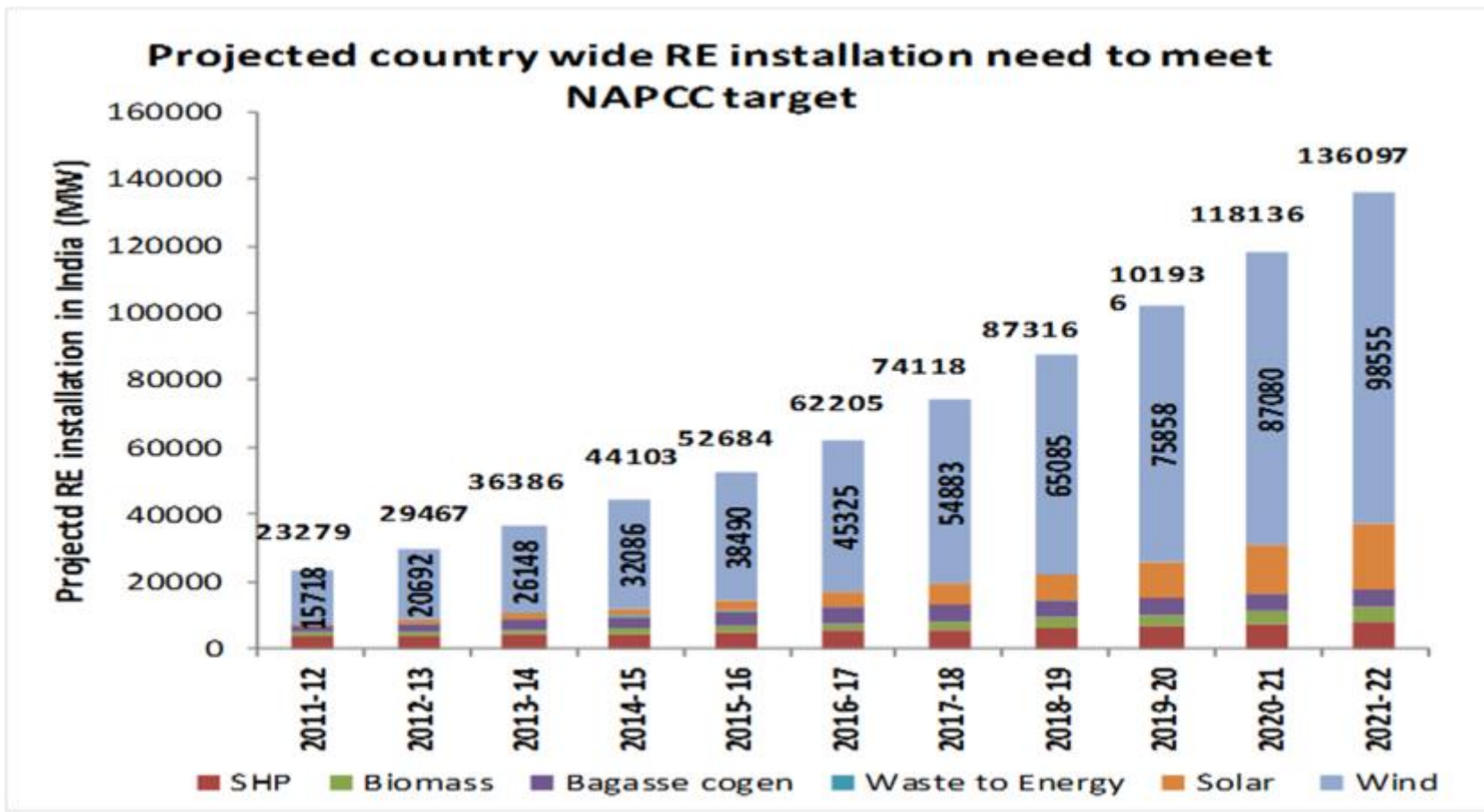
- **Total RETs: 31.70 GW**
- **Share in overall electricity mix: ~13%**
- **Off-grid power: 1022 MW**

Source: MNRE

# RE development scenario in India



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*To meet 17% NAPCC target by 2021-22, 98.5 GW wind installation will be required apart from 20 GW solar*



# JNNSM targets

20000

Utility grid power, including roof top (MW)

2000

Off grid solar applications (MW)

20 million

Solar Collectors (sq. meters)

4000-10000

2017-22

1000

To create favorable conditions for solar manufacturing capability, particularly solar thermal for indigenous production and market leadership.

