

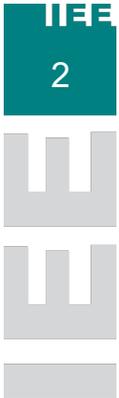
# Electricity Economics in India:

## LESSONS LEARNED FROM EUROPE

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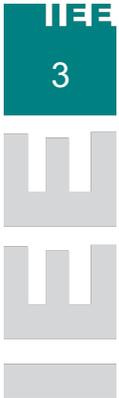
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# Objective and Motivation

- ***Objective:***

- Comparison of the Indian and European electricity sectors
- Check: Interdependency of the European and Indian electricity sector
- Solutions for the transition of Indian electricity sector

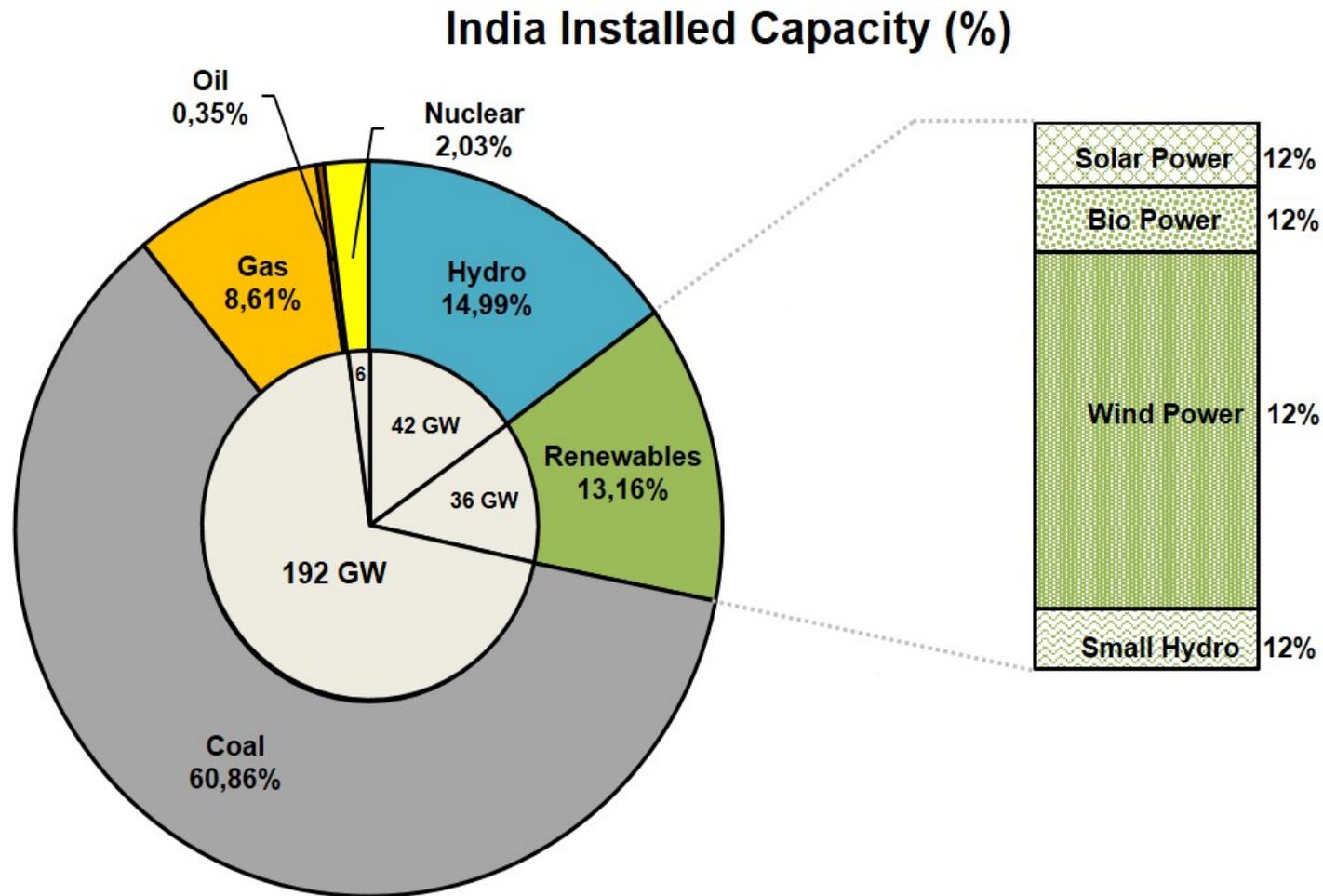
- ***Motivation:***

- European sector is in between an ‚Energiewende‘
- Indian sector beginning a radical transformation

