Renewable Energy Scenario in India

Divya Datt

The Energy and Resources Institute

September 5-6, 2017

SDGs and Financing: No Longer Business as Usual

India's quadruple energy challenge

Growing energy demand

By 2030
Energy demand >2X
Electricity demand ≈ 3X

Economic growth, development, rise in population, urbanization

India's quadruple energy challenge

Growing energy demand

Energy access & electrification

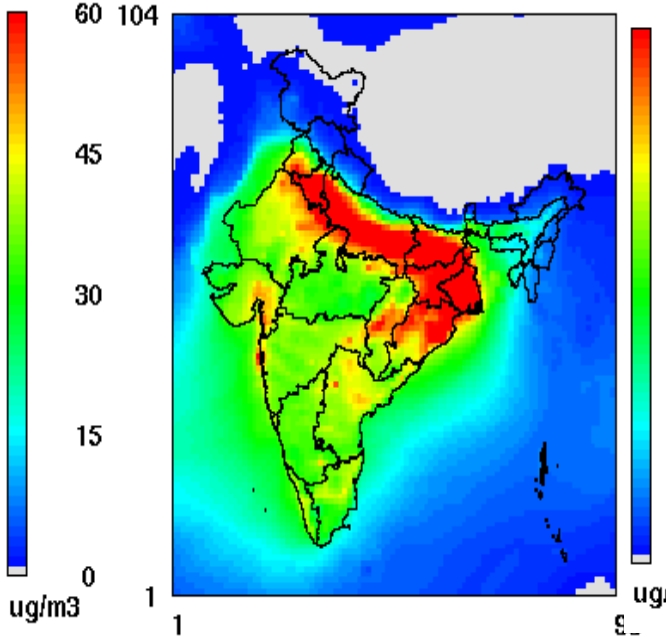
- 300 million people with limited or no access to electricity
- 50% households still use firewood for cooking
- Per capita consumption: India vs world (2011/12)
  - Energy: 0.6 vs 1.88 toe
  - Electricity: 884 vs 3044 kWh

India's quadruple energy challenge

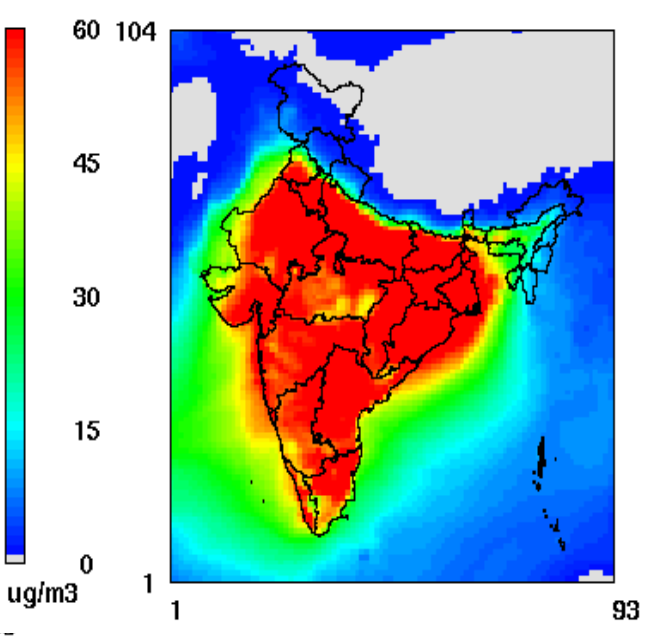
Growing energy demand	Energy access & electrification	GHGs & local pollutants

- Fossil fuels ~70% of the primary energy supply (MOEF, 2012)
- Energy sector accounts for over 71% of total GHG emissions in India
- GHG intensity has been decreasing

PM2.5 (2011: Winter)



PM2.5 (2031: Winter)



- By 2011/12 most cities had exceeded ambient air quality standard
- Mortality from PM 2.5 was 0.57 million
- Air quality will worsen in BAU increasing the mortality to 3.36 million (2031/32)

