सत्यमेव जयते
GOVERNMENT OF GUJARAT

Renewable Energy
Sector Profile

Vibrant GUJARAT 10-13 Jan 2017
Connecting India to the World | 8th Global Summit

Renewable Energy
India Scenario

Renewable Energy: India Scenario

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- India is giving a strong push to renewable energy in line with its commitment to cut carbon emissions by 35% and increase the use of renewable energy sources to generate at least 40% of its power needs by 2030.
- In line with the Paris Climate Agreement, Ministry of New & Renewable Energy, Government of India announced the renewable energy target of installing 175 GW capacity by 2022.
- India has already installed 6GW of utility scale solar capacity and 740MW of rooftop capacity. 25GW of projects are under different stages of development. It added 3019 MW of solar power in 2015 which has been an increase of 142% as compared to 2014.
- With expected new capacity addition of 5.4 GW in 2016, India will become the fourth largest solar market globally this year, overtaking the UK, Germany and France.
- A rapid reduction in costs and increased demand for solar installation has fanned tremendous growth over the past 12 months in India.
- Wind power accounts for 63.2% of the total installed capacity of renewable energy in India.
- India ranks fourth in the world in wind power installed capacity with an installed capacity of 26,769 MW

Source: The Solar Handbook 2016 – A Bridge to India Report, Ministry of Power, Government of India; Ministry of New and Renewable Energy, Government of India

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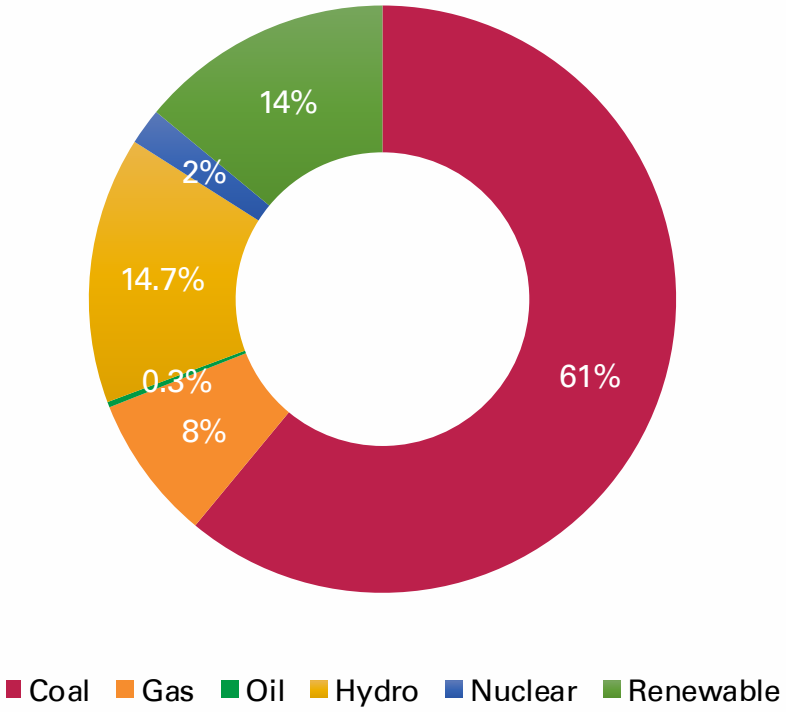
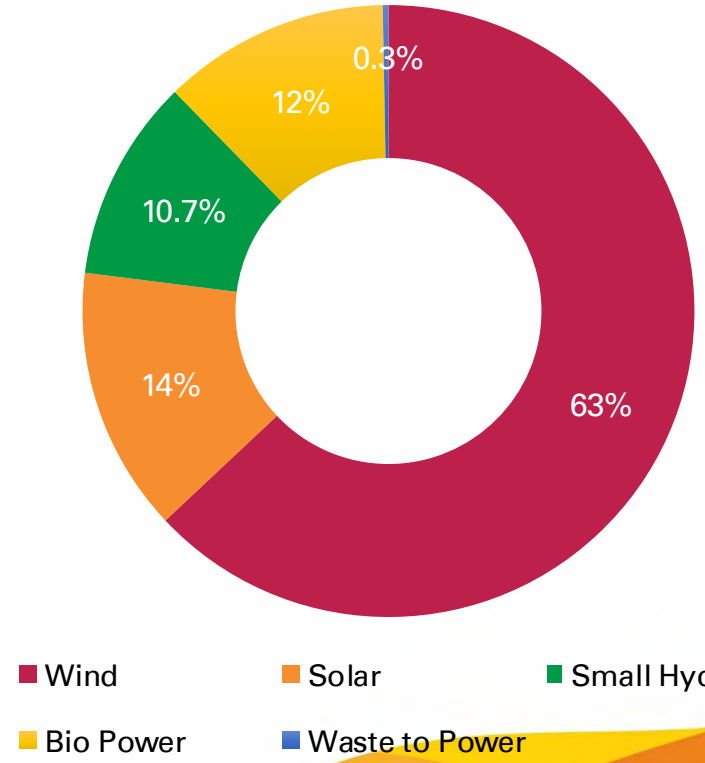
As on 31st March 2016, total installed power capacity from renewable energy sources (excluding Hydro Power) was 43.7 GW. This accounts for ~14% of the total installed power capacity