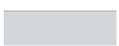
# The Indian Electricity sector

- India :
  - Geographical area = **3,3 million sq. Kms**
  - Population = **1,295 billion**, Dec 2014
  - Primary energy demand = **775 Mtoe** (2013, weo 15)
  - Electricity demand = **897 TWh**
  - Electricity demand growth rate = **6,9% p.a.** (2013-2030)
  
- Electricity sector:
  - Drastic changes in electricity sector
  - Coupling of economical development and energy use
  - ‚Make in India‘, 2014

# Installed generation capacity : India



Quelle: Ministry of Power, India

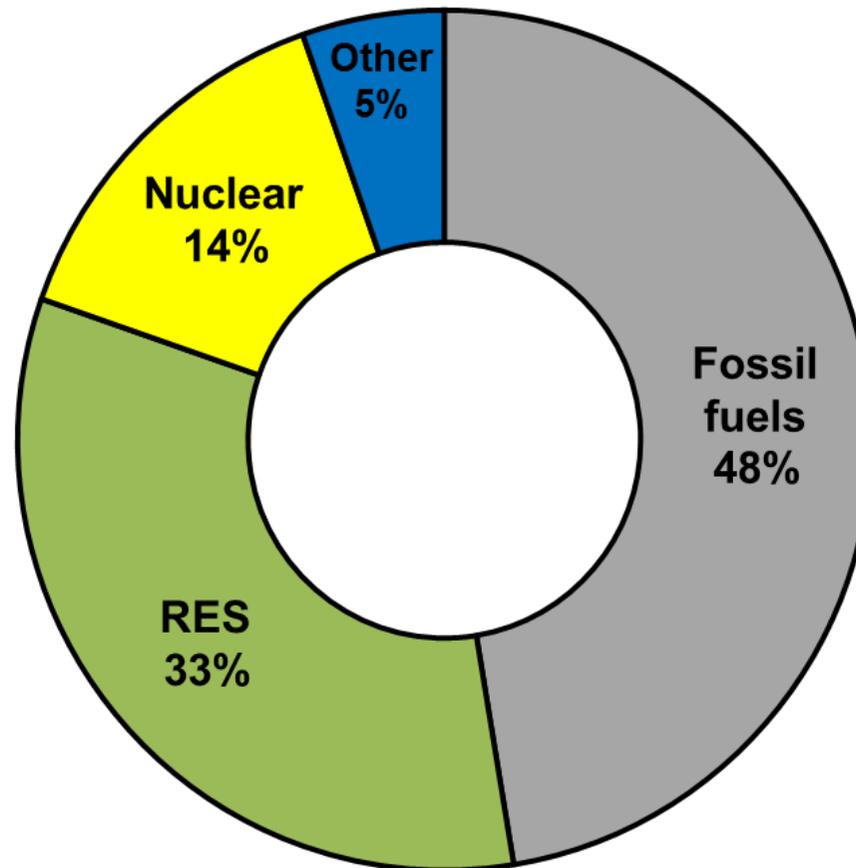


# The European electricity sector

- The EU 27
  - Geographical Area = **4 million sq. kms**
  - Population = **508,191 million**
  - Primary energy demand = **1624 Mtoe** (2013, weo 15)
  - Electricity demand = **2836 TWh**
- Electricity sector
  - After the Fukushima Daiichi nuclear accident: Green Transition
  - Esp. Germany: Solar PV and Wind
  - Possible shut down of majority of coal fired power plants

# Installed Generation Capacity : The EU

EU 27, Installed generation Capacity, 2012



# Challenges : Indian electricity transition



- High demand growth rate
- Huge dependency on coal
- Nuclear power
- CO<sub>2</sub> emissions
- Capital Investment
- Transmission and Distribution losses
- Large scale renewable energy
- Energy efficiency