15 million



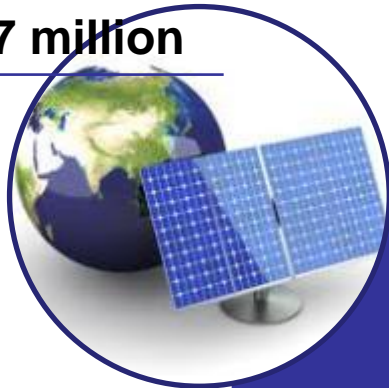
2013-17

Capacity will be aggressively ramped up to create conditions for up-scaled and competitive solar energy penetration in the country after taking into account the experience of the initial years.

1000-2000

200

7 million



2010-13

Main focus on capturing the easily available options in solar-thermal and on promoting off-grid systems to serve populations without access to commercial energy and modest capacity addition in grid-based systems.

Launched in 2008



# ...Enabling environment



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- Regulatory facilitation
  - Renewable Purchase Obligation
    - Separate quota for solar and biomass
  - Feed-in tariff
  - Renewable Energy Certificates
  - Access to grid
  - Wheeling of electricity
  - Banking of electricity
  - Third party sale

# Green corridor



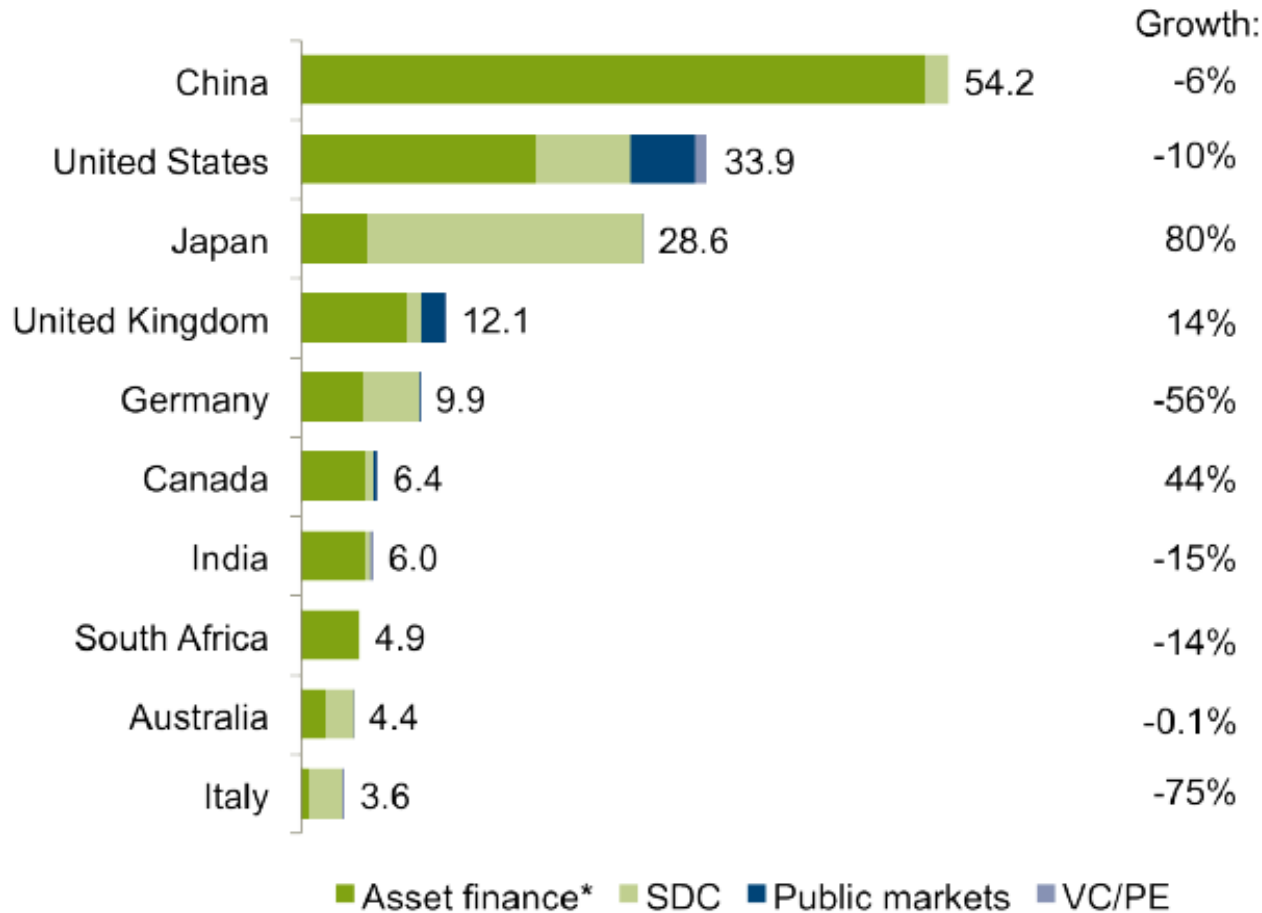
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- It is envisaged that about 41 GW of RE capacity may be added during 2012-17 (~ 66 GW cumulative)
  - Wind (30 GW)
  - Solar (9.5 GW)
  - Small Hydro (1.5 GW), thus
- Transmission system strengthening to facilitate
  - transfer of RE power from the RE rich States (viz. Tamil Nadu, Karnataka, Andhra Pradesh, Gujarat, Maharashtra, Rajasthan & Himachal Pradesh) to other States
- Estimated cost: USD 7 billion