Break-up of installed power generation capacity



Installed capacity of renewable energy in India



Source: Ministry of Power; Ministry of New and Renewable Energy, Government of India

Renewable Energy: India Scenario
Wind Energy

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Wind power has the highest share in the installed capacity of renewable energy in India

- India has a substantial wind power potential, estimated by India's National Institute of Wind Energy at around 302GW for onshore wind turbine installations with a hub height of 100 meters.
- The most promising sites are in the west and south, with around 90% of the potential in the states of Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Karnataka, Maharashtra and Gujarat.
- Wind power generation is projected to increase strongly, with installed capacity rising from 26.9GW to 142GW in 2040.
- Year 2015-16 saw the highest ever capacity addition of 3515 MW.

Source: India Energy Outlook 2015 by International Energy Agency; Ministry of New and Renewable Energy, Government of India

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Wind Energy

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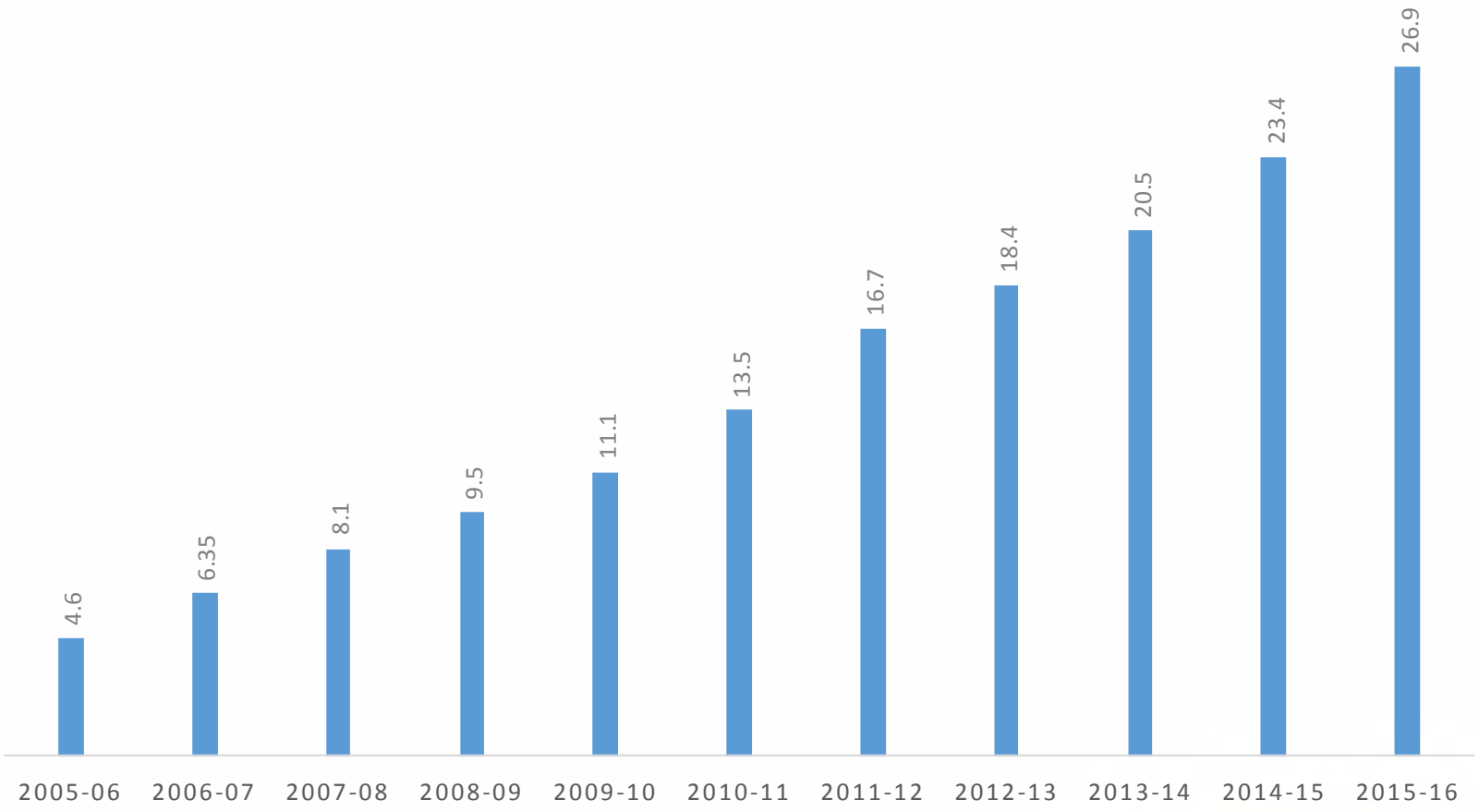
Cumulative Wind-Capacity Additions (GW)