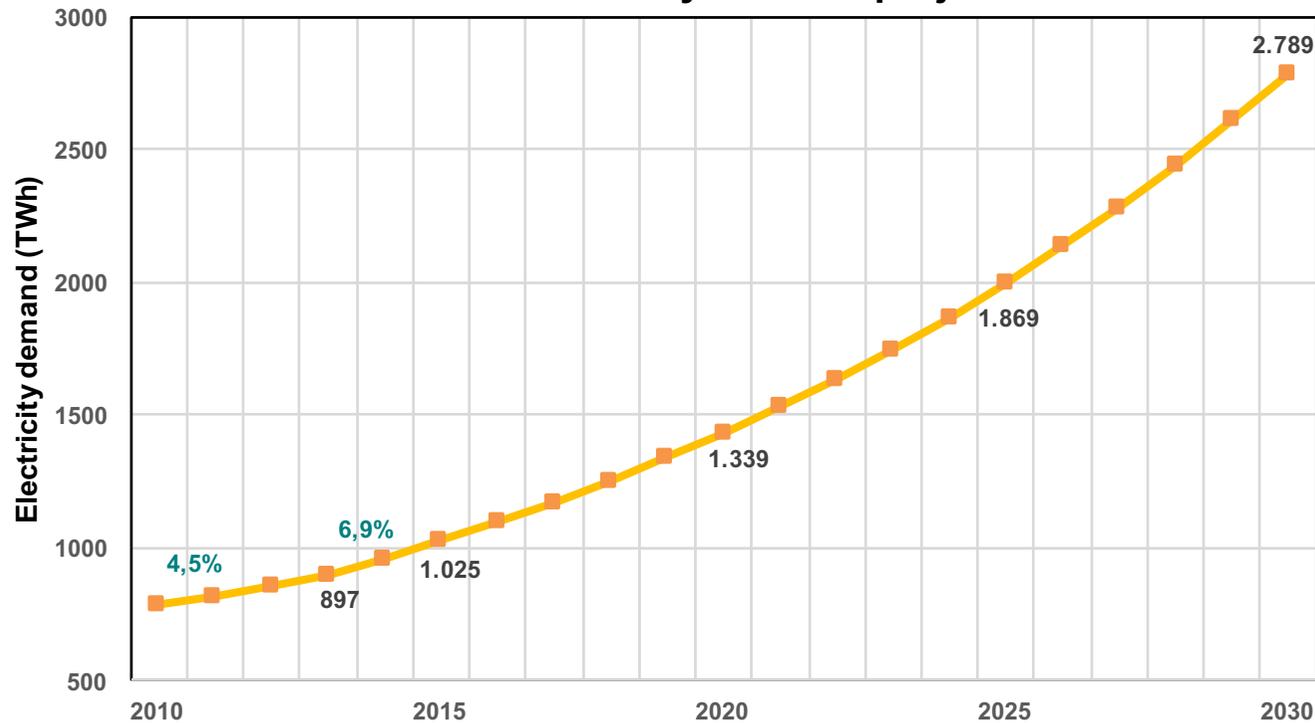
## Electricity demand growth rate



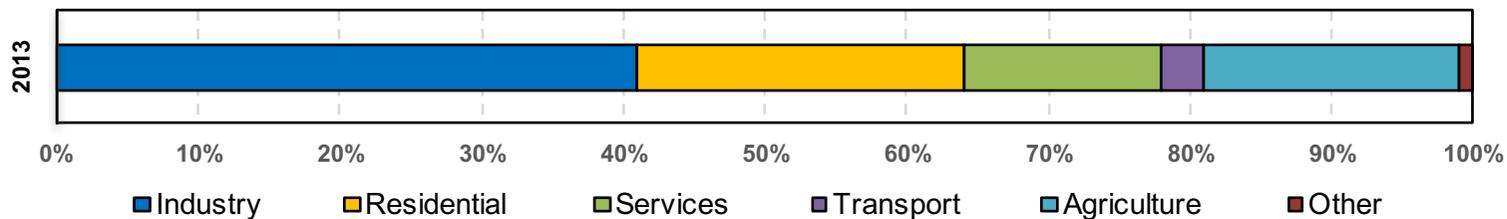
- Developing economy and population
- Economic reforms in 1990 : increase in demand
- (2013-2030): 6,9% annual growth rate
- ‚Make in India‘ initiative : expect higher demand rates
- Industrial demand : 42% of total demand
- Demand supply gap growing