# New investments in RE by country, 2013 and growth on 2012, \$Bn



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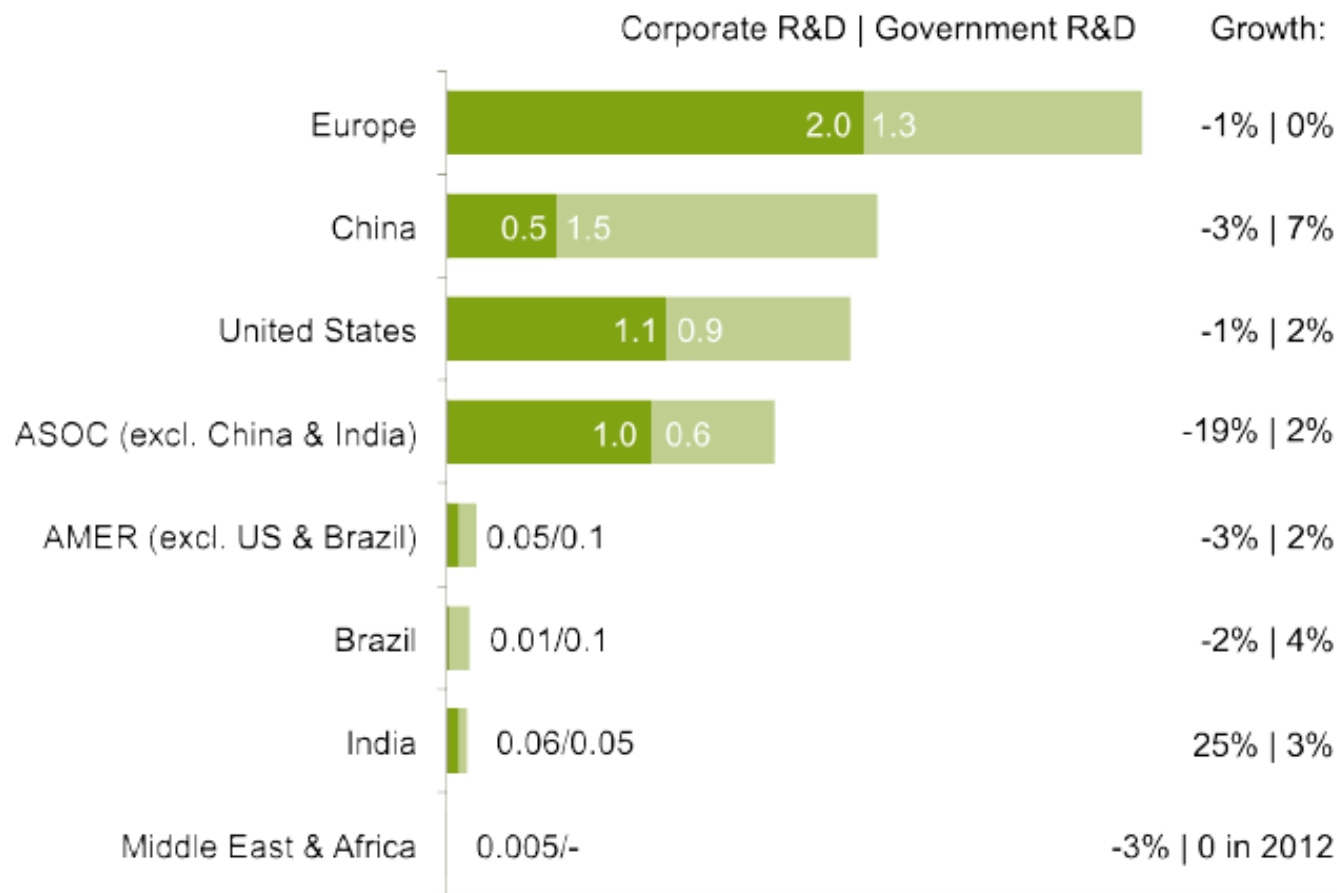
Source: UNEP, Bloomberg New Energy Finance