Source: TERI's Integrated MARKAL, WRF, CMAQ Models Results

India's quadruple energy challenge

Growing energy demand

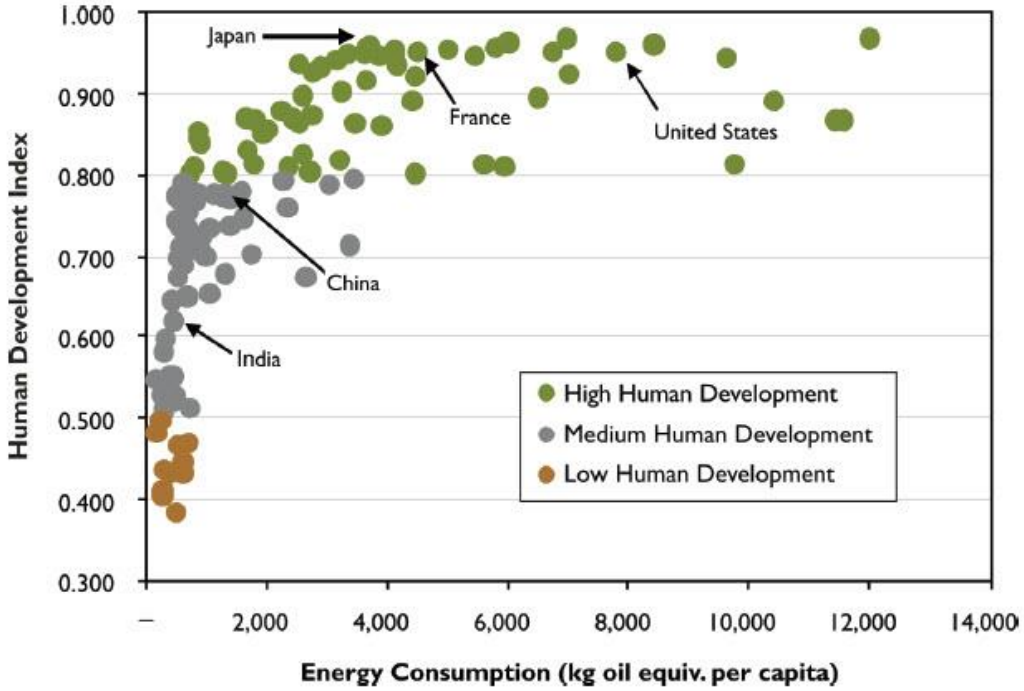
Energy access & electrification

GHGs & local pollutants

Energy security

High oil imports: 76% in 2011
Coal imports: 23% in 2011

Decarbonizing future energy growth is imperative



- India: HDI level of 0.609 (2014) with global rank of 130
  - No country has been able to achieve a HDI > 0.9 without an annual energy availability >4 toe/capita

India's NDC commitments at Paris

1. 33-35% reduction in emissions intensity of GDP by 2030 from 2005 levels
2. Achieving around 40% non fossil share by 2030 (conditional on GCF support)
3. Creating a carbon sink of 2.5 to 3 bn t CO_2e through forests

India's renewable energy program

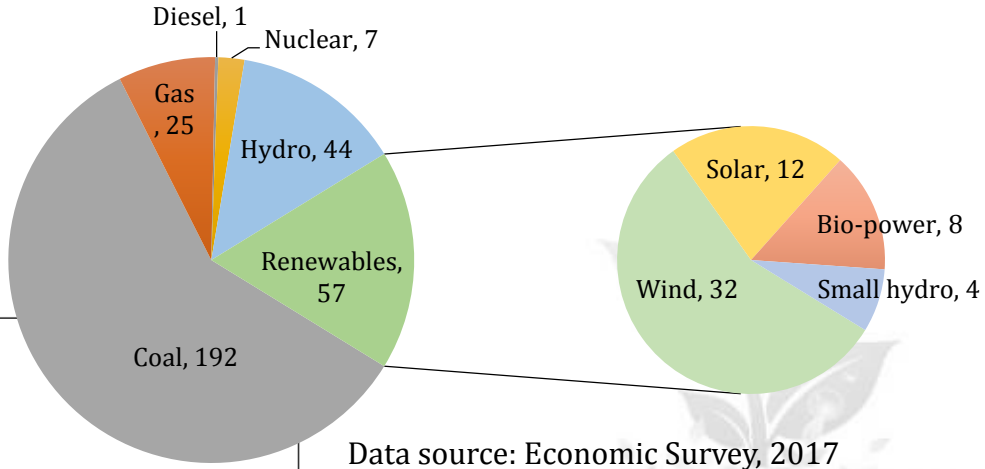
Segments

- Utility scale grid connected projects
- Small and rooftop solar
- Small energy grids
- Solar home systems & lanterns