# Electricity demand growth rate

India: Electricity demand projections



Electricity demand shares by sector

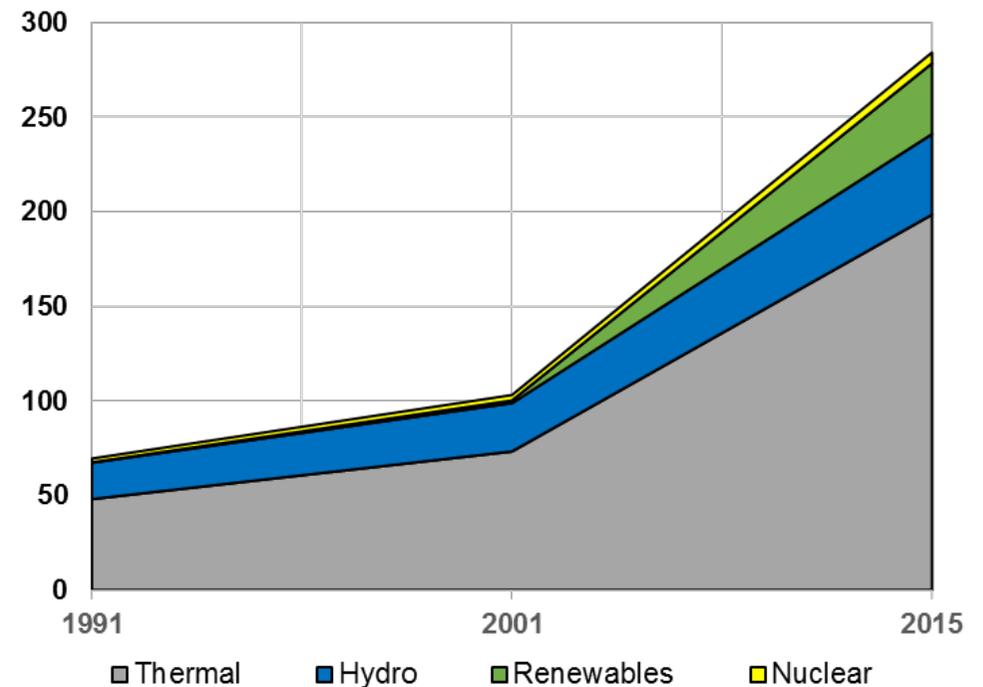


Quelle: WEO2015, IEA

## Dependency on coal

- 1990 – 2000 : Large capacities of coal fired power plants added
- Cheap availability of domestic and imported coal
- Coal fired capacity : 60,6%
- Major CO<sub>2</sub> emissions source
- Use of super critical and ultra supercritical boilers

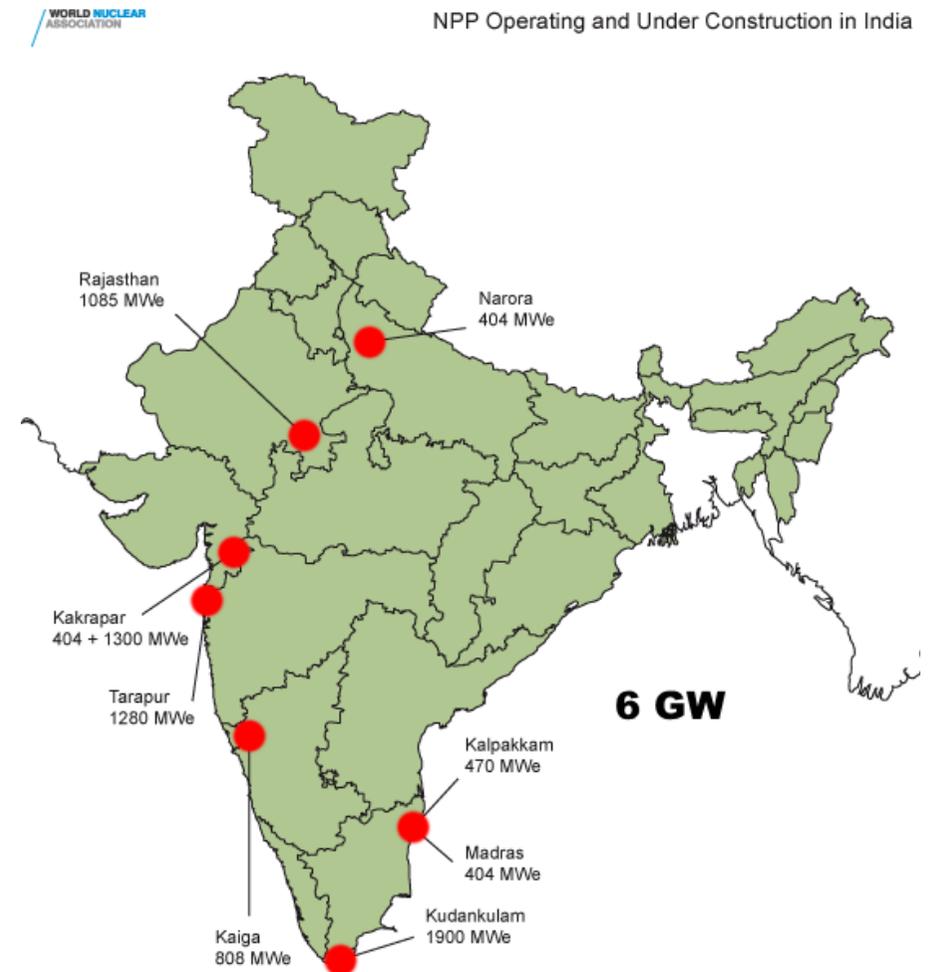
Capacity addition after the economic reforms of 1990