The renewable electricity space witnessed 32 private equity (PE) and merger and acquisition (M&A) deals worth \$129 billion in 2013.

# Private & public R&D investment, 2013 and growth on 2012, \$Bn



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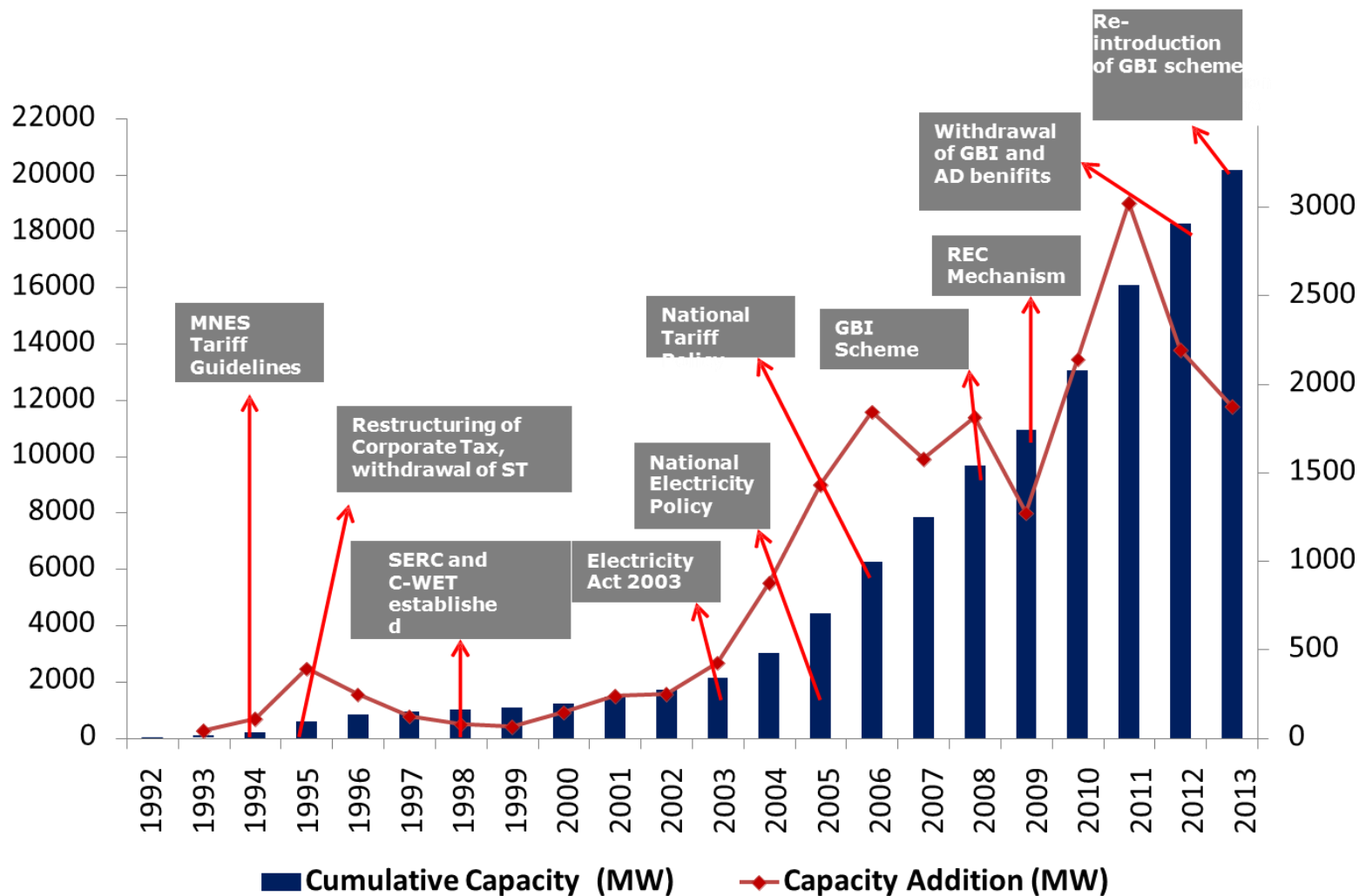