Source: Ministry of New and Renewable Energy, Government of India

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Solar Energy

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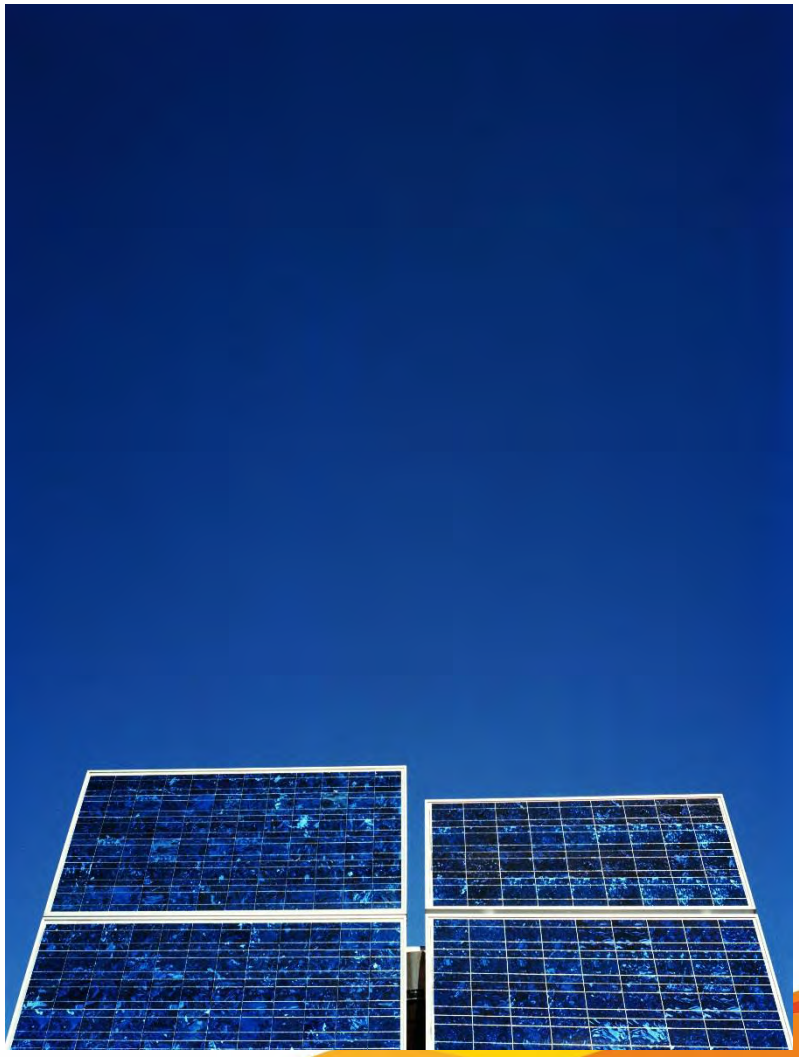
India added 3,713 MW of solar power in 2015-16 which has been an increase of 142% as compared to 2014

- Based on the estimate by India's National Institute of Solar Energy, India has a solar potential of around 750 GW (based on the assumption that 3% of wasteland in each state can be used for solar power projects, plus an assessment of the potential for rooftop solar).
- Solar power in India has witnessed impressive growth in a short span of time - from just 35MW as of March 2011 to 7,457MW as of March 2016.
- The steep growth in the last five years has come on the back of a favourable policy environment, particularly Jawaharlal Nehru National Solar Mission (JNNSM)
- In the last two years, capital cost per mw has fallen from Rs.14 crore per mw to less than Rs. 8 crore. Consequently, average solar tariff rates have declined from Rs. 15 per kWh to Rs. 8 per kWh.