Quelle: Ministry of Power, India

# Nuclear Power

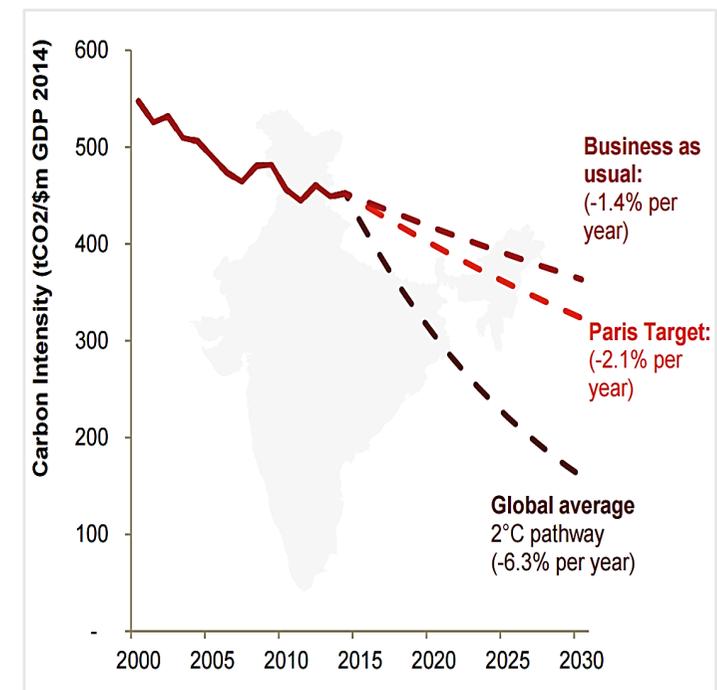
- Nuclear non-proliferation treaty: No participation
- Limited or no trade in tech or fuel: 34 years
- 6 GW capacity, 20 GW by 2020
- Nuclear co-operations: Canada, Russia, France and U.S.A
- Uranium and Thorium deposits



Quelle: World Nuclear Association

# CO2 emissions

- Third largest CO2 emitter
- Electricity sector: one of the major sources
- Economic development coupled with emissions
- Pressure from other countries : reduction
- Pollution in major cities: Already a problem
- Emission targets: depend on electricity sector