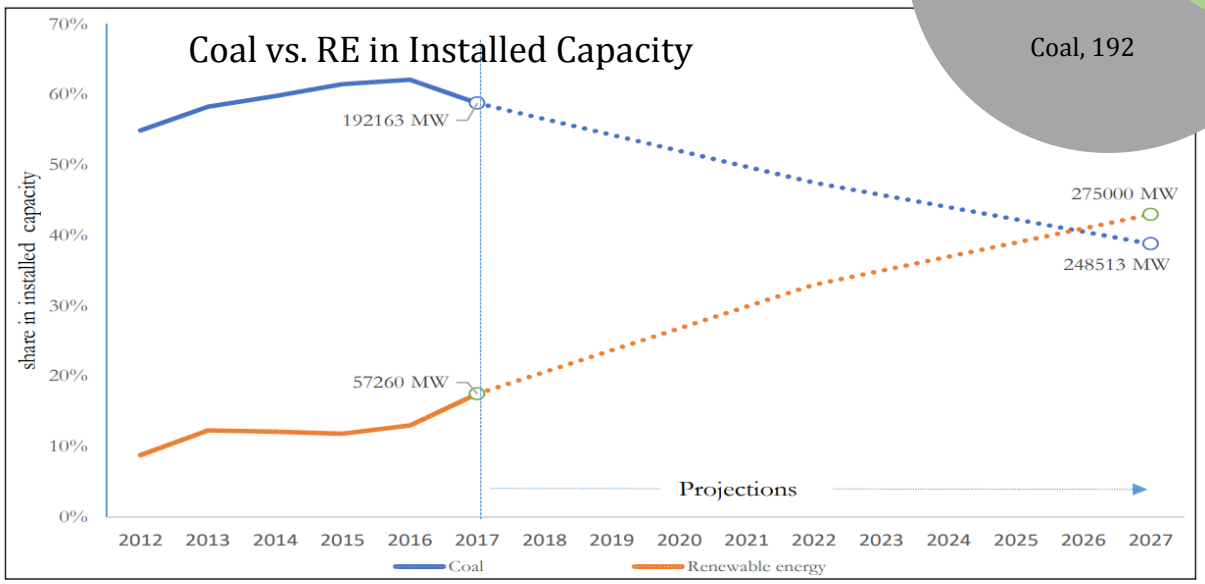
Ambition: 175 GW capacity by 2022

100-solar; 60-wind; 10-biomass; 5-small hydro

Installed Capacity (GW) : 2017



Data source: Economic Survey, 2017



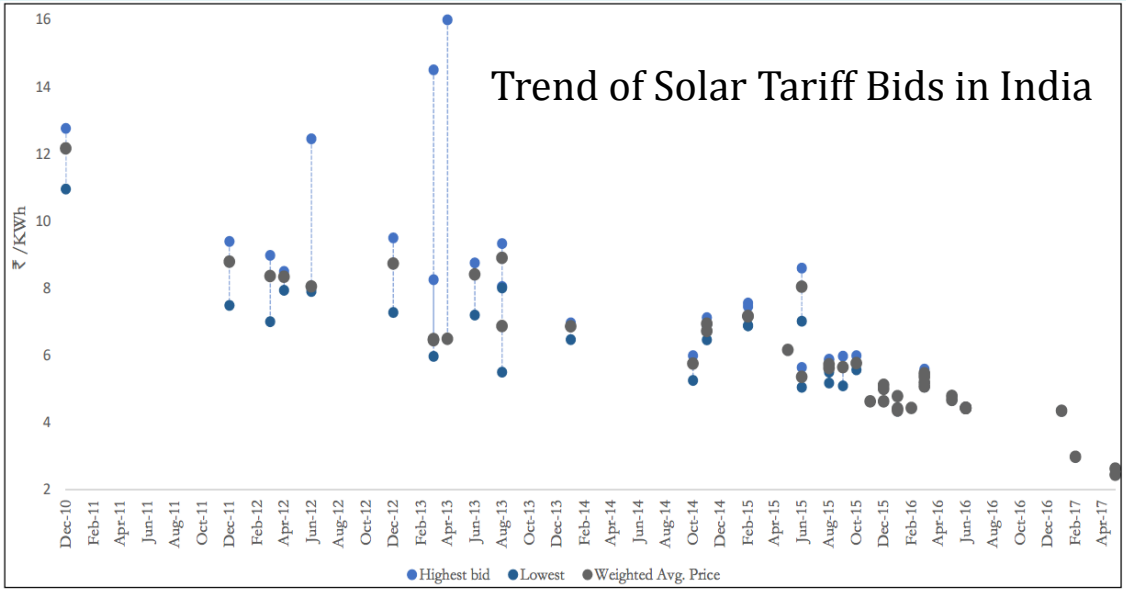
Source: **Historical installed capacities from CEA Monthly Reports for March, for years from 2013 to 2017 and projections for installed capacity for coal and renewables from CEA (2016).**

