

# ENERGY SCENARIO

# What is Energy

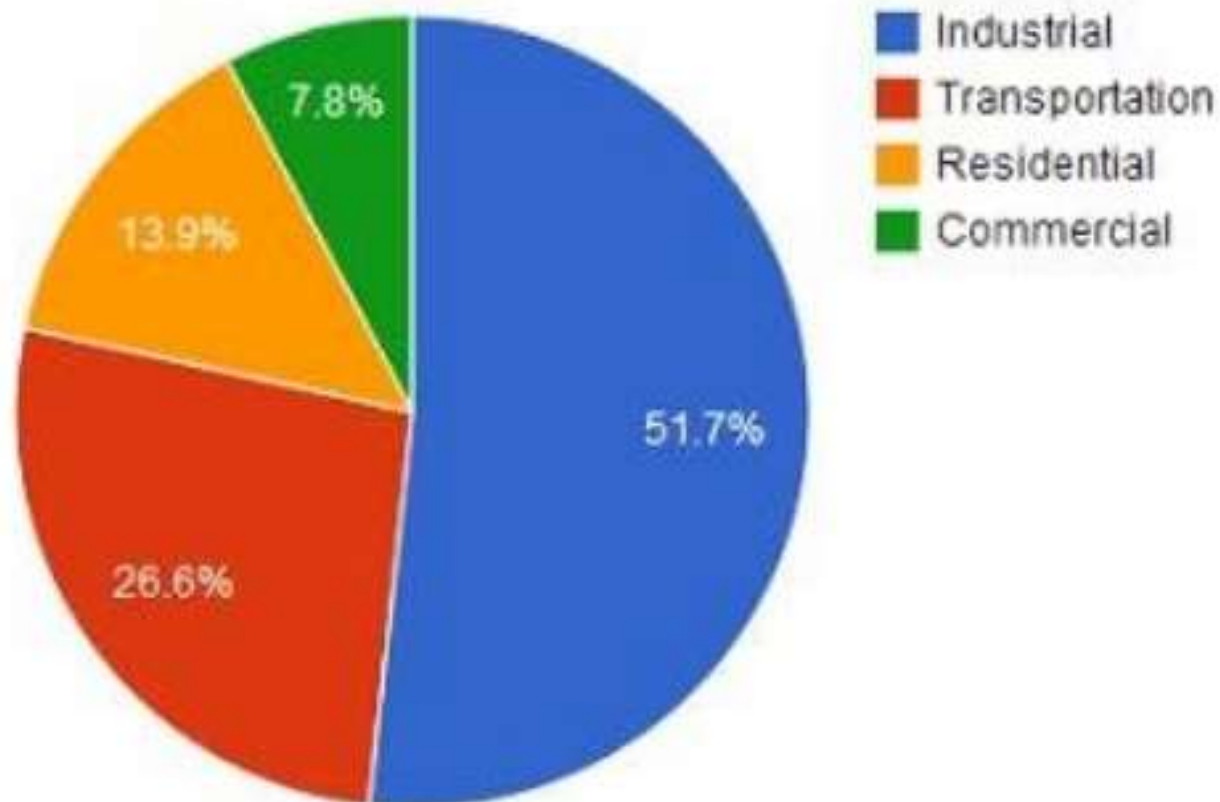
# Energy applications

- Household
- Commercial buildings
- Industry
- Agriculture

# Energy consuming sectors

- Industrial sector
- Mining sector
- Residential sector
- Transportation sector
- Agriculture sector
- Construction sector
- Commercial sector

## World Energy Consumption by Sector, 2012 (EIA Data)



The world energy consumption by economic sectors in 2012. The industrial sector comes first (factories, workshops, etc) was over 50%. Global transportation sector comes second with 26% (light duty vehicles, trucks, buses, aviation, trains, marine vessels, etc). International Energy Agency [<http://www.iea.org/statistics/statisticssearch/>].

# Forms of Energy

- Thermal energy-eg. IC Engines
- Chemical energy- Biomass bioenergy
- Electrical energy-commonly used
- Mechanical energy-used in transportation, agriculture

# Forms of Energy

## HIGH GRADE ENERGY

- Energy that can be completely transformed into work without any loss i.e. fully utilizable.

- Examples of high grade energy are:

1. Mechanical work
2. Electrical work
3. Water Power
4. Wind Power
5. Tidal Power

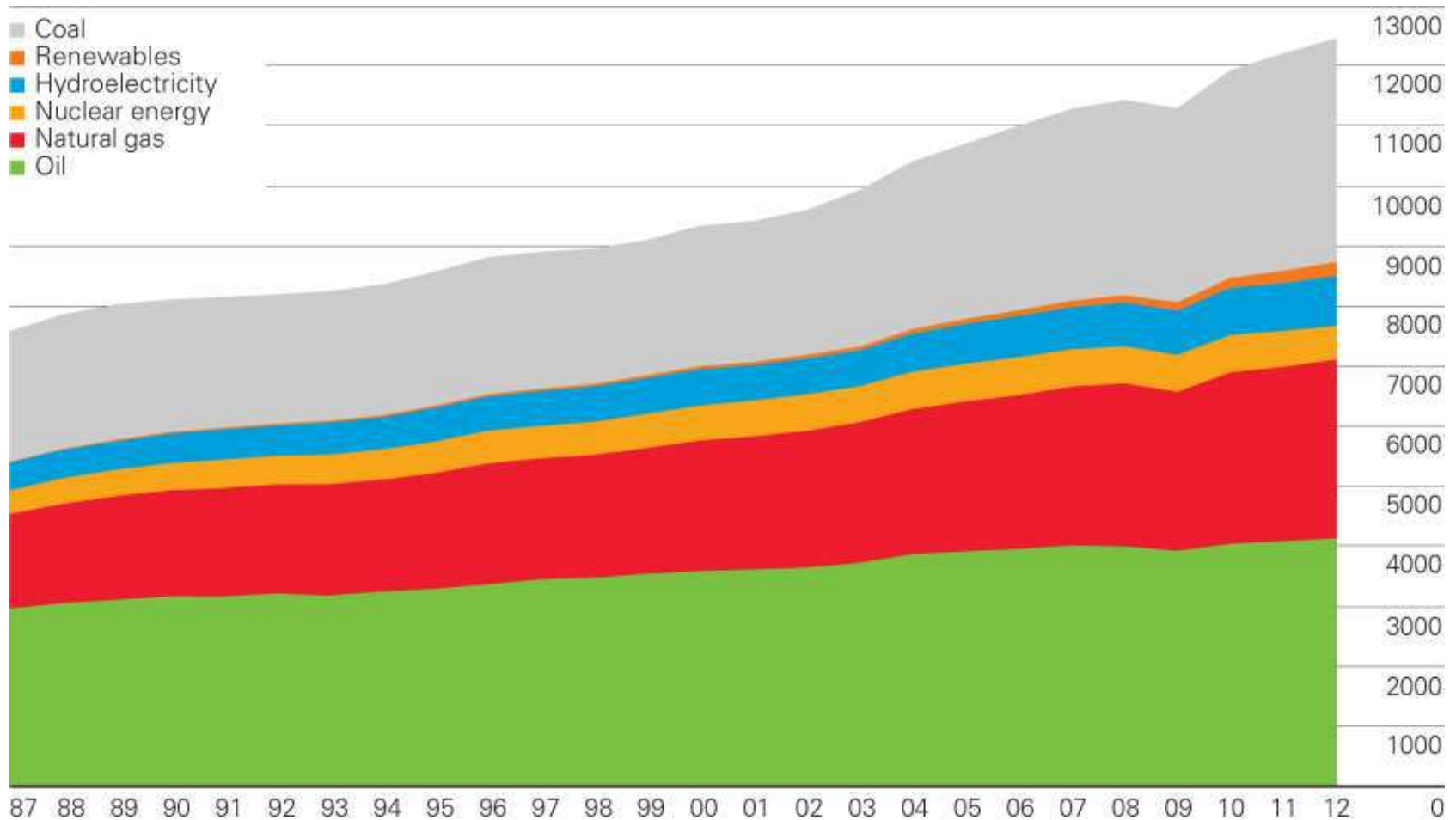
## LOW GRADE ENERGY

- Energy of which only a certain portion can be converted into mechanical work is called low grade energy.

- Examples of Low grade energy are:

1. Heat or Thermal Energy
2. Heat derived from combustion of fossil fuels
3. Heat derived from nuclear fission or fusion.

# Progress of energy use (World scenario)



Primary Energy World Consumption (courtesy British Petroleum 2013)  
(Million tonnes oil equivalent)