Source: Bloomberg, Bloomberg New Energy Finance, IEA, IMF, various government agencies

# Wind power growth trends



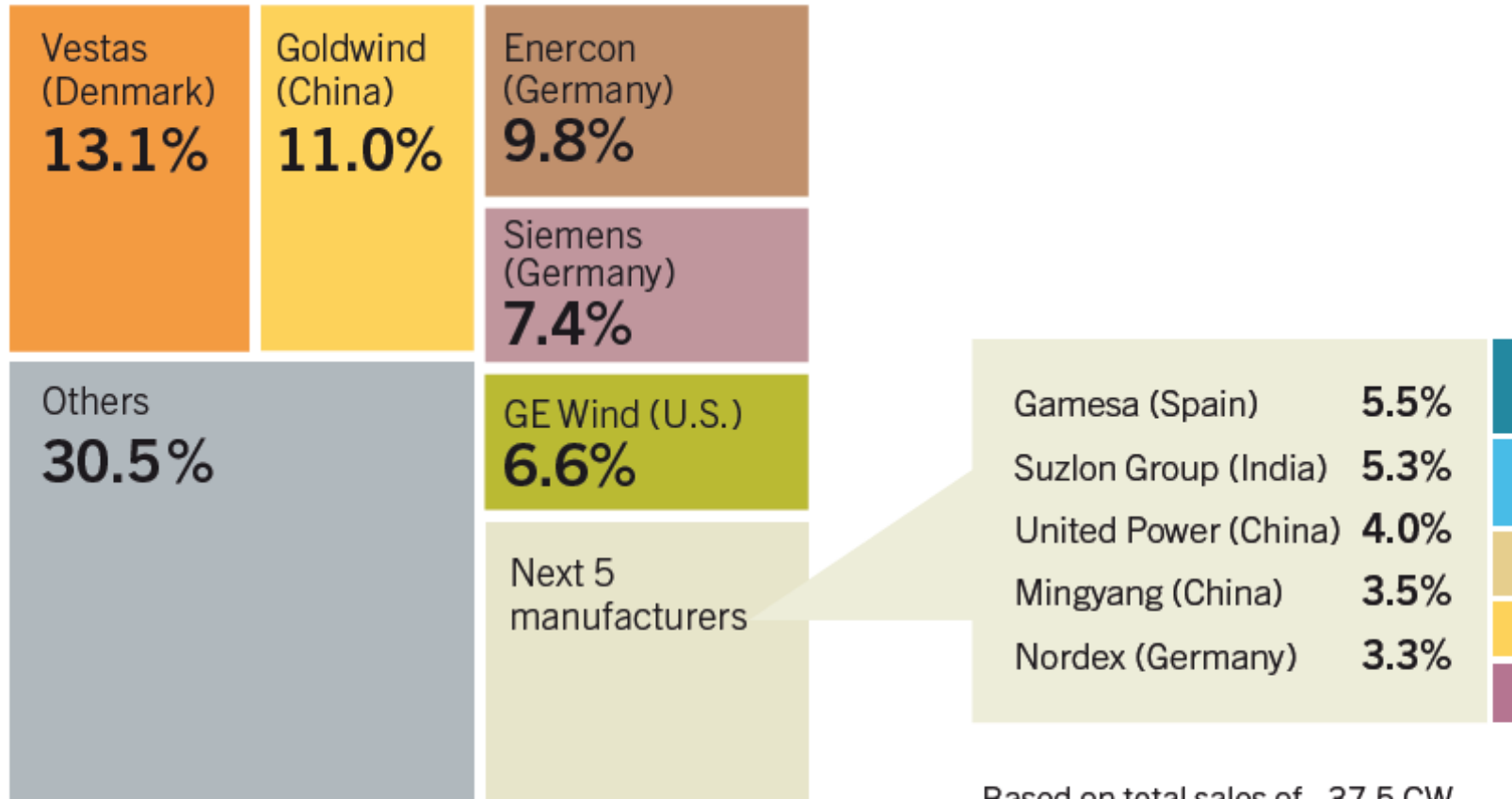
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# Market Shares of Top 10 Wind Turbine Manufacturers, 2013