Source: A white paper on India solar and wind energy by CRISIL & PHD Chamber; Ministry of New and Renewable Energy, Government of India

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Solar Energy

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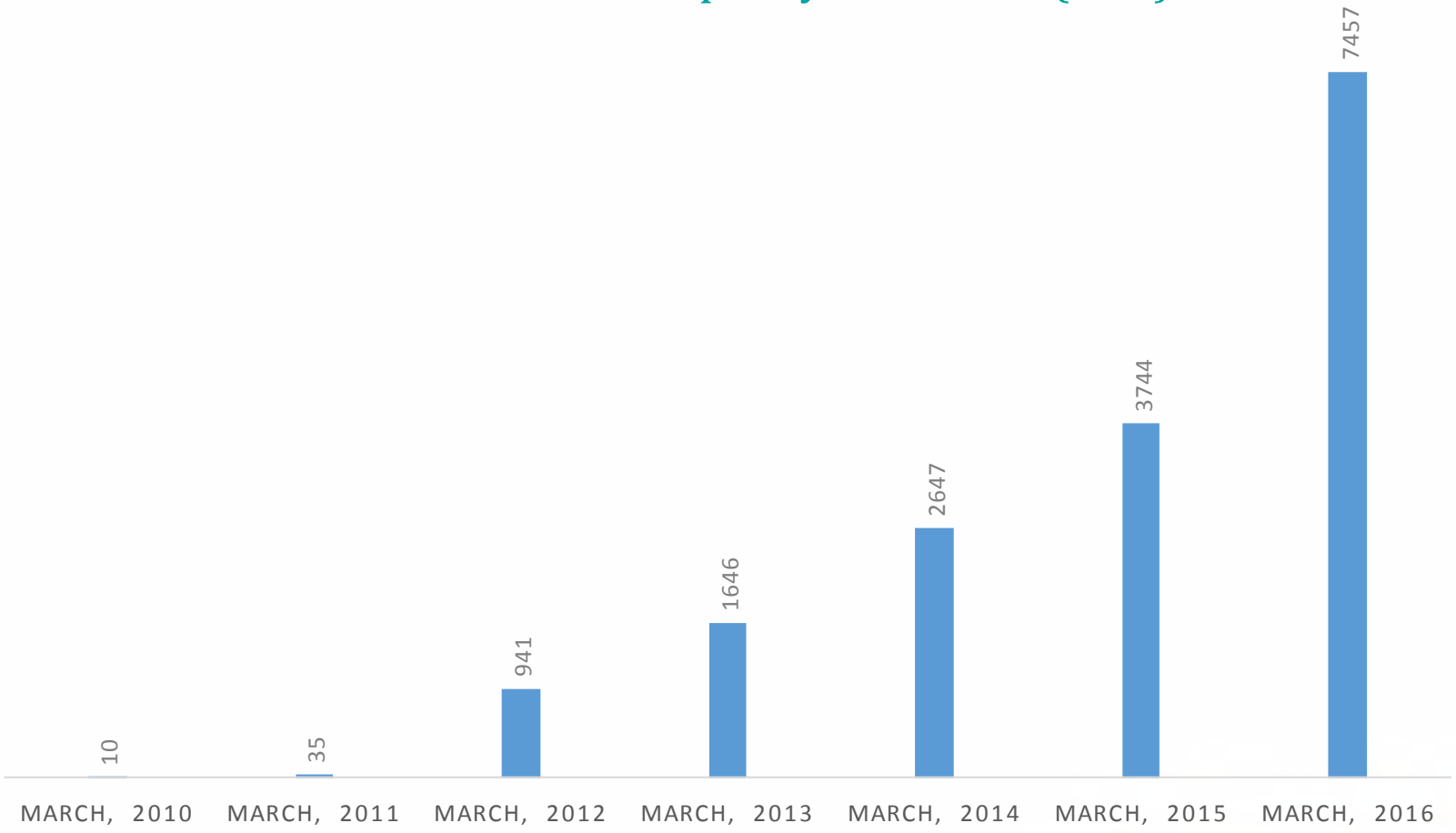

Source: A white paper on India solar and wind energy by CRISIL & PHD Chamber; Ministry of New and Renewable Energy, Government of India

Renewable Energy: India Scenario
Bio Energy & Waste to Energy

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- A total of 4,831MW grid connected capacity has been installed in bio energy in India as on March 31st, 2016
- A total of 400MW capacity was added in the year 2015-16
- Rapid urbanisation and industrialisation over the recent decades has resulted in increased waste generation in Indian cities
- Waste to Energy (WtE) projects could play a critical role in achieving safe and integrated solid waste management in an environmentally sound, socially accepted, and economically feasible manner
- As on March 31st, 2016, grid-interactive waste to power has a capacity of 115MW in India

Source: Ministry of New and Renewable Energy, Government of India; Indo-German Energy Forum

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Government of India's Support to the Sector