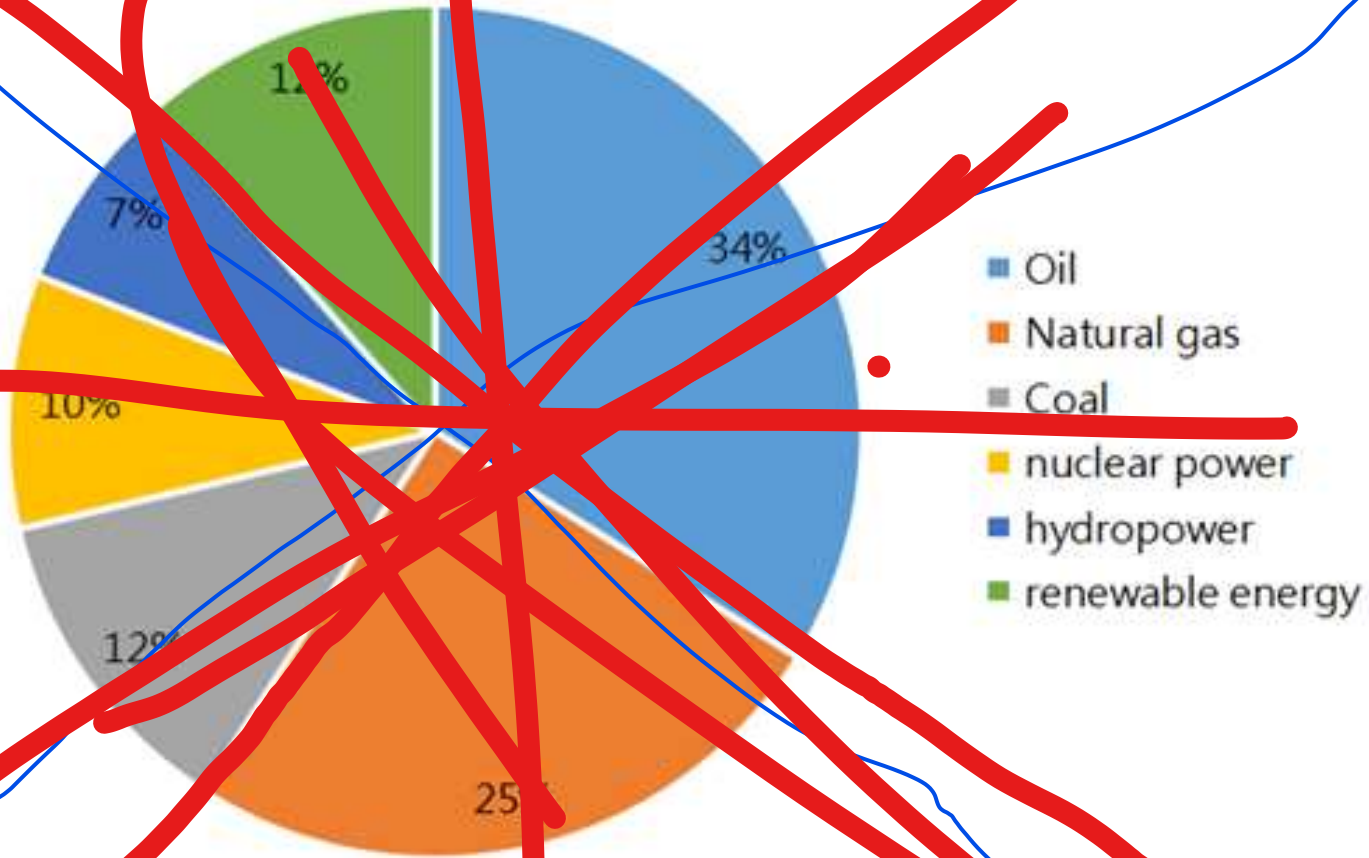
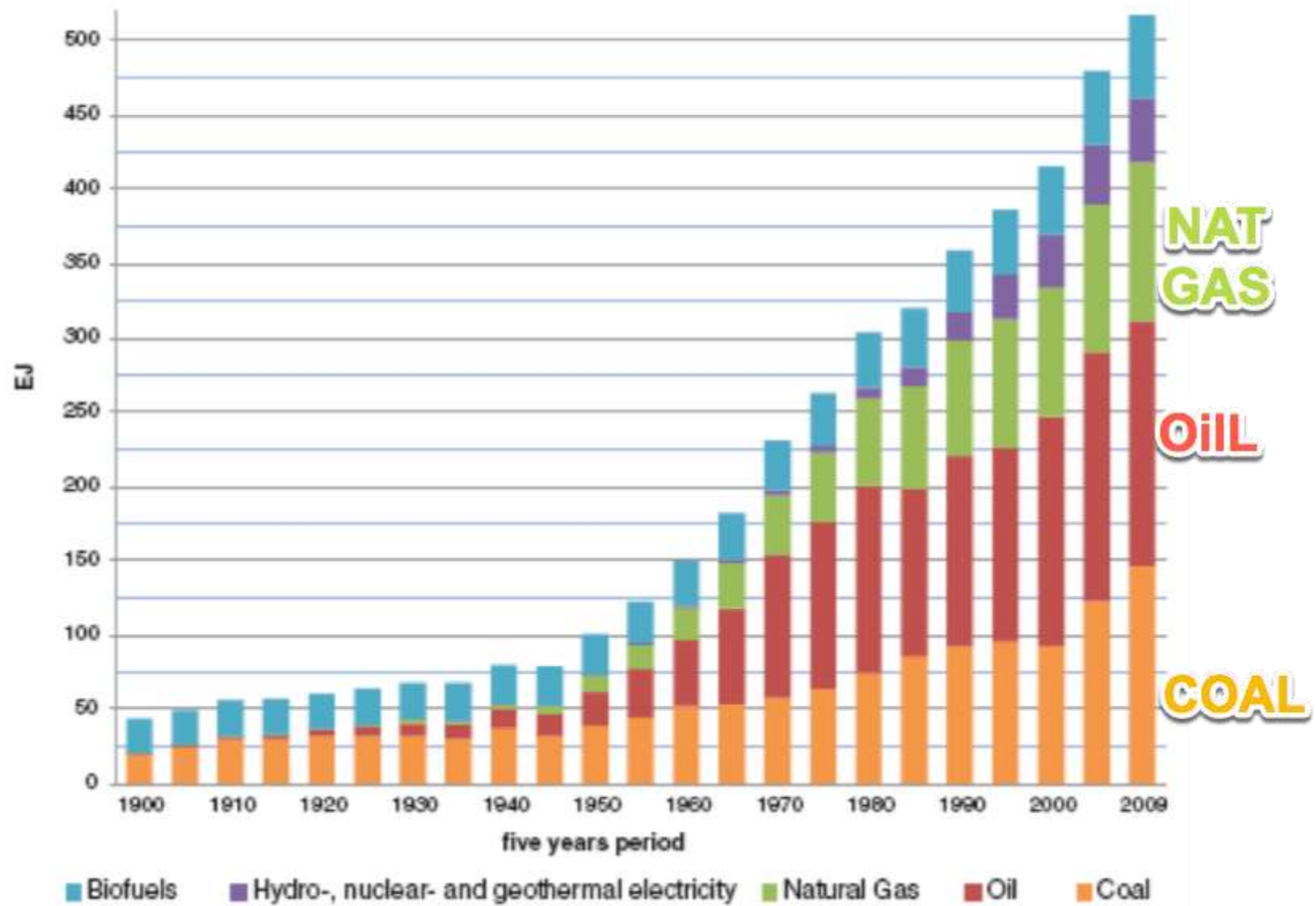


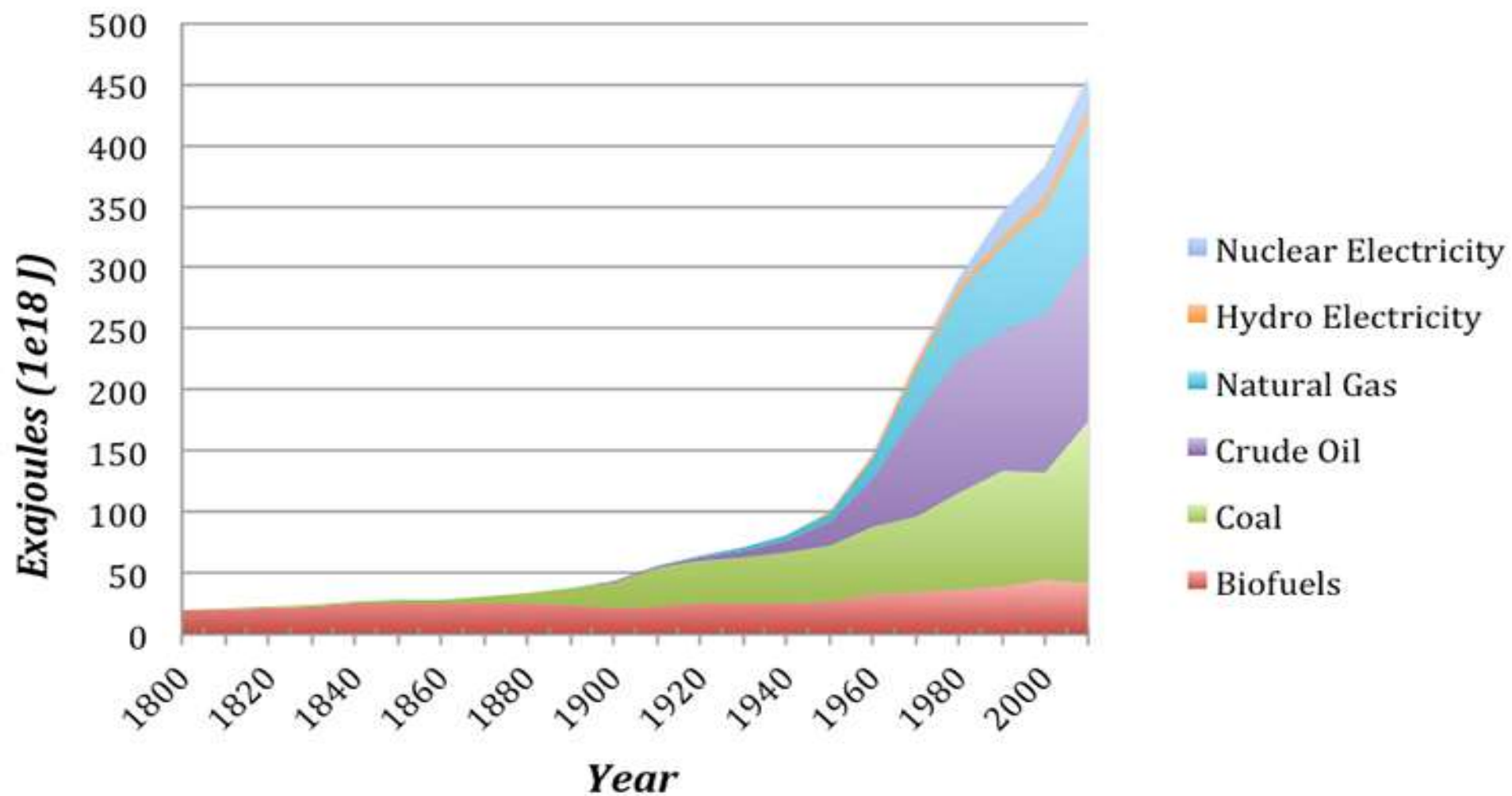
Figure : Energy Consumption Structure of Europe in 2020  
Source: [Energy Trend, 2022](#)

The exajoule (EJ) is equal to one quintillion ( $10^{18}$ ) joules.

**Figure 3.1.4.1**  
The world's total primary energy supply for 1900–2009



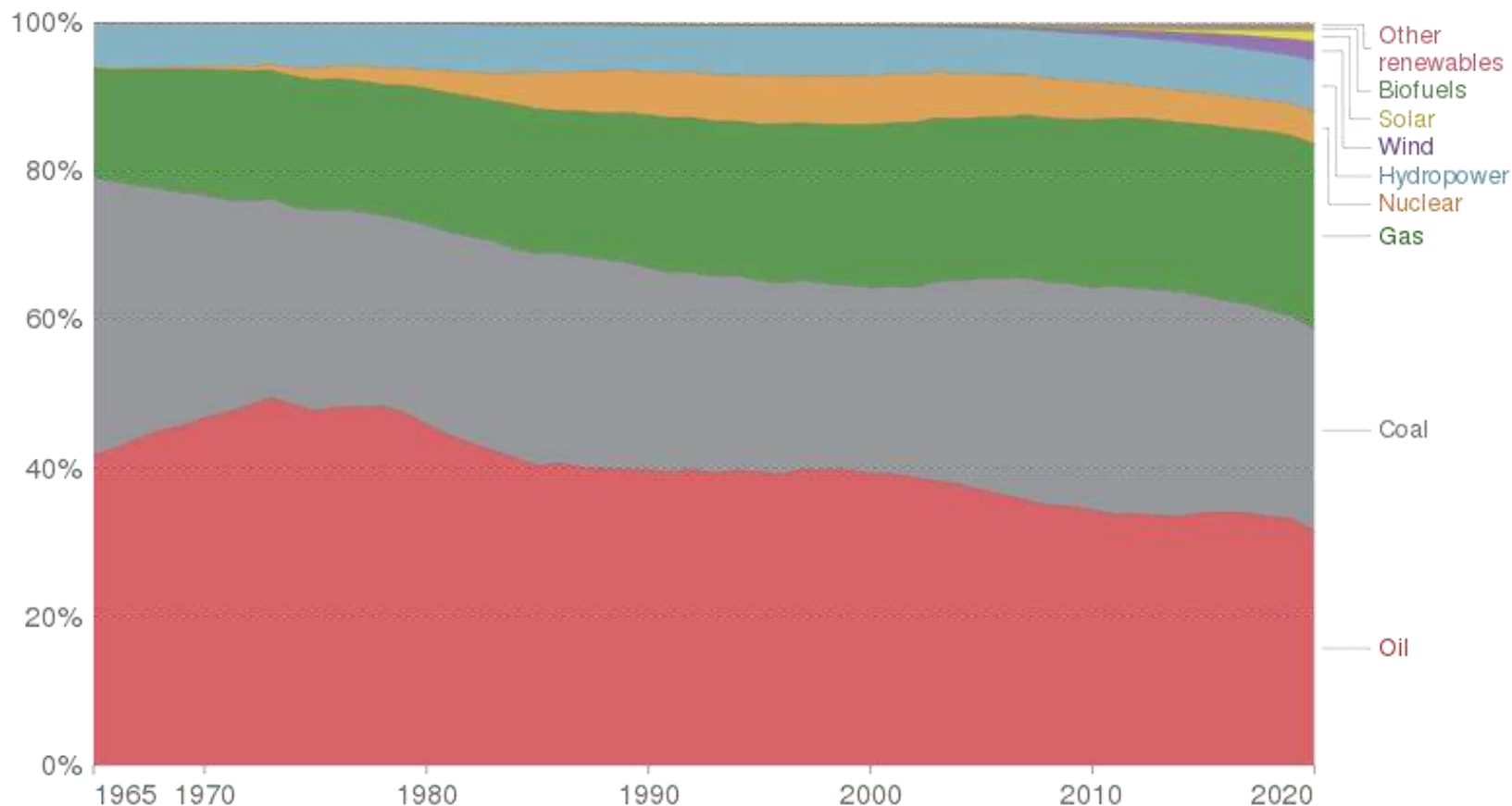
## *History of Global Energy Consumption*