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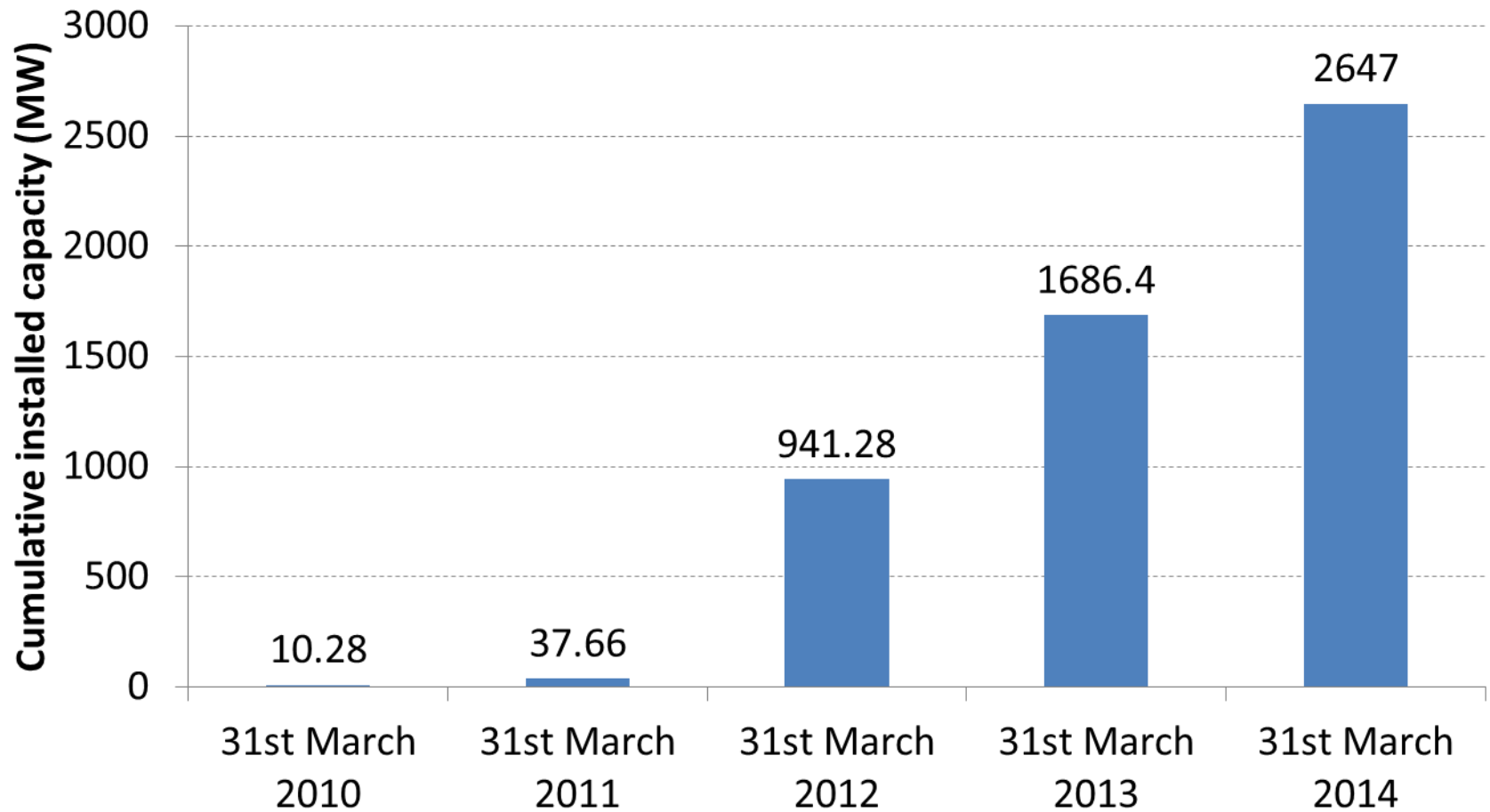