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- Foreign Direct Investment (FDI up to 100% is permitted under the automatic route for renewable energy generation and distribution projects subject to provisions of The Electricity Act, 2003.
- Full exemption on excise duty is being provided on Pig Iron (SG grade) and ferro-silicon-magnesium for use in the manufacture of cast components of wind-operated electricity generators.
- The excise duty on solar water heater and system is restructured from 12% to NIL without CENVAT credit or 12.5% with CENVAT credit.
- Full exemption on excise duty is being provided on round cooper wire and tin alloys for use in the manufacture of solar PV ribbon for manufacture of solar PV cells.
- Full exemption from basic customs duty (BCD) is being provided on evacuated tubes with three tyres of solar selective coating for use in the manufacture of solar water heater and system.
- BCD is being reduced to 5% on Active Energy Controller (AEC) for use in the manufacture of Renewable Power System (RPS) Inverters to 5%.
- Exemption from excise duties and concession on import duties on components and equipment required to set up a solar plant.
- A 10-year tax holiday for solar power projects.

Source: Ministry of New and Renewable Energy, Government of India; Make In India

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- Guaranteed market through solar power purchase obligation for states.
- GBI schemes for small solar projects connected to a grid below 33KV.
- Special incentives for exports from India in renewable energy technology under renewable sector-specific SEZ.
- Accelerated depreciation: a claim of 80% depreciation in the first year for certain specific equipment for wind power
- A 10-year income tax holiday for biomass power projects
- Concessional customs duty and excise duty exemption for machinery and components during the setting up of the project for biomass power projects
- Financial assistance from IREDA for the setting up of biomass power and bagasse co-generation projects.

Source: Ministry of New and Renewable Energy, Government of India

Renewable Energy
Gujarat Scenario

Renewable Energy: Gujarat Scenario

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- Gujarat contributes ~ 15% to India's renewable energy basket
- The State has a potential of 35,000MW in wind energy and 69,000MW in solar energy
- Gujarat houses one of the Asia's largest solar park
- After a feasibility study of Indian offshore wind potential, Gujarat is one of the two states that has been selected as ideal to feature the first Indian offshore wind farm
- The state with a ~1600km coastline also has a potential of 8200 MW in tidal energy

Source: Energy & Petrochemicals Department, Government of Gujarat

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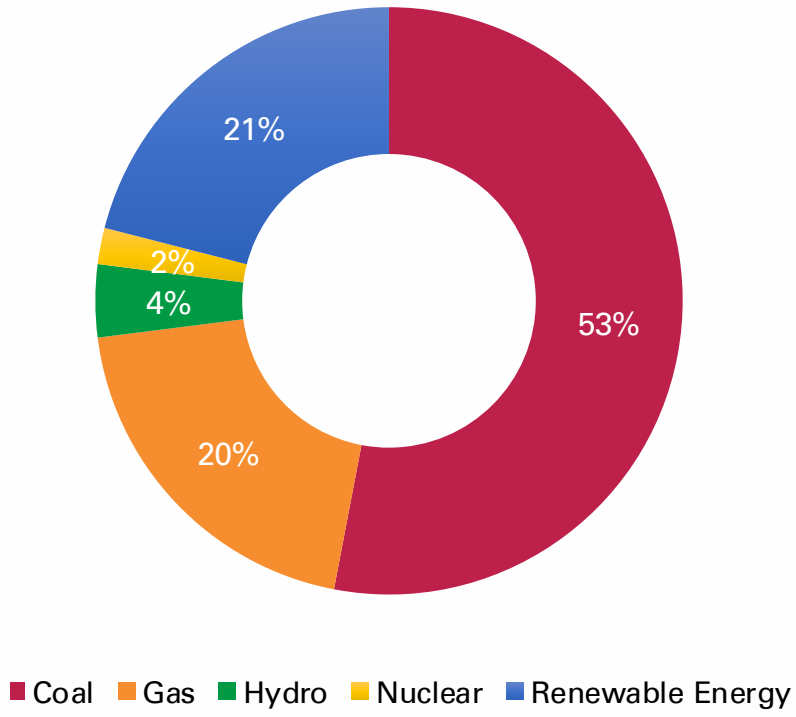
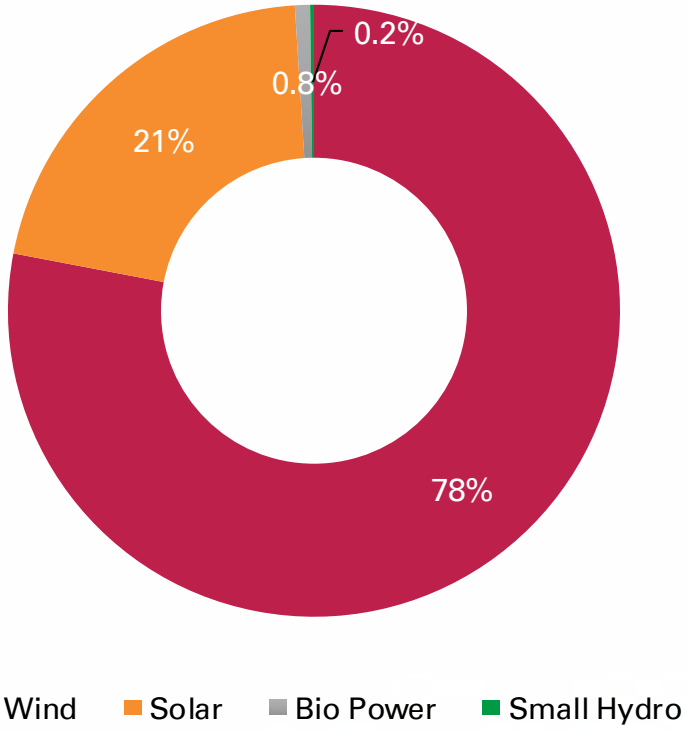
Breakup of Installed Power Capacity in Gujarat