# Energy consumption by source, World



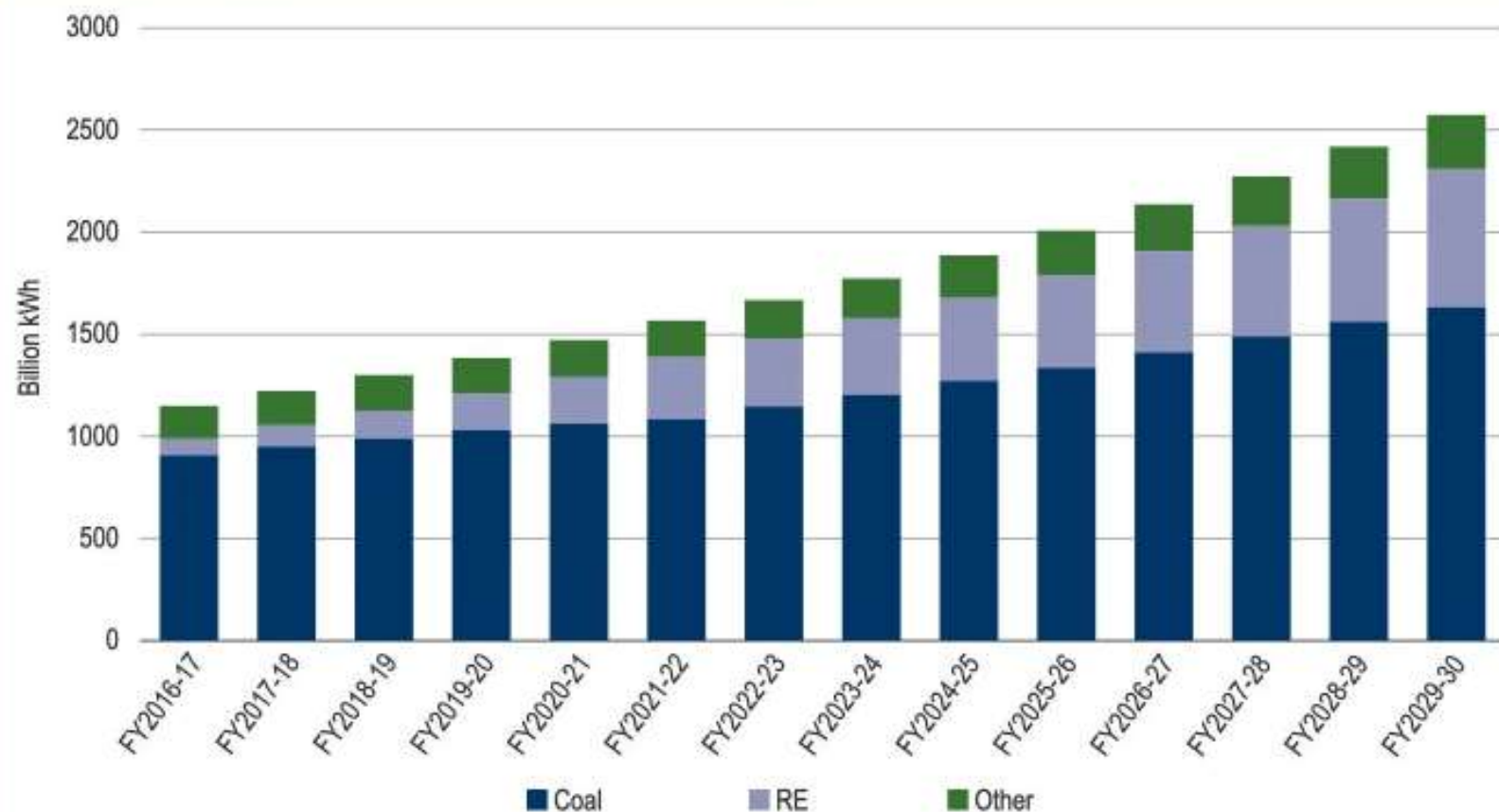
Primary energy consumption is measured in terawatt-hours (TWh). Here an inefficiency factor (the 'substitution' method) has been applied for fossil fuels, meaning the shares by each energy source give a better approximation of final energy consumption.



Source: BP Statistical Review of World Energy

Note: 'Other renewables' includes geothermal, biomass and waste energy.

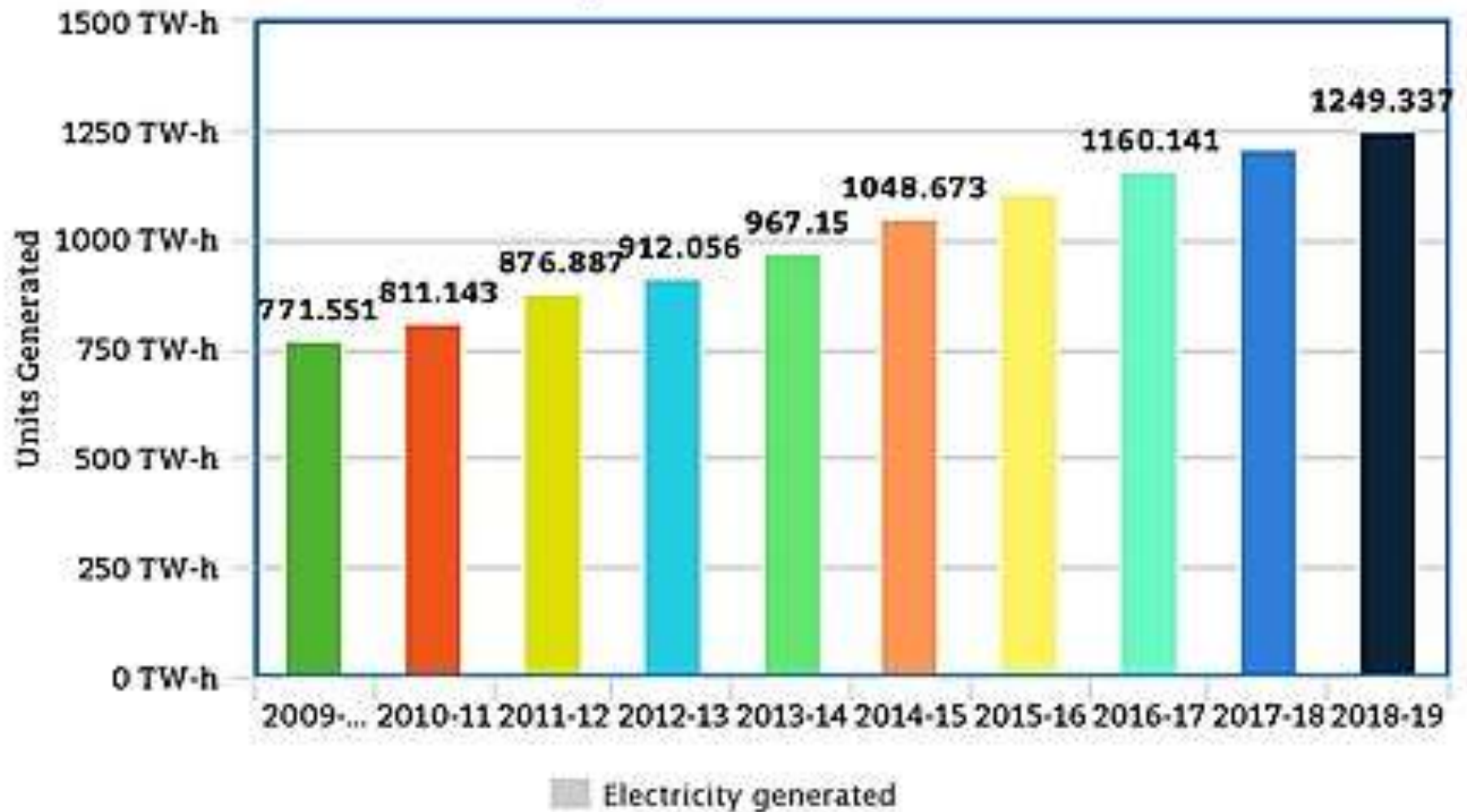
Figure 11: Projected end-use electricity generation in India, by technology



Details of assumptions for the 2030 projection are given in the appendix. The calculation of aggregate electricity demand in 2030 comes from a study by Sahli Ali<sup>35</sup> at Brookings India.

## Electricity Generation (Conventional Sources) Year Wise

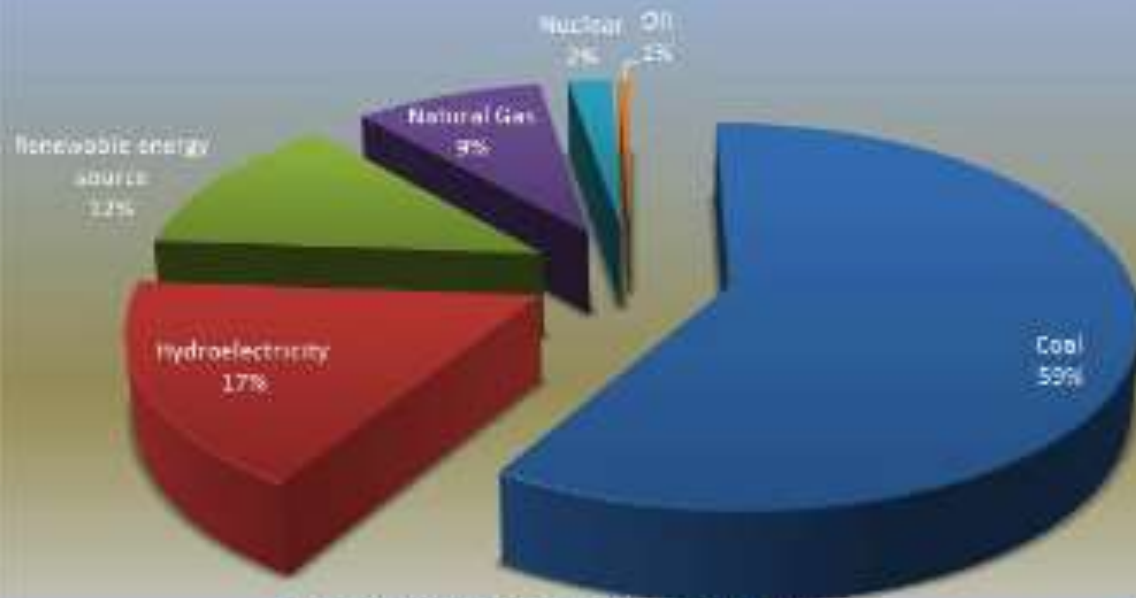
powermin.nic.in



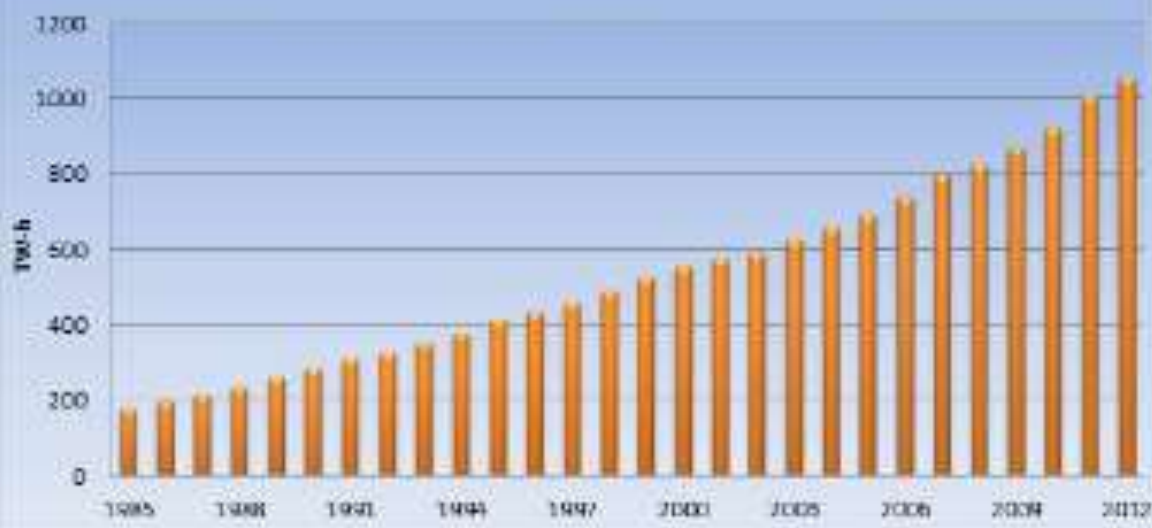
1 TWh = 1,000 GWh = 1,000,000 MWh = 1,000,000 000 kWh;