The average size of turbines delivered to market in 2013 was 1.3 MW in India.

# Solar PV growth trends



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# CSP in India



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1 Aurum Renewable Energy

2 Corporate Ispat Alloys

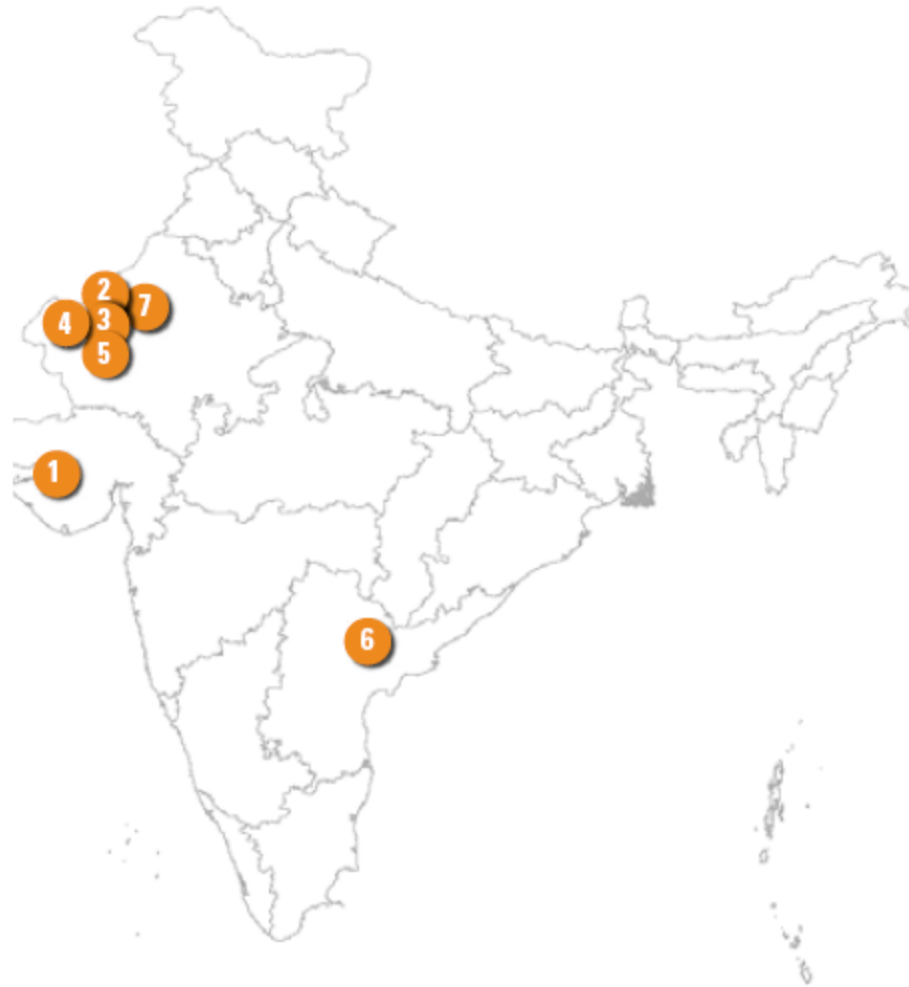
3 Diwakar Solar

4 Godawari Green Energy

5 KVK Energy Ventures

6 Megha Engineering

7 Rajasthan Sun Technique



Concentrated Solar Power: Heating up India's solar thermal market under the national solar mission, Council on Energy, Environment, Water and Natural Resources Defense Council, 2012

# ...CSP in India



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Project	Promoter	Technology	Size (MW)	Bid (₹/kWh)	Supplier(s)	EPC Contractor	Location	Financing (Lead)
1 <b>Aurum Renewable Energy</b>	Aurum	Linear Fresnel	20	12.19	Sumitomo Shin Nippon	Indure	Mitrala, Porbandar, Gujarat	SBI
2 <b>Corporate Ispat Alloys</b>	Abhijeet	Parabolic Trough	50	12.24	Siemens turbine & receivers	Shriram EPC	Nokh, Pokaran, Rajasthan	BOI and IOB
3 <b>Diwakar Solar</b>	Lanco	Parabolic Trough	100	10.49	Siemens	Lanco Solar & Initec Energía	Askandra, Nachna, Rajasthan	Axis
4 <b>Godawari Green Energy</b>	Hira Group	Parabolic Trough	50	12.20	Siemens, Schott Glass, Flabeg, Aalborg	Lauren, Jyoti Structures	Nokh, Pokaran, Rajasthan	Bank of Baroda led consortium
5 <b>KVK Energy Ventures</b>	Lanco	Parabolic Trough	100	11.20	Siemens	Lanco Infratech	Askandra, Nachna, Rajasthan	ICICI
6 <b>Megha Engineering</b>	Megha Engineering Limited	Parabolic Trough	50	11.31	GE	MEIL Green Power Limited	Anantapur, Andhra Pradesh	IDBI led consortium
