



## Sustainable Energy Consulting Project

"What are the government plans of your country to have the lowest carbon footprint in the energy mix?"

Agamjot Singh Pruthi  
Guided by- Vishwaraj (LUM- Sustainable Energy)

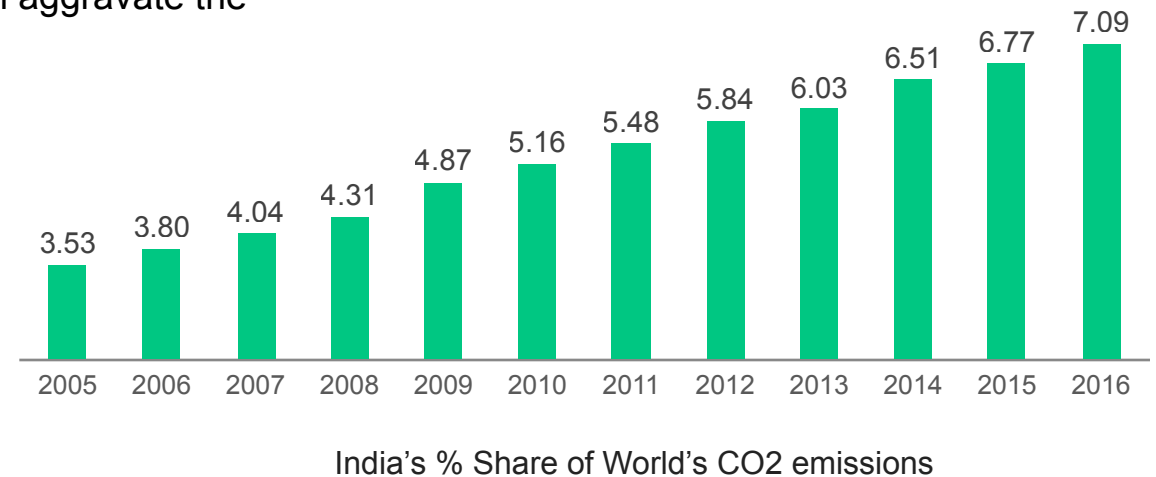
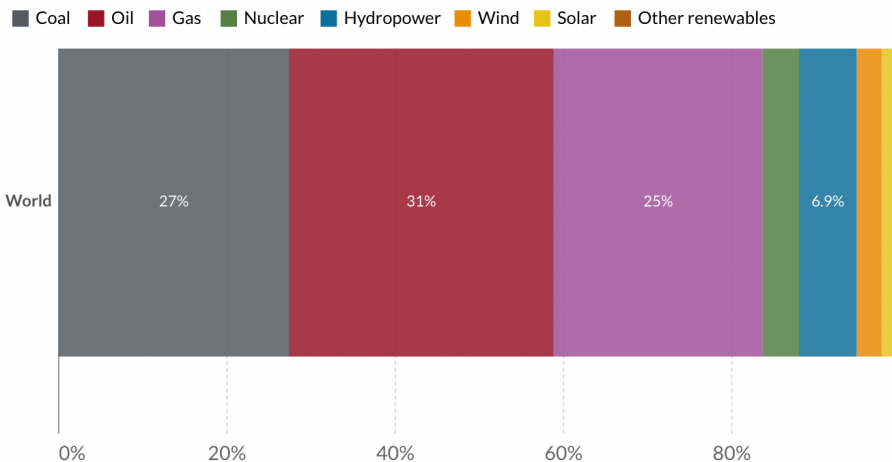
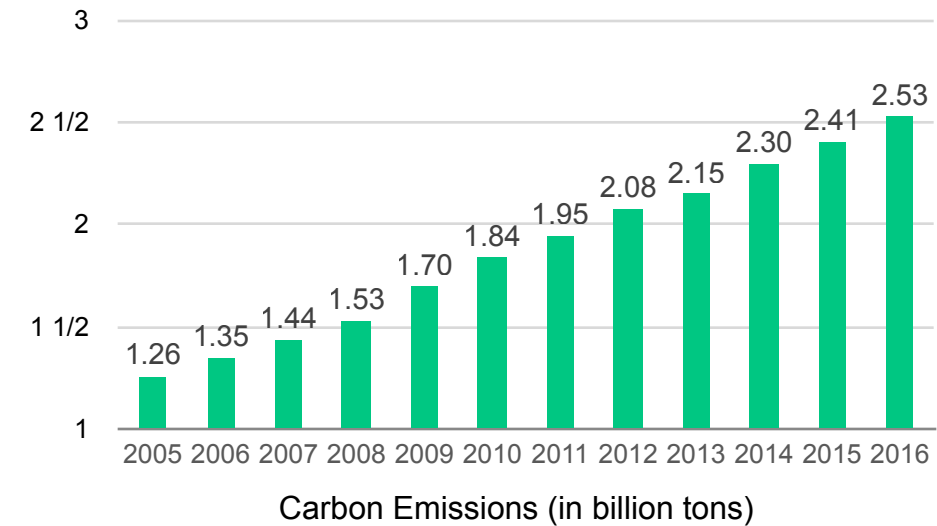