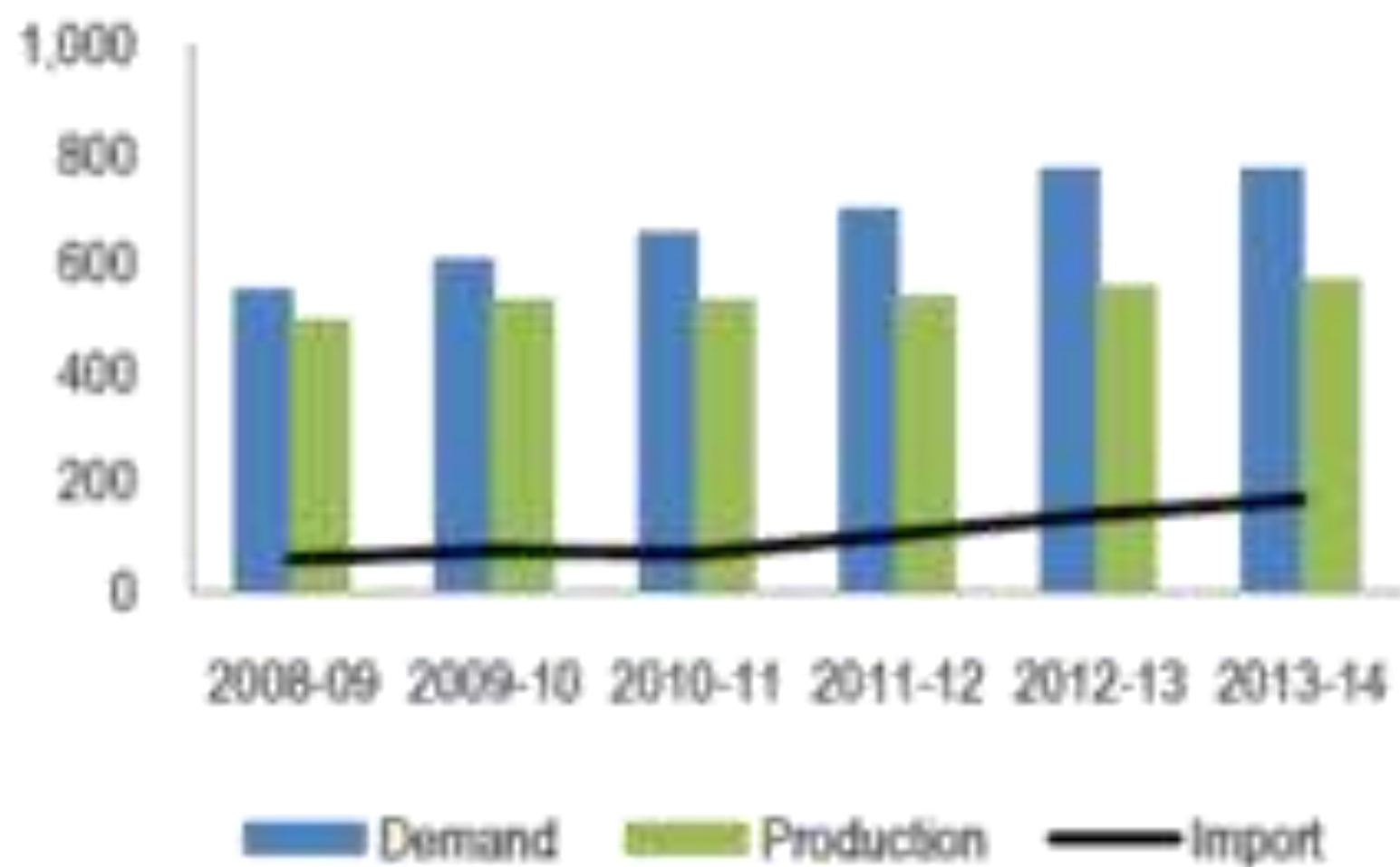
# Sources of electricity in India by Installed Capacity



## Electricity Production in India

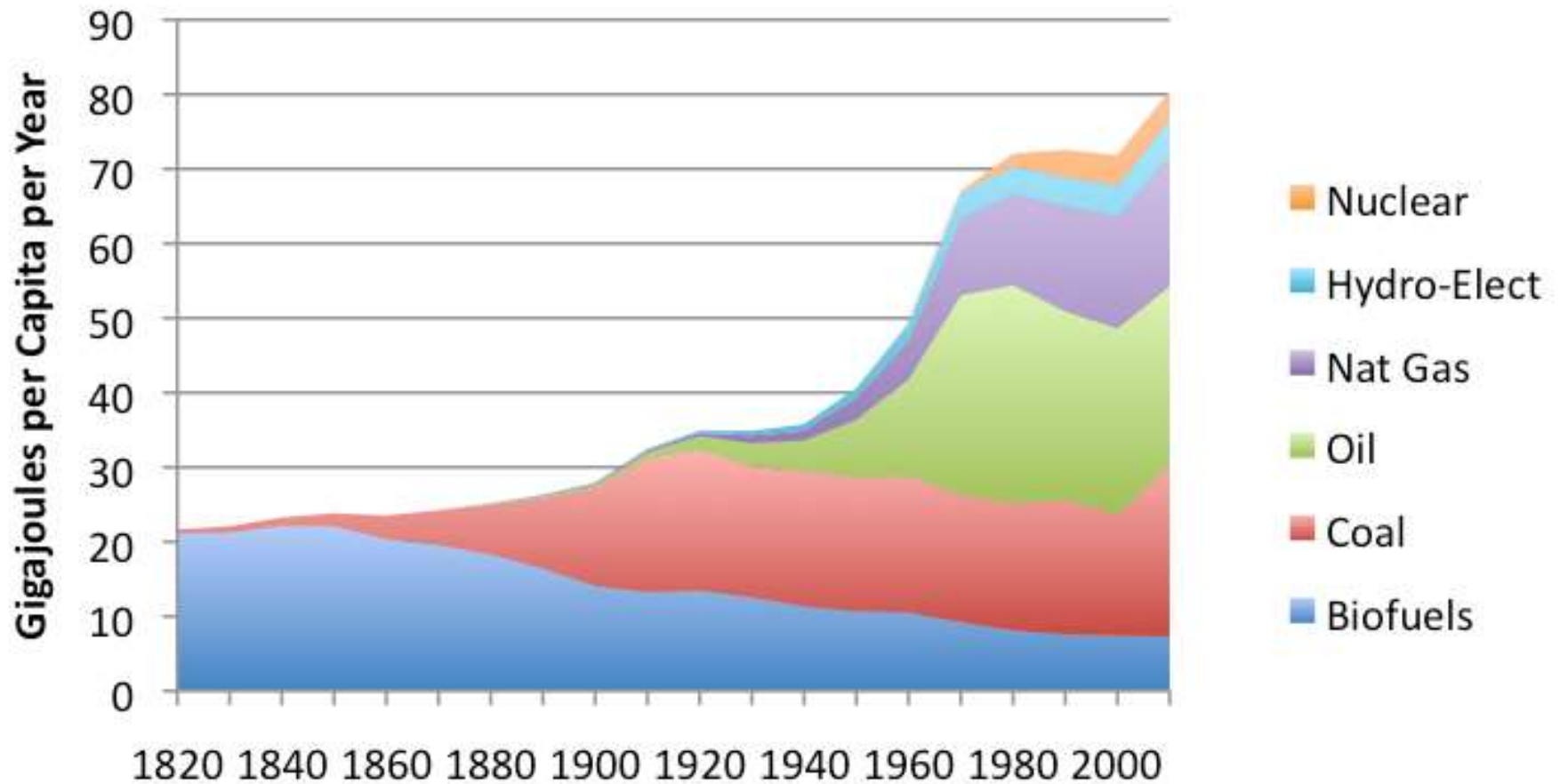


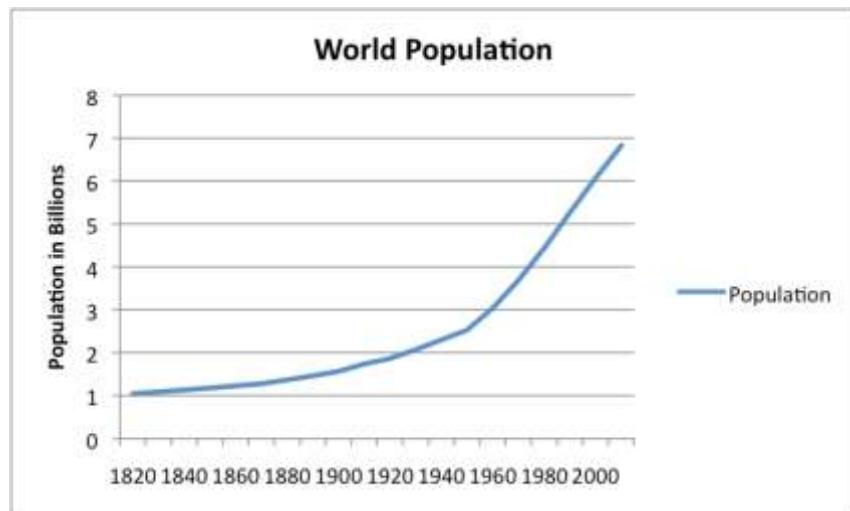
Demand, production and import of coal (in million tonnes)





## World per Capita Energy Consumption





World Population	Year
1 billion	1804
2 billion	1927
3 billion	1959
4 billion	1974
5 billion	1987
6 billion	1998
7 billion	2011
8 billion	2022

### When will India have more people than China?



*Source: United Nations Population Fund*

# Energy crisis

- India's energy system cannot keep up with the country's rising electrical consumption. It frequently experiences power outages and blackouts that can last for hours or days.
- Solar, hydropower, wind, geothermal, and biomass energy can be used to solve the world's energy crisis.
- **Causes of energy crisis**