Installed capacity of renewable energy in Gujarat



Source: Energy & Petrochemicals Department, Government of Gujarat

Renewable Energy:
Gujarat Scenario Wind Power

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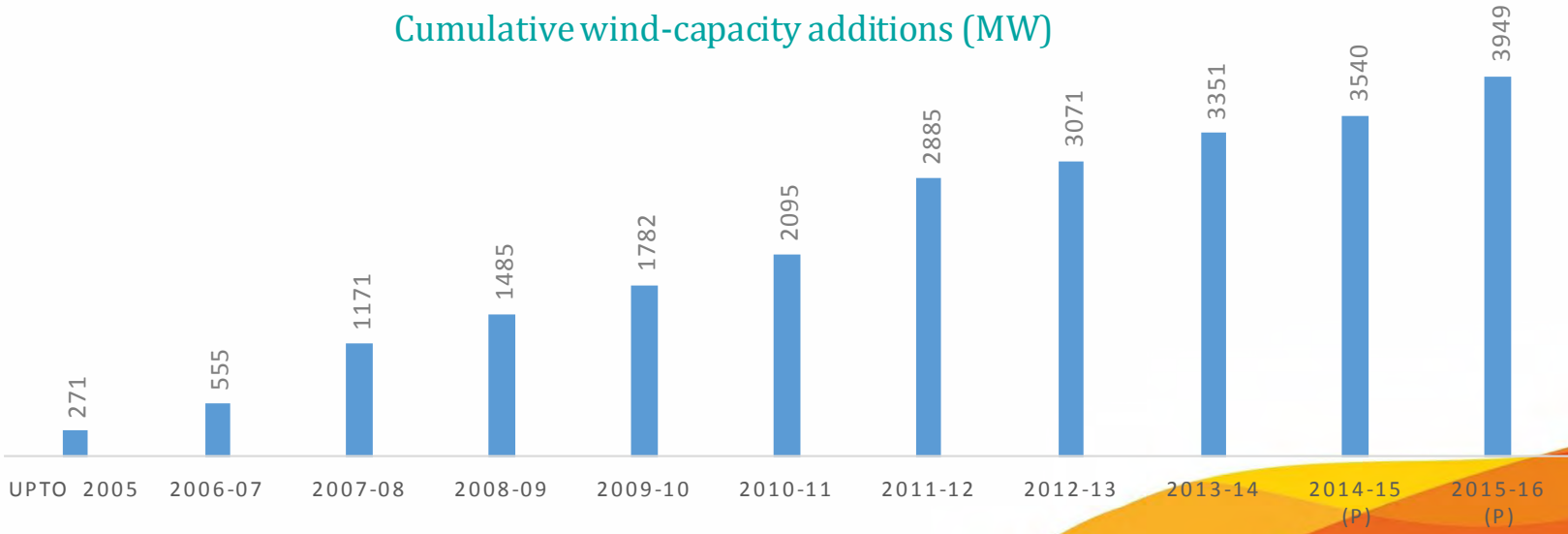
- Gujarat has the fourth largest Wind Power installed capacity in the country which is about 3948.61 MW (as on March 2016)
- The Centre for Wind Energy Technology, an autonomous R&D institution under MNRE, has identified and approved 40 sites for wind energy deployment with annual average wind power density greater than 200 W/sq. m. at a 50 m height in Gujarat
- Over a period of last more than 25 years more than 65 sites have been monitored for the wind speed and wind power density, and over 50 sites have been found feasible for harnessing wind power