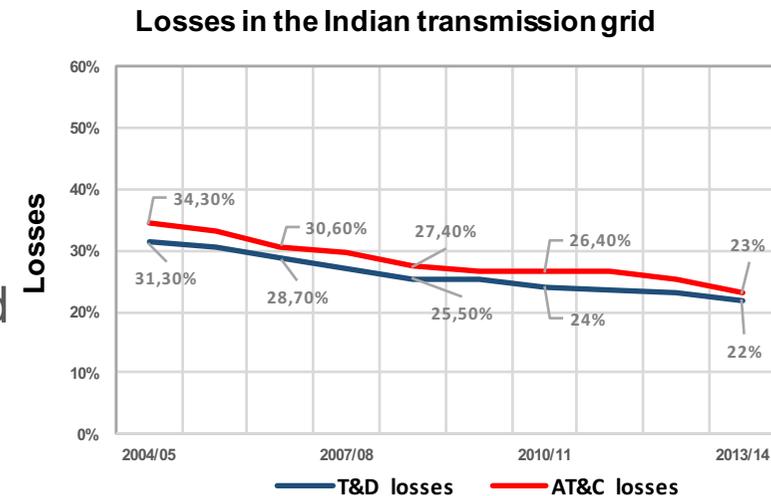
Quelle: PwC

## Capital investment

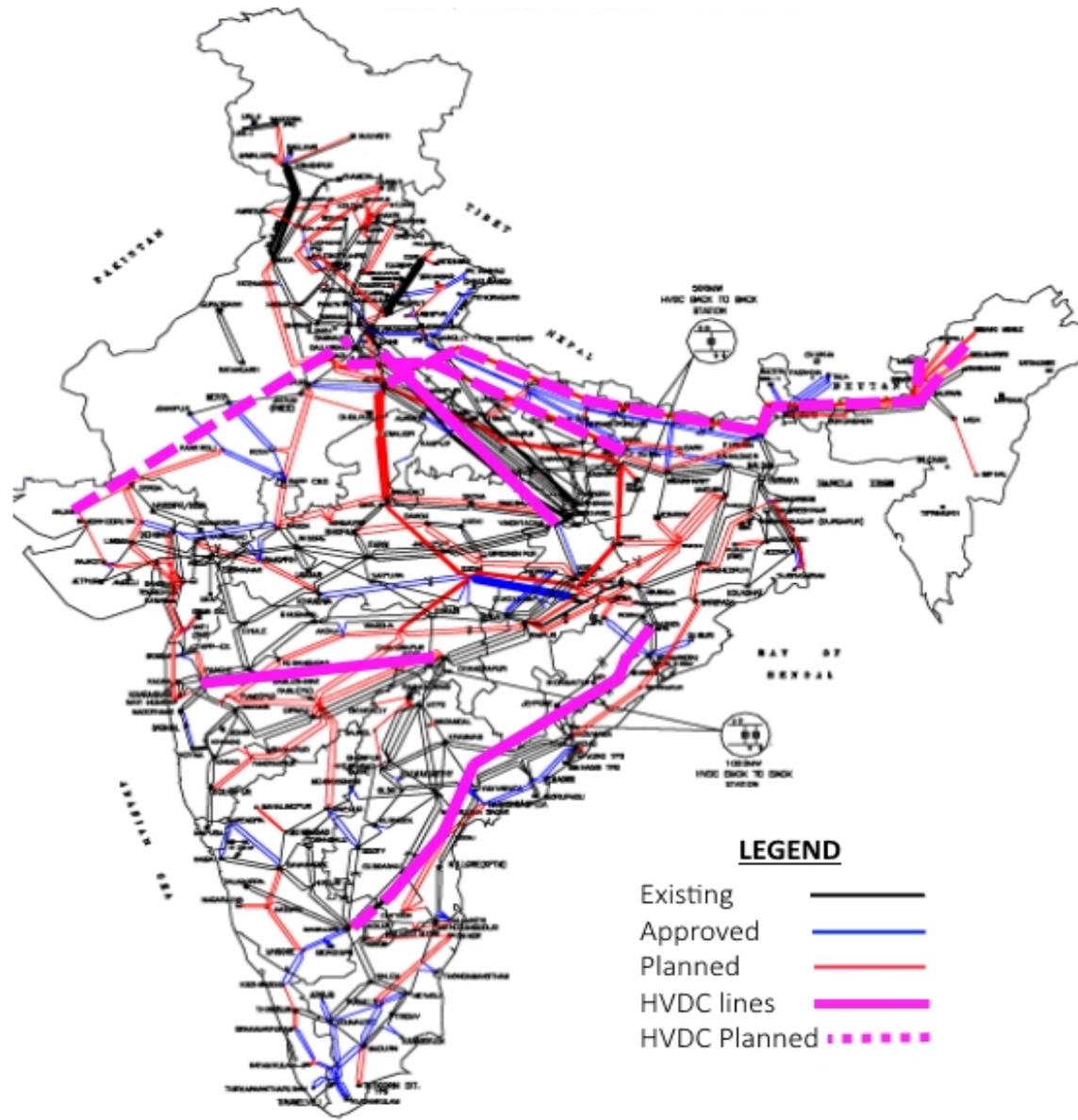
- Indian Power sector : majorly in debt
- Due to T&D and AT&C losses
- Major private utilities: Unable to repay loans
- With large scale renewable addition : stranded assets (coal power plants)
- Access to the global financial debt markets