## World Energy scenario

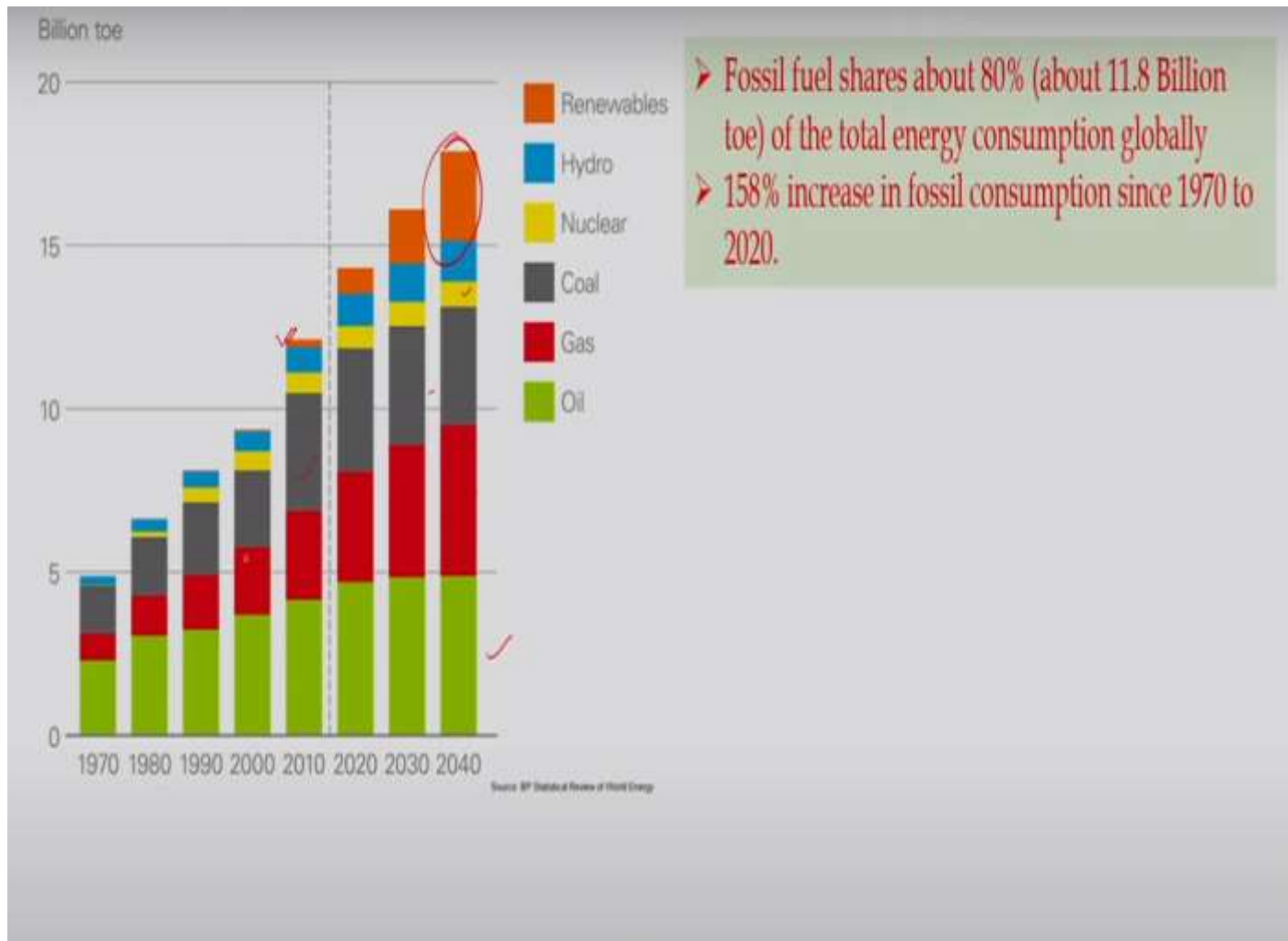
Breakdown by country (Mtoe) World - 2018



- World energy consumption 13.5 Btoe
- Energy consumption of China is about 3164 Mtoe in the year 2018 ✓

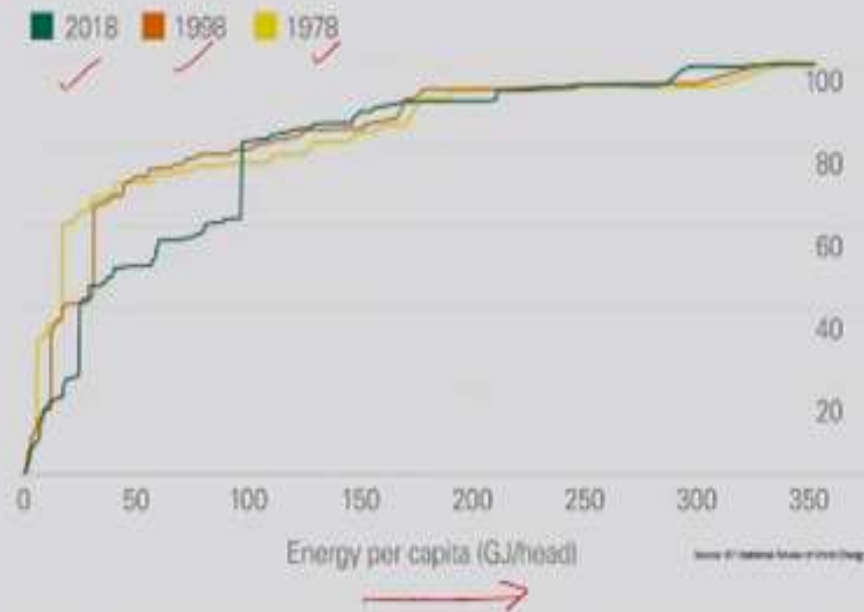
Followed by US and India 2258 and 929 Mtoe respectively

Millions of tonnes of oil equivalent (Mtoe)



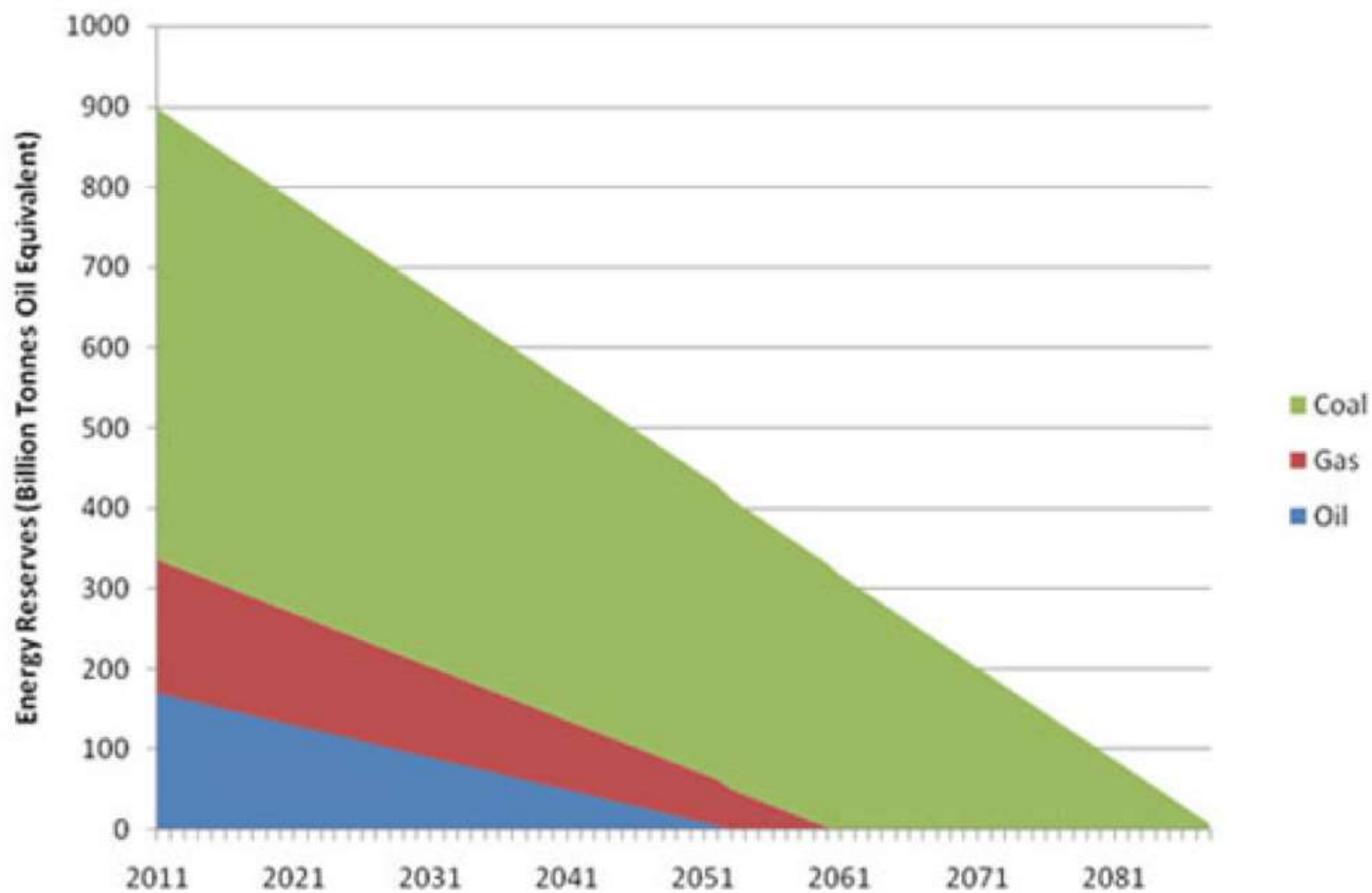
World energy scenario

## World Energy scenario



- In 2018, about 81% of global population consumed less than 100 GJ energy per head.
- Average energy demand per capita in China increased from 17 GJ/head in 1978 to 97 GJ/head in 2018.