Source: Gujarat Energy Development Agency

Renewable Energy:
Gujarat Scenario Solar Power

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- Gujarat has over 1GW of installed solar capacity, accounting for ~17% of India's total.
- Gujarat also has Asia's First Solar Park
  - Village Charanka, Ta:Santalpur, Patan 2024 hectares of wasteland
  - For setting up 3000MW Generation & Manufacturing Facilities
  - 345 MW Capacity Power Plants have been installed at Charanka Solar Park
- 91 plants totaling to about 1121 MW capacity were commissioned in Gujarat up to March 2016

Source: Gujarat Energy Development Agency

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Gujarat Scenario Solar Power

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GUJARAT'S LARGEST SOLAR POWER PLANTS		
Plant	**District**	**MW**
Torrent Power Ltd.	Surat	81
Kindle Engineering and Construction Pvt. Ltd.	Patan	50
Adani Enterprises Ltd.	Kachchh	40
Sanland Real Estate Pvt. Ltd.	Banaskantha	25
Tata Power Company Ltd.	Jamnagar	25
Alex Astral Power Pvt. Ltd.	Patan	25
Roha Dyechem Pvt. Ltd.	Patan	25
Sun Edison Energy India Pvt. Ltd.	Patan	25
Kiran Energy Solar Power Pvt. Ltd.	Patan	20
PLG Photovoltaic	Patan	20
Hiraco Renewable Energy Pvt. Ltd.	Porbandar	20

Source: Gujarat Energy Development Agency

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Gujarat Scenario Bio Energy

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The total bio-mass potential for Gujarat is about 1,800 MW from crop residue and about 140 MW from forest residue

- 41.10 MW capacity biomass projects commissioned in Amreli, Junagadh and Vadodara
- 14.389 MW waste-to-energy power generation projects
- Institutional biogas plants with capacity 15730 m3/day across the state

Source: Gujarat Energy Development Agency

Renewable Energy

Gujarat Scenario: Success Stories

Renewable Energy: Gujarat Scenario
Model Solar City Project- Gandhinagar

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Gandhinagar: The Model Solar City project

- Government of India declared to develop Gandhinagar as a Model Solar City setting an example for Solar Cities throughout India and other nations
- Two solar projects with cumulative installed capacity of 2000kW installed in the city
- 7415 kW Grid Tied Roof Tops installed under the Solar City Project
- Wind-solar hybrid system with 60 KW capacity installed in the city
- The Model Solar City project has led to an annual savings of 149.20 lacs kWh in Gandhinagar
- The project has helped reduce 14,900 tons of carbon emission and avoid usage of 10,430 tons of coal

Source: Gujarat Energy Development Agency

Renewable Energy: Gujarat Scenario
Solar Rooftop Programme: RENT A ROOF

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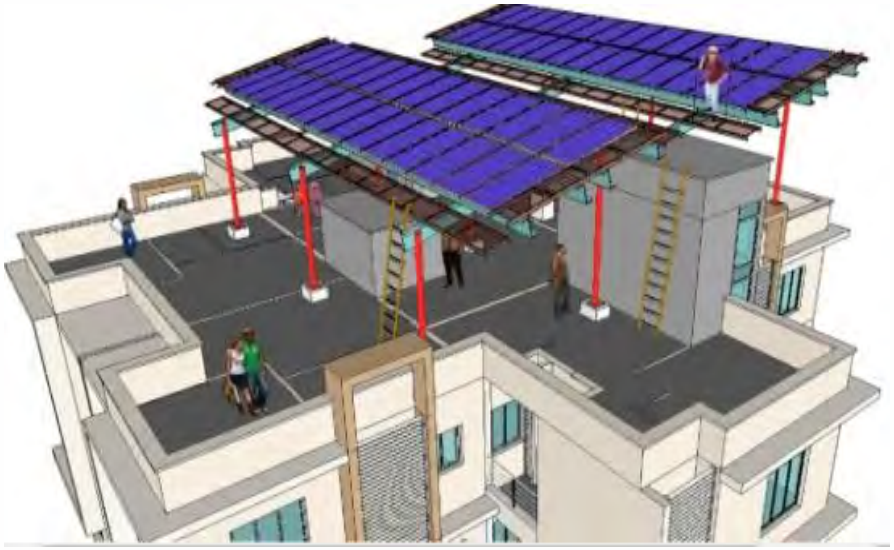
Gandhinagar & Vadodara Solar Rooftop Programme

- This Programme provides an opportunity to property owners in Gandhinagar City for participation by offering their rooftop or terrace for installation of Solar Photovoltaic System for solar power generation
- 5 MW solar rooftops have been setup in Gandhinagar as part of the Model Solar City Project on Government and private households



- 328 locations have been covered in Gandhinagar including 276 households and 52 Government Buildings
- The programme has been replicated in Vadodara too where solar rooftops with capacity of ~4 MW are setup.
- The owner of property is paid a "Green Incentive" on the basis of units (kWh) of electricity generated by the SPV system installed on the property