# Transmission and Distribution losses

- Vast transmission network
- One nation- one grid- one frequency  
(2013/14)
- Energy access : 240 million people lack electricity access
- Large losses in T&D and AT&C : 22% and 23%
- Problem: for centralized generation
- State owned distribution utilities: inefficient



Quelle: PowerGrid, Ministry of Power, India



# Large Scale Renewable Energy

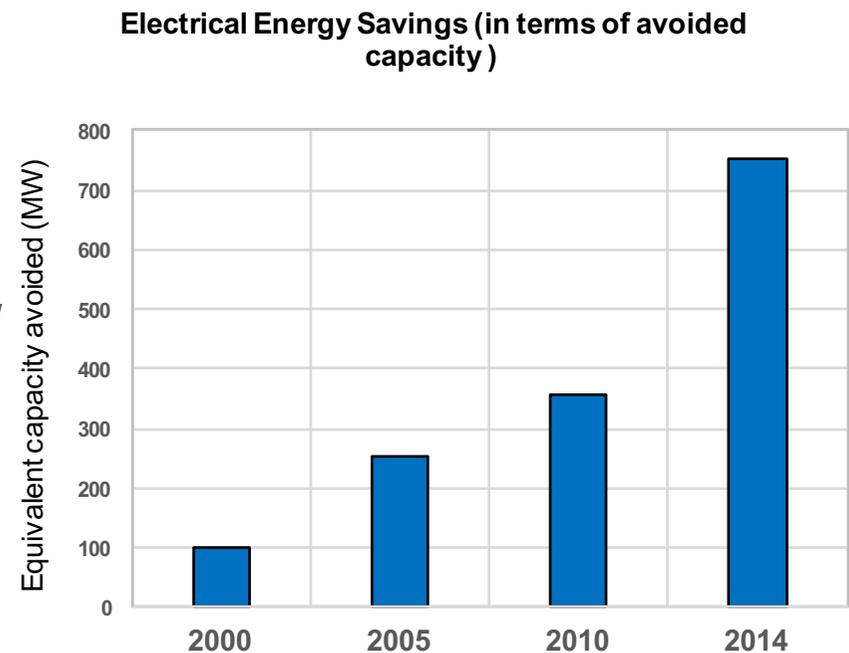


- Major influence : to curb emissions, reduce electricity prices
- Vast potential : wind and solar
- Target : 100 GW solar, 75 GW wind by 2022
- Wind power competitive with imported coal power
- Solar power: cheaper than power from imported coal (2019)
- Three sectors:
  - Utility scale
  - Distributed/ Rooftop PV
  - Offgrid



# Energy Efficiency

- Bureau for Energy Efficiency (BEE) : standards for efficiency
- Reduction of electricity demands
- LED bulb distribution for rural areas
- Energy conservation : Major goal
- 2014, Electrical energy savings: 751MW



Quelle: Ministry of Power, India

# 7-point checklist as solution

From comparison :

**i. Promotion of Energy efficiency for reduction in demand:**

Efficiency directives and enforced norms like in the EU

**ii. Implementation of ,clean‘ coal based generation and aggressive nuclear power expansion:**

Difficult task for a single country to finance all areas in the sector

**iii. Norms for energy related emissions:**

Adhere to the emission goals and enforce emission norms for the industry

# 7-point checklist as solution



## **iv. Promotion of Private sector participation:**

Renewables and nuclear power, improved financial footing of the power sector

## **v. Upgrade of Transmission and Distribution:**

No existing and possible inter-regional problems (like in the EU)

## **vi. Gradual deployment of solar energy capacities:**

To avoid stranded coal fired assets (E.ON and RWE in the EU) and promotion of solar energy

## **vii. Promotion of energy efficient urbanization**

# Possible benefits to European sector

- India's unique situation: economic development with increasing electricity demand while managing emissions growth and energy security
- An extreme - case energy scenario for the future
- Indian electricity sector: market for clean energy technologies
- Interdependency: Manufacture of Solar PV panels in India, could effect the European PV sector immensely

# Conclusion

- India needs to diversify its electricity generation
- Rapid expansion of nuclear capacity (with strict safety standards)
- India needs to capitalize on the large solar potential
- To support the renewable integration, the transmission network must be expanded and upgraded
- Energy efficient urbanization and demand side management: reduction of the electricity demand.

# Danke für Ihre Aufmerksamkeit!

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