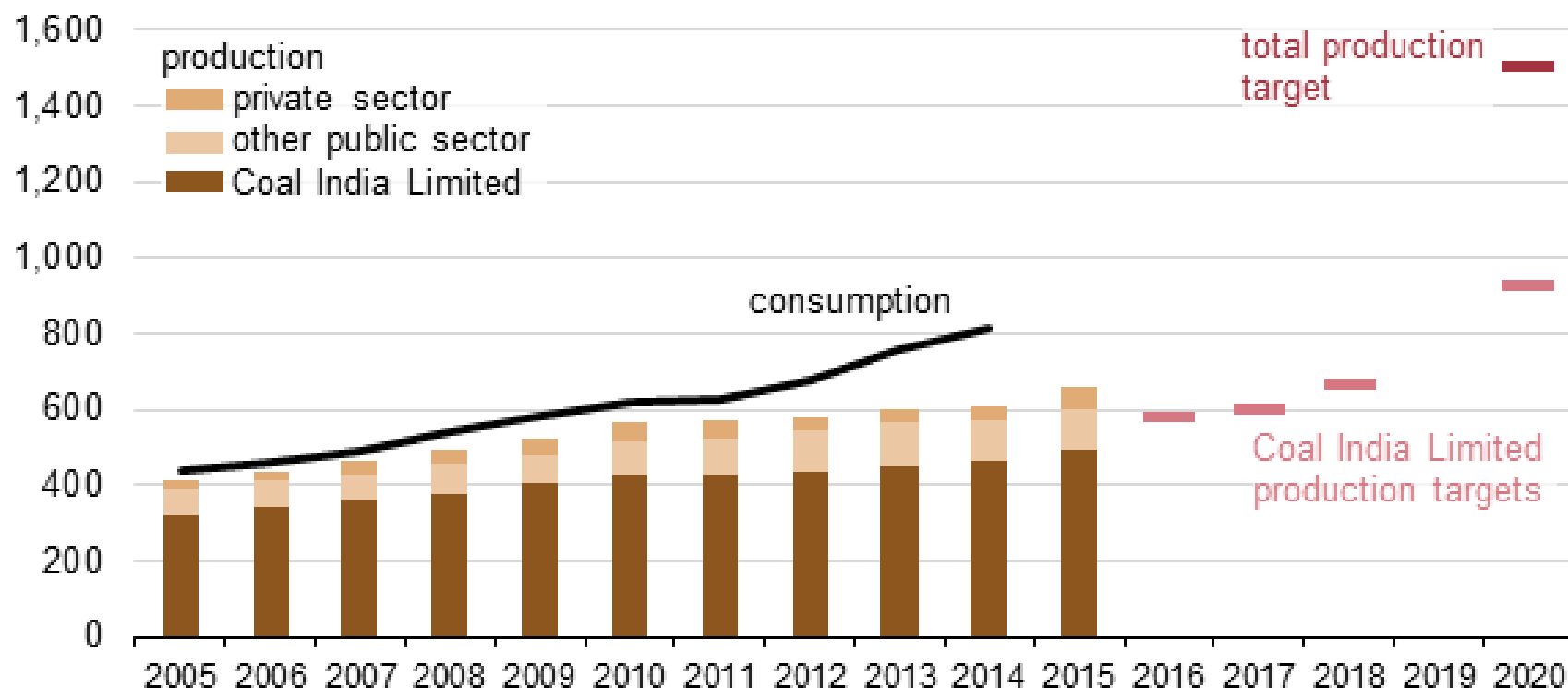




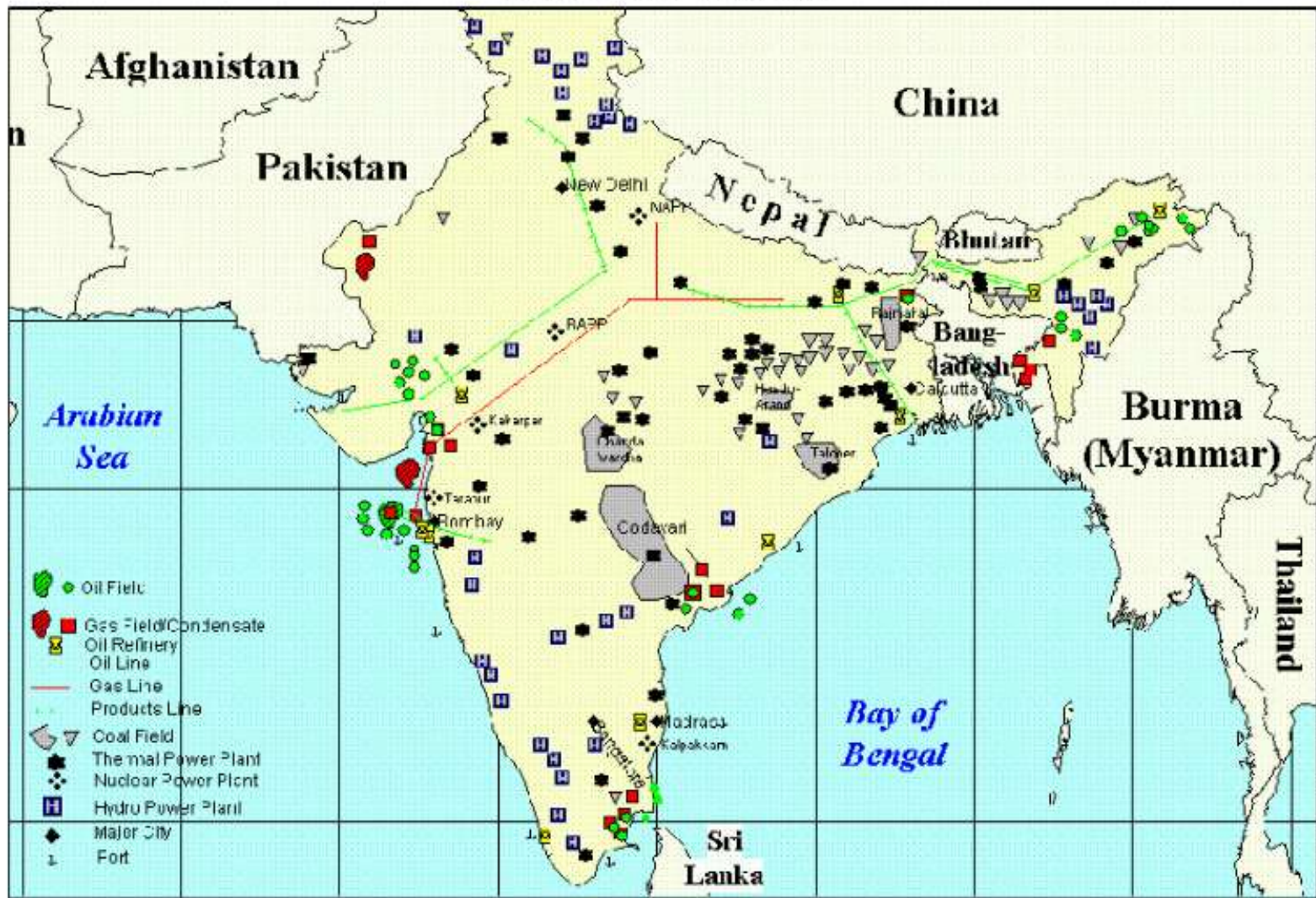
# India's domestic coal consumption, production, and production targets (FY2005-20)



million metric tons

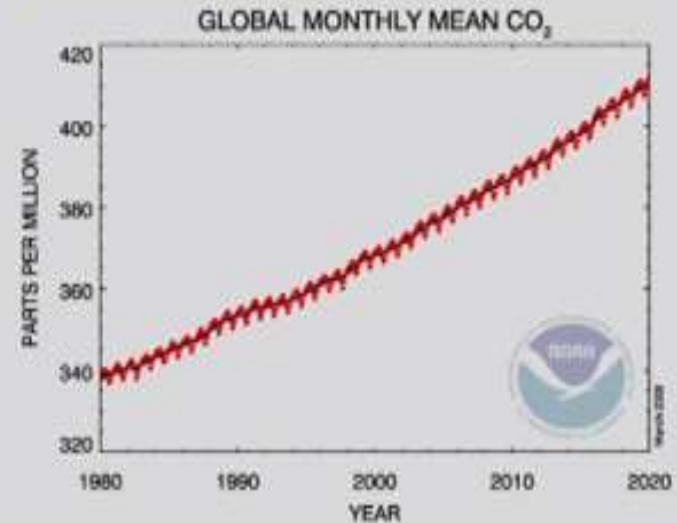
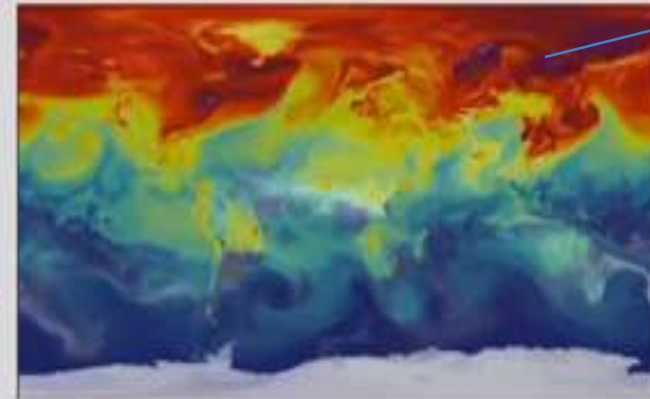
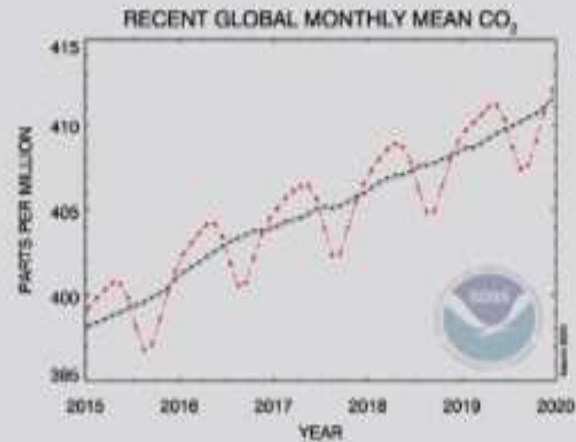