Source: GEDA, GPCL

Renewable Energy: Gujarat Scenario
India's First Canal Top Solar Power Project

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Gujarat has initiated the world's first canal-based solar power project on Narmada branch canal new Chandrasan village of Mehsana district

Energy generated from this pilot project will be directly fed into the local electricity grid and utilized by nearby towns and villages

Source: GSECL

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India's First Canal Top Solar Power Project

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TECHNICAL DETAIL

- Projected energy production: 1.6 million units/year/MW
- Irradiation: 4.6 – 6.4 kWh/m2
- Installed capacity: 1 MWp
- Technology: polycrystalline solar modules, 280 Wp
- Number of modules: 3616
- Canal length used: 750 m
- Power evacuation system: 11 KV

INNOVATIVE IDEAS

- Cover the canal with Solar Panels to
- Save Land @ 5 acre per MW
- Minimize evaporation from canal (9 million liters water saving per MW per year)
- Produce eco-friendly power
- Shadowing effect of panel results in reduced photosynthesis and less algae growth leading to less maintenance cost
- Pilot Project is for 1 MW

Source: GSECL

Renewable Energy: Gujarat Scenario
Renewable Energy Players in Gujarat

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Solar power developers

Azure Power, Welspun, SunEdison simplifying solar, AES Solar, ROHA Colouring the Future, Tata Tata Power, Lanco Always Inspiring, Moser Clean Energy Limited, adani, Essar Power, Sun Group, Louroux Bio Energies Limited, Abellon CleanEnergy, GMR, Gujarat Power Corporation Ltd., Kiran Energy, ACME, ENAM, emami, GPPC, GSECL Gujarat State Electricity Ltd., Gujarat Industries Power Co. Ltd., GMDC Fueling the Growth

Solar PV manufac-turers

Tata BP Solar, GreenBrilliance, JJ PV Solar, Sunrise Technology, Inc., Eurosolar Power, Star Energy, Ritika, Vimal Electronics, Topsun Energy Ltd., Waaree

Wind power developers

Natural Resources Environment NRE, Essar Power, Suzlon Powering a Greener Tomorrow, IPCL India Power Corporation Limited, Tata Tata Power, ONGC

Wind equipment manufac-turers

Vestas, Elecon, Jyoti Ltd., Essar Power

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Government of Gujarat's Support to the Sector

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Solar Power Policy-2015	• Policy valid till 2020.
	• Subsidy of INR 10,000 per kW for installing solar rooftops at private residences; with maximum limit of subsidy of INR 20,000/- per consumer
	• Support to following projects
	  • Solar Projects with sale of power to DisComs
	  • Solar Projects under REC mechanism with sale of power to DisComs at APPC
	  • Solar Projects with sale of power under NSM
	  • Solar Projects with sale of power to third party under open-access

Small Hydel Policy - 2016	• Policy valid till 2021 • Eligible Capacity: 100 kW to 25 MW • End Use of Electricity: Captive use or for sale to power obligated entities / Third Party • Electricity duty exempted • Exemption from demand cut
Waste to Energy Policy - 2016	• Policy valid till 2021 • ULBs, Municipal Corporations to provide land at token rent of Re. 1 per annum for the Project • ULBs / Municipal Corporation not to charge any tax, cess, royalty, levies, stamp duty, land allotment charges to the Project Developer • End Use of Electricity: Captive use or for sale to power obligated entities / third party • Electricity duty exempted • Exemption from demand cut

*ULB – Urban Local Body

Renewable Energy

Gujarat Scenario:
Business Opportunities in Gujarat

Renewable Energy: Gujarat Scenario
Business Opportunities

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Solar Energy	• Manufacturing core products – Ingots & Wafers • Manufacturing Cells and Modules • Manufacturing BoS Utility Grid • Installation & Support • Training, consulting and IT • Power Plant Developer
Wind Energy	• Machinery Suppliers • Original Equipment Manufacturing • Component Manufacturing • Trading Opportunities • IT & Training and Support Services • Power Plant Developer
Biomass Energy	• Feedstock producers & processors • Biofuel companies • Equipment Manufacturers & Technology suppliers • Transport services • Power Producers

Organisation	Description
Energy and Petrochemicals Department http://guj-epd.gov.in/	• The Energy and Petrochemicals Department looks after the portfolio of oil, natural gas, renewables and power within the State of Gujarat.
Gujarat Energy Development Agency http://geda.gujarat.gov.in/	• GEDA shoulders the responsibility of a state nodal agency (SNA) for the Ministry of New and Renewable Energy Sources (MoNRE) and the state designated agency (SDA) for Bureau of Energy Efficiency (BEE)

THANK YOU