7 <b>Rajasthan Sun Technique</b>	Reliance	Compact Linear Fresnel	100	11.97	Areva	Reliance Infrastructure	Dahanu, Pokaran, Rajasthan	ADB, US Ex-Im, FMO

Concentrated Solar Power: Heating up India's solar thermal market under the national solar mission, Council on Energy, Environment, Water and Natural Resources Defense Council, 2012

# India globally



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## Annual investments/net capacity additions/production in 2013

Hydropower capacity	China	Turkey	Brazil	Vietnam	<b>India</b>
CSP capacity	USA	Spain	UAE	<b>India</b>	China
Wind power capacity	China	Germany	UK	<b>India</b>	Canada
Solar water heating capacity	China	Turkey	<b>India</b>	Brazil	Germany

# ...India globally



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## Total capacity or generation as of end-2013

Renewable power (excluding hydro)	China	USA	Germany	Spain/Italy	<b>India</b>
Biopower generation	USA	Germany	China	Brazil	<b>India</b>
Wind power capacity	China	USA	Germany	Spain	<b>India</b>

# India's strengths



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- Well-developed R&D infrastructure
- Wide network of academic and research institutions
- Large manufacturing base, spanning all the areas
- Availability of skilled manpower
- Strategic location: access to the vast upcoming markets

# Conclusions



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- India has abundant renewable energy resources, which can contribute towards reduction in dependency on imported fossil fuels.
- Renewables assume special significance in India considering its geographic diversity and size, not to mention the size of its rural economy.
- India has an ambitious RE plan.

# Thank You!

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