# ENERGY MAP OF INDIA



Distribution% of Natural Gas Reserves - as of 31st March 2011

## Effect of fossil based fuels

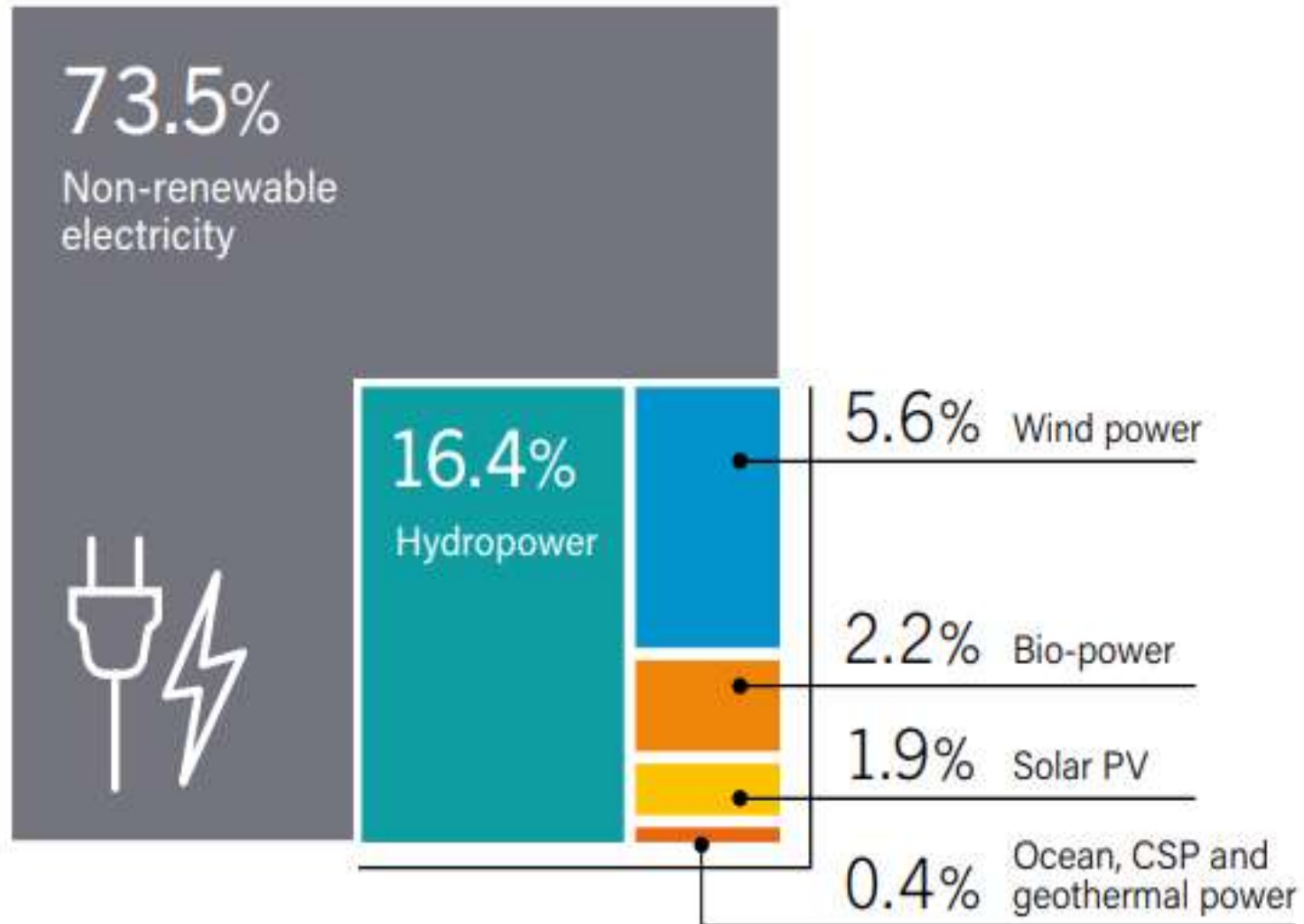


CO<sub>2</sub> emission is estimated to be 32 Gigatonnes in the year 2017

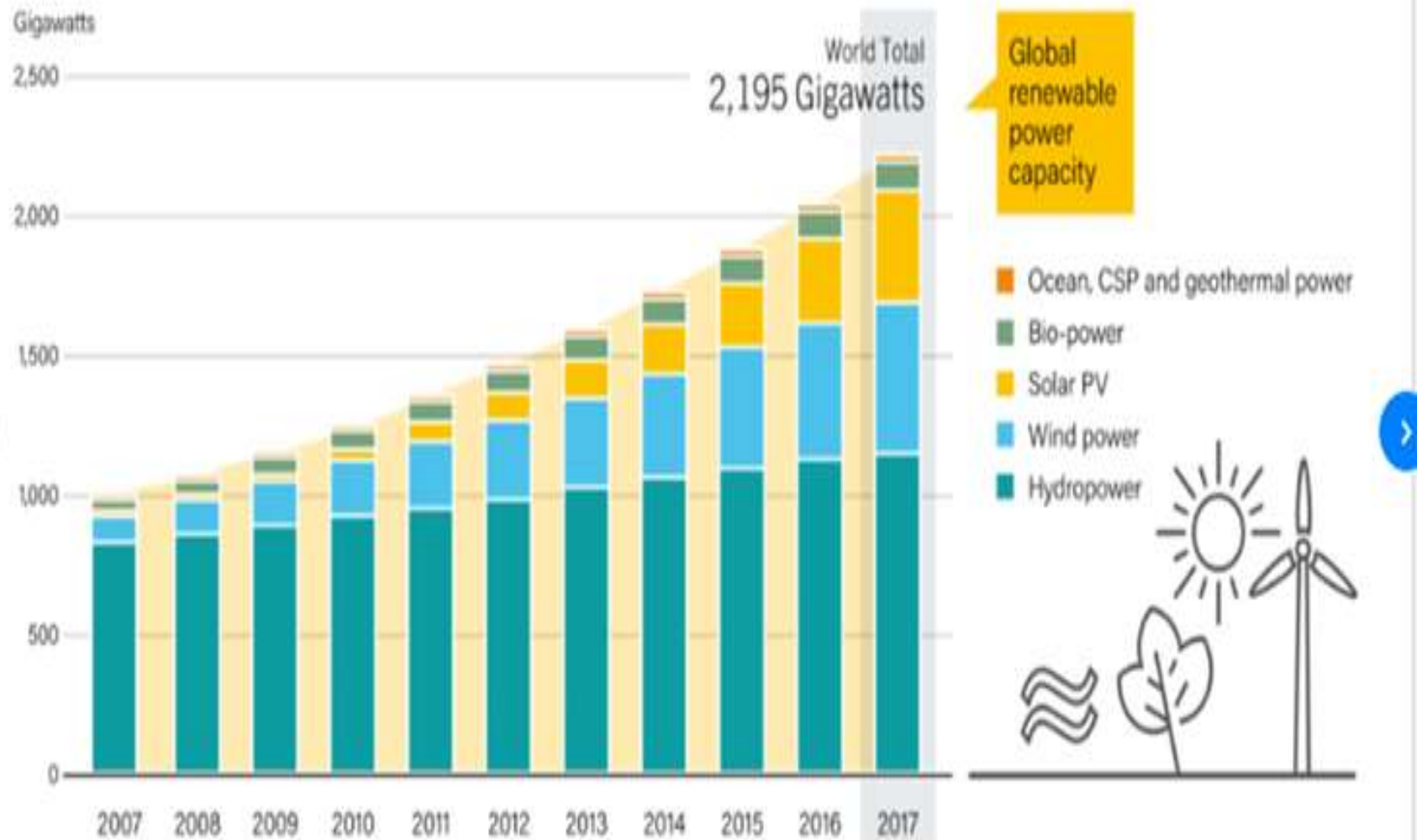
Climate change

# Why alternative energy sources

- Prices of crude oil
- Energy security
- Energy sustainability



Estimated renewable energy share of global electricity production, end-2017



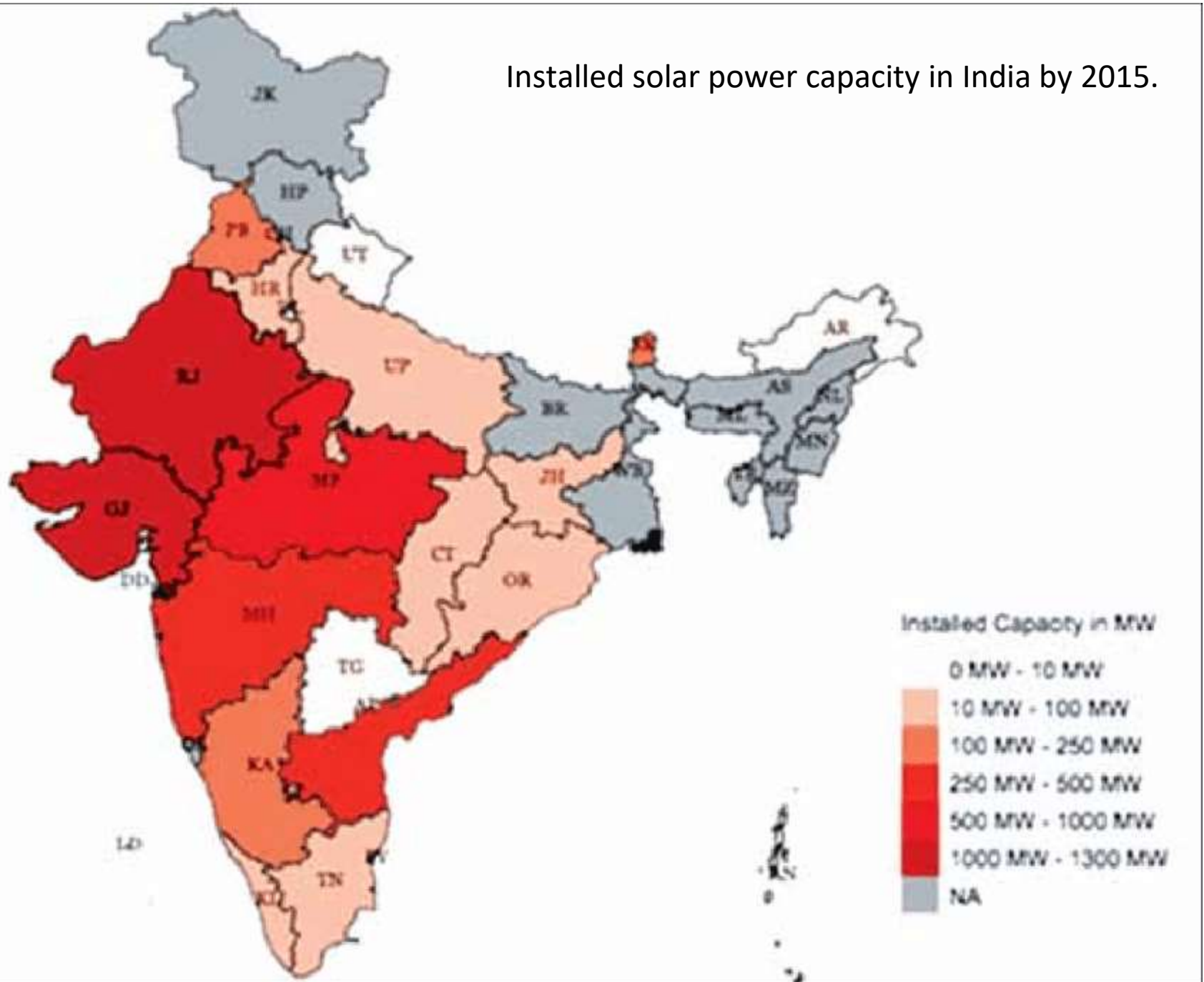
Global Renewable Power Capacity, 2007-2017 (REN21 2018b).

CSP = Concentrated solar power

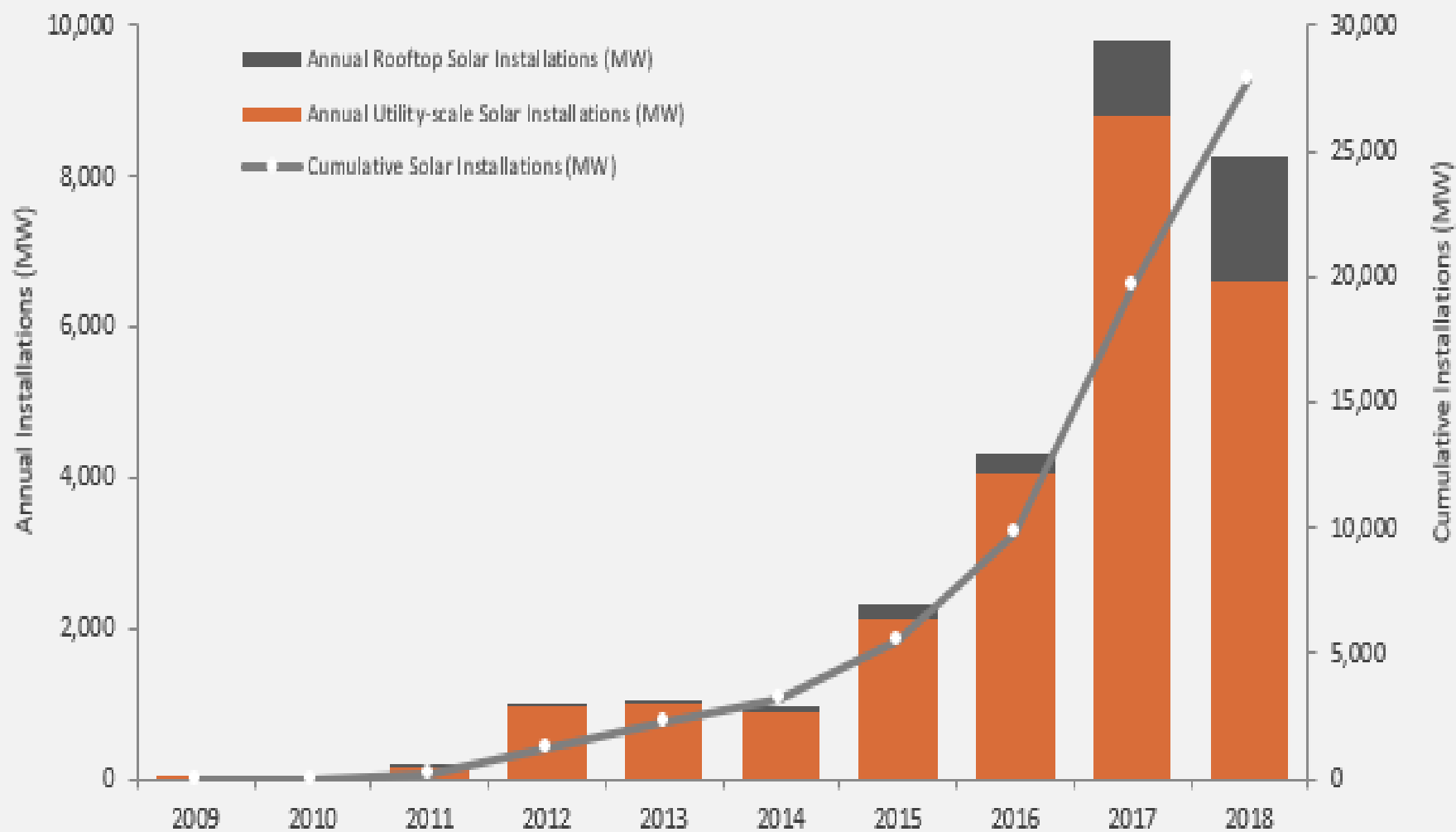
1,000 GWh = 1,000,000 MWh = 1,000,000 000 kWh;



Installed solar power capacity in India by 2015.