India's renewable energy program: recent performance

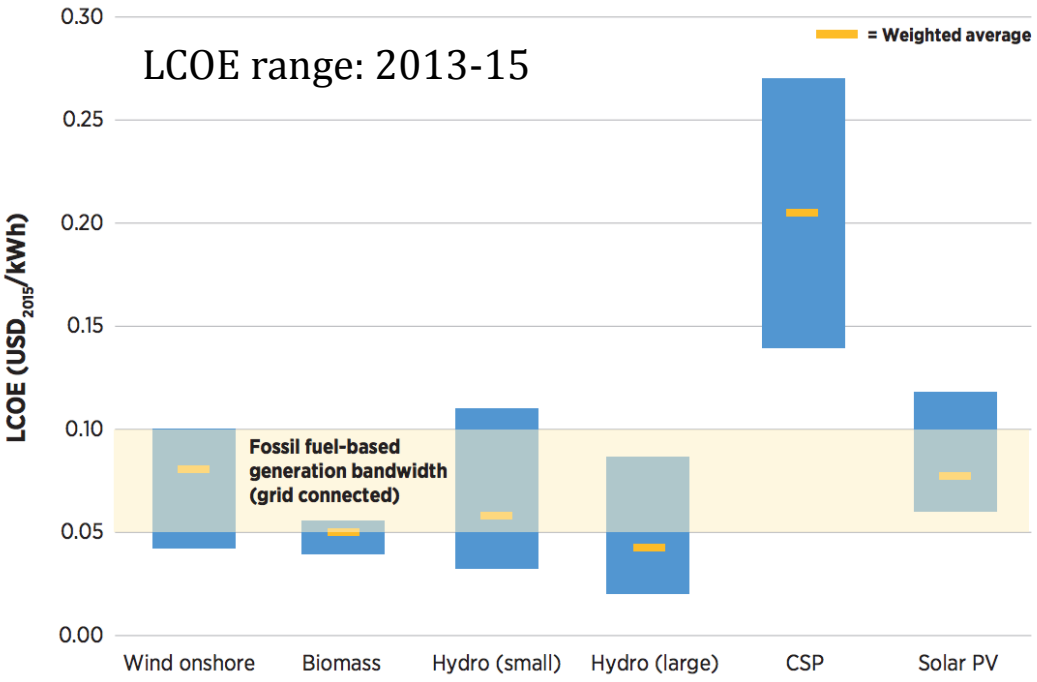
Category	Total installation (upto FY 2016)	Key incentives	Market size of investment (FY13-16)	Growth rate of annual installation (CAGR- FY13-16)	Estimated financing needs
Utility scale	42.7 GW	Solar: competitive auctions Wind etc.: feed-in tariffs (likely to be phased out for wind also), auctions; RPOs, fiscal incentives	$26 bn	15% (wind:12%; solar:59%)	$100 bn to reach 135GW target
Rooftop solar (1kw-1MW)	500 MW	Capital subsidy, net metering and feed-in-tariffs, competitive auctions, (for cluster of government buildings), high electricity tariffs for commercial /industry	$0.6 bn	92%	$48 bn to meet 40GW target
SEG (100W-50kW)	2.9 MW	Grants, subsidies, tax benefits	$27m	40%	
Solar home systems (<100w)	7.3m units	Grants, subsidies	$200m	47%	

Source: Compiled from "Financing India's clean energy transition", Bloomberg New Energy Finance, 2016; and other sources

Solar success story



Economic Survey, 2017, Government of India



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Several challenges ahead

- Mobilizing investment
  - Limited pool of capital (primarily bank debt) at comparatively high cost
- Coal based generation still most economical
  - High costs of balancing RE based power
  - Economic Survey, 2017: Social cost of renewables is around 3 times that of coal at Rs11/Kwh (largely due to stranded assets) though the gap reduces as we move towards 2030
- Storage solutions
  - Currently not economically viable; may raise environmental and energy security concerns of their own
- Regulatory uncertainties and delays
  - RPOs (around 10%), must-run
- Competing land uses
  - Long-term
- Subsidies to fossil fuels and financial health of utilities

Thank you