# Executive Summary

- **It is imperative for the government to reduce the carbon footprint in the energy mix to reduce its impact on the climate, to safeguard lives and to improve energy security.**
- **Industry, Electricity, Heat Production and Transport are the possible sectors where carbon footprint can be reduced**
- **Solar, Wind, Nuclear and Bio Energy can act as the 4 supporting pillars of India's energy needs**
- **Government can target states with abundant resources and incentivise a shift towards to non-carbon resources**
- **Making Policies based on these selection processes can help reduce Carbon Footprint by a large extent**

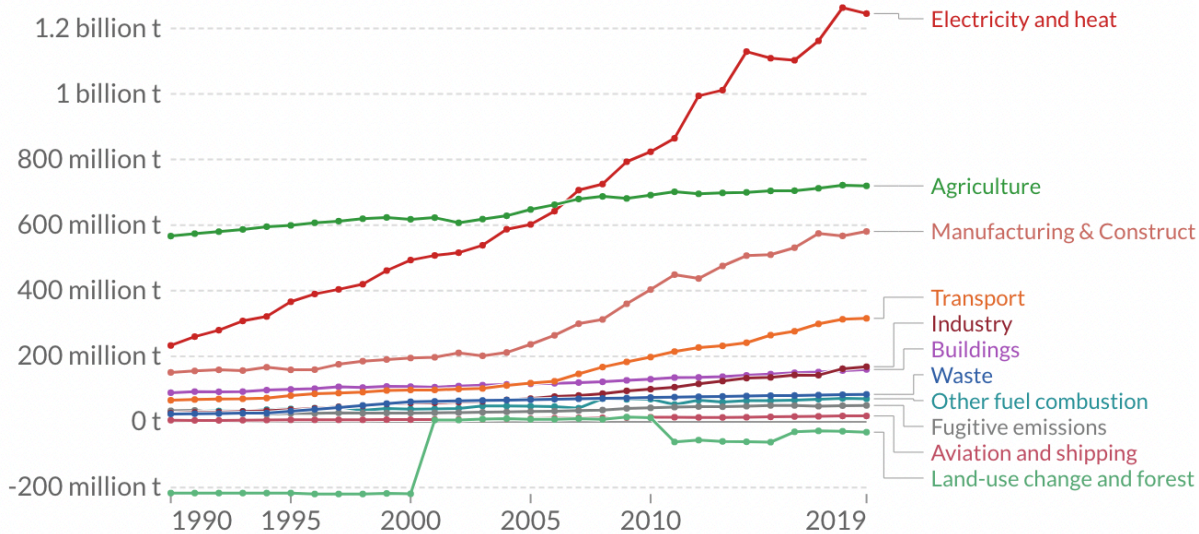
# It is imperative for the government to reduce the carbon footprint in the energy mix to reduce its impact on the climate, to safeguard lives and to improve energy security.

- Carbon Emissions cause **climate change** by trapping heat, and they also contribute to **respiratory diseases** from smog and air pollution
- **3.6 million people died** because of burning fossil fuels in 2019.
- A report by the London-based global think tank Overseas Development Institute found that **India has the world's highest social cost of carbon.**
- Carbon Emissions have been steadily rising in India giving rise to problems in heavily populated Industrial areas.
- India's share in the world's total CO2 emissions has increased by **more than 3%** from 2005 to 2016.
- Carbon based sources contribute to **more than 80%** in the Energy mix
- Burning Fossil Fuels also leads to the formation of toxic gases which aggravate the **greenhouse effect**

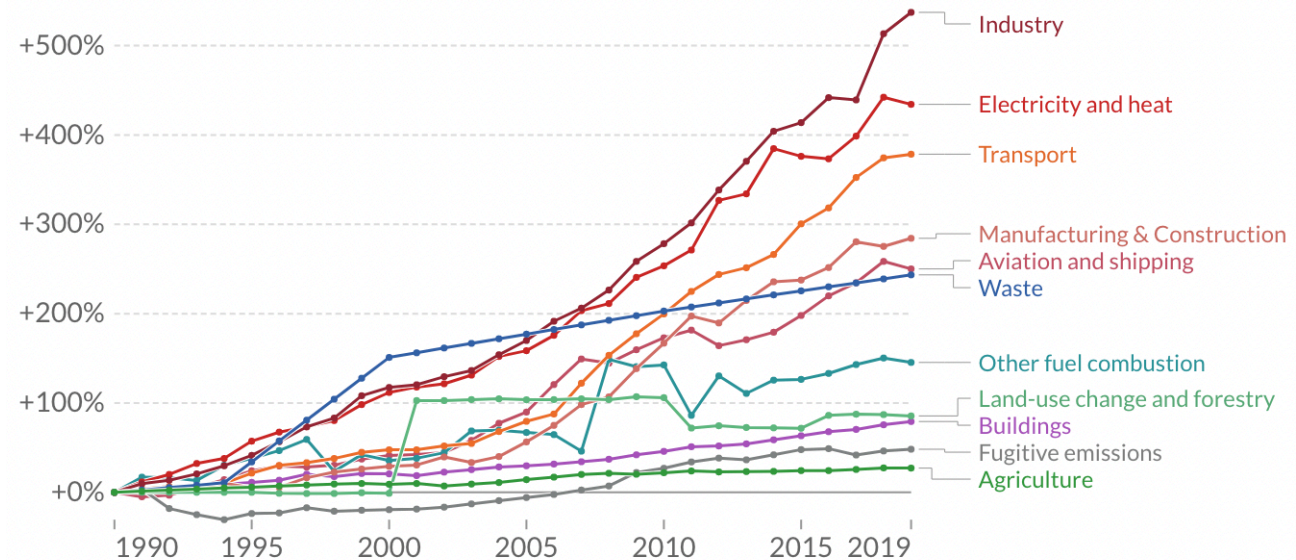


# Industry, Electricity, Heat Production and Transport are the possible sectors where carbon footprint can be reduced

- Measuring the amount of **carbon-based energy** required can be substituted by measuring the **carbon emissions** from various sectors which give a picture of how much carbon-based energy a sector uses.
- **Electricity production** and **generation of heat** uses up a lot of carbon-based energy sources for they release a major chunk of carbon emissions according to the data from previous years.
- If we look at the relative change, carbon emissions in **Industry** and **Transport** sectors are rapidly growing with high growth rates and are possible targets for government regulations.

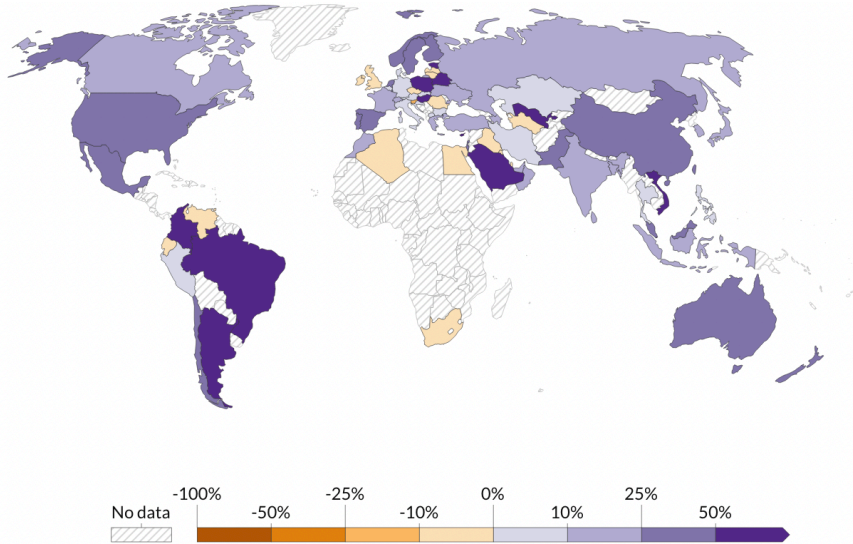


Carbon Emissions (in billion tons)



Relative Change

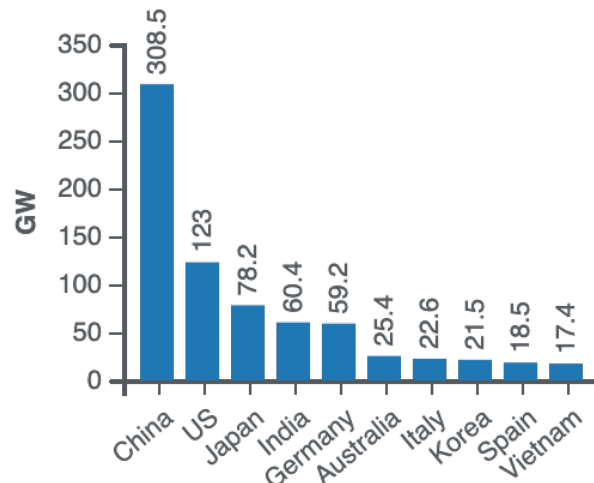
# Solar, Wind, Hydropower and Bio Energy can act as the 4 supporting pillars of India's energy needs



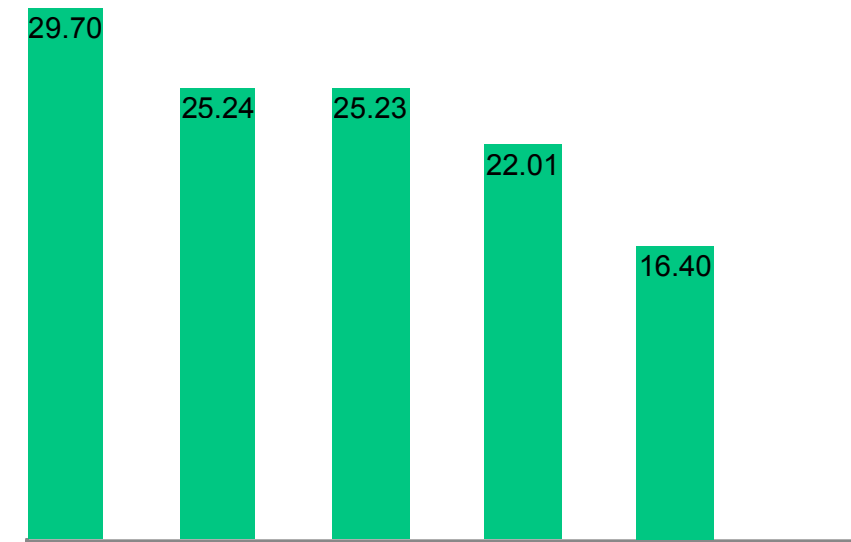
Solar Energy % change Map

- Solar energy is **non-exhaustive, renewable** and a **clean** source of energy.
- India's total electricity consumption is around **1.137 trillion kWh** per year .
- About **5,000 trillion kWh** per year energy is incident over India's land area with most parts receiving **4-7 kWh per sq. m per day**.
- India's solar installed capacity was **59.302 GW/ 59.302 million kWh** as of 31 August 2022 which falls way below the potential output.
- India's solar energy consumption growth of **16.4%** falls below the world's solar energy consumption growth of **22%** and is no where near China's massive **300+ million kWh** consumption level

- Solar energy can thus replace traditional forms of carbon based energy by some extent.
- Because of its non-exhaustive and renewable nature, strengthening the capturing of solar energy can thus help improve energy security

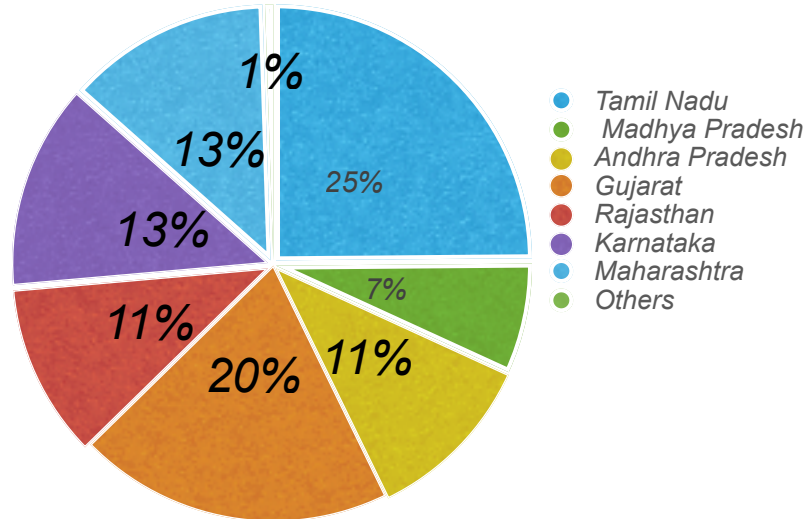


Top 10 countries by cumulative solar power installed capacity

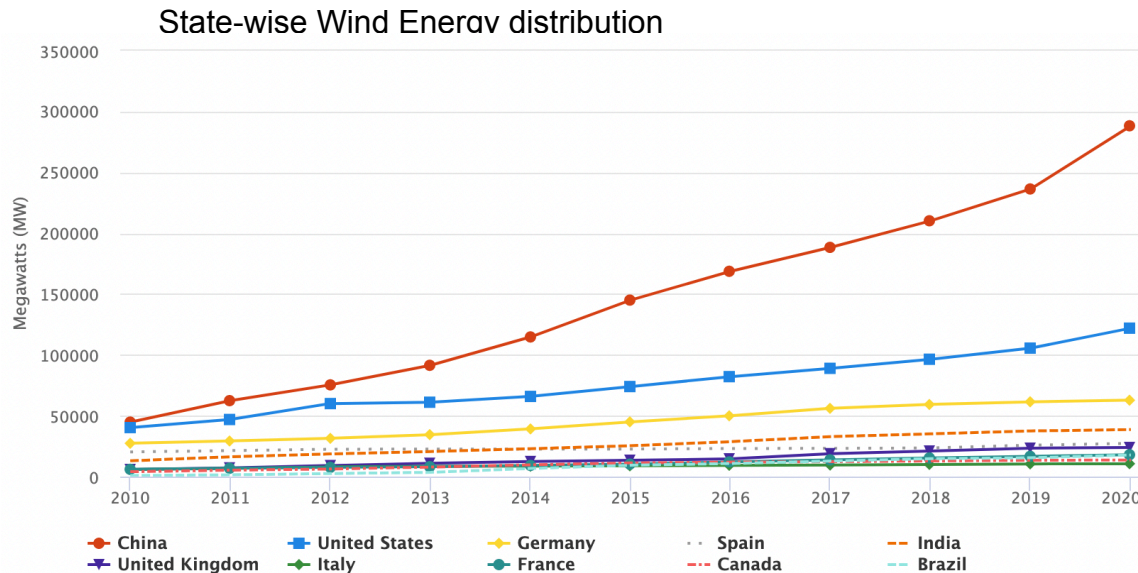


Country-wise Solar Energy % change Chart