## India Solar Installations (MW)



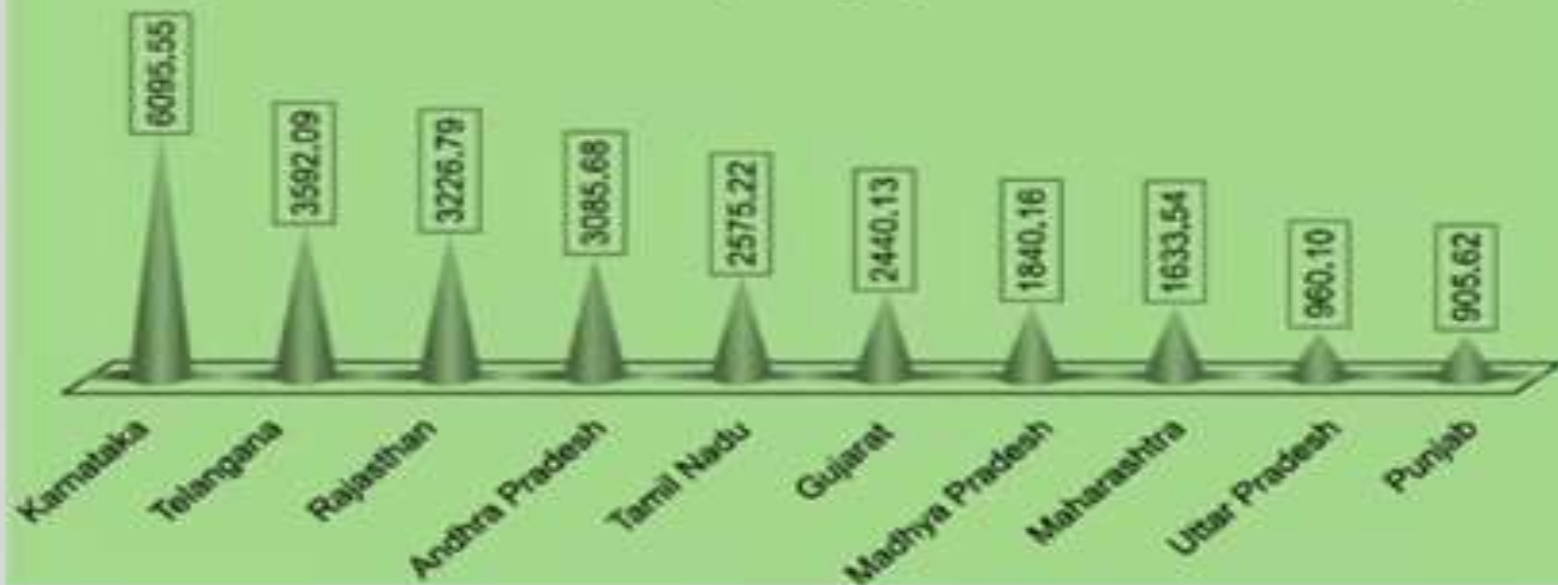
Source: Mercom India Research (Dec 2018)



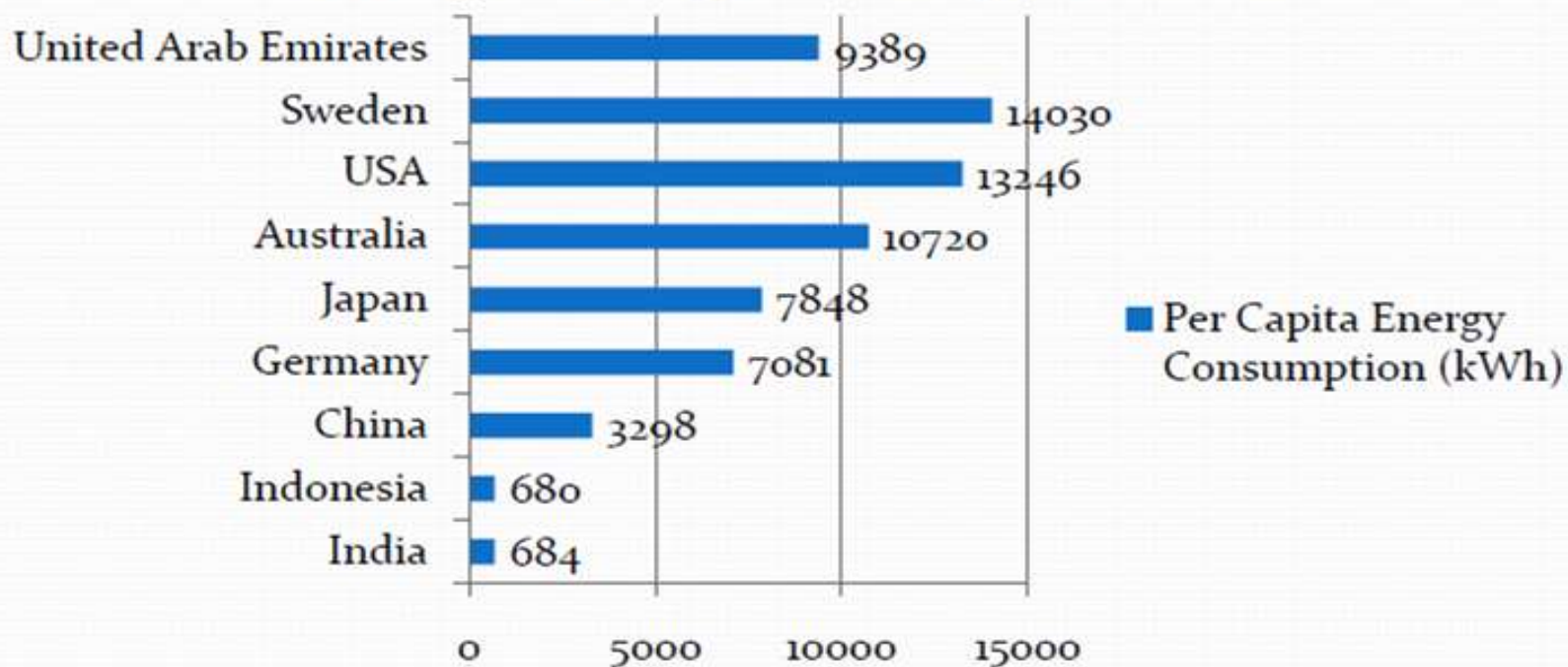
## Solar Energy Scenario

- ✓ Solar Installed capacity in India: 19.6 GW as on 28<sup>th</sup> February 2018
- ✓ Solar Potential in India: 789 GWp

**Top 10 State in Solar Capacity (in MW, till March 2019)**



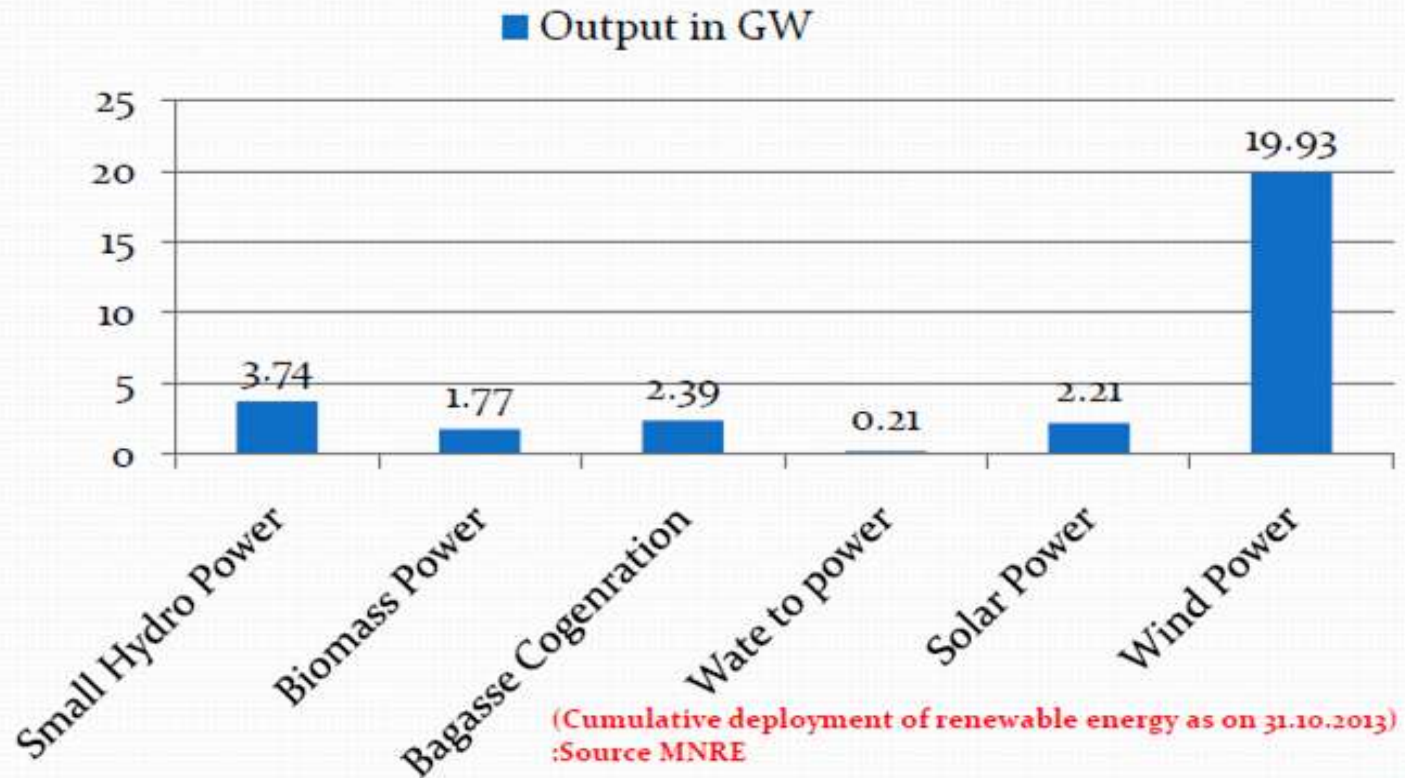
## Per Capita Energy Consumption (kWh)



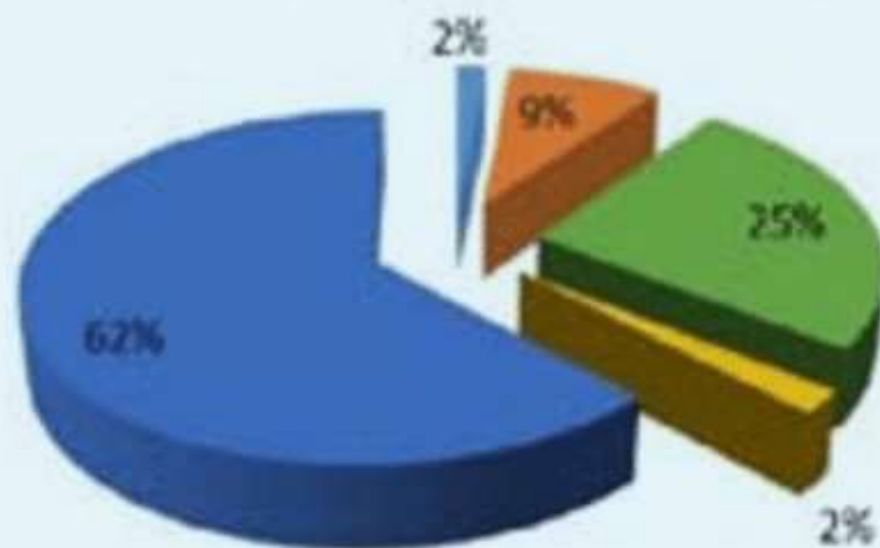
Source: <http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC>

# Renewable Energy in India

- Ministry of New and Renewable Energy (MNRE) come in picture in 2006
- It work to increase the share of renewable energy



**Total potential of Renewables in India: 1198856 MW**



**Potential**

- Small Hydropower (19749 MW)
- Wind Power (102788 MW)
- Wind Power (302235 MW)
- Bio-Power (25094 MW)
- Solar Power (748990 MW)

# Why alternative energy sources

- Prices of crude oil
- Energy security
- Energy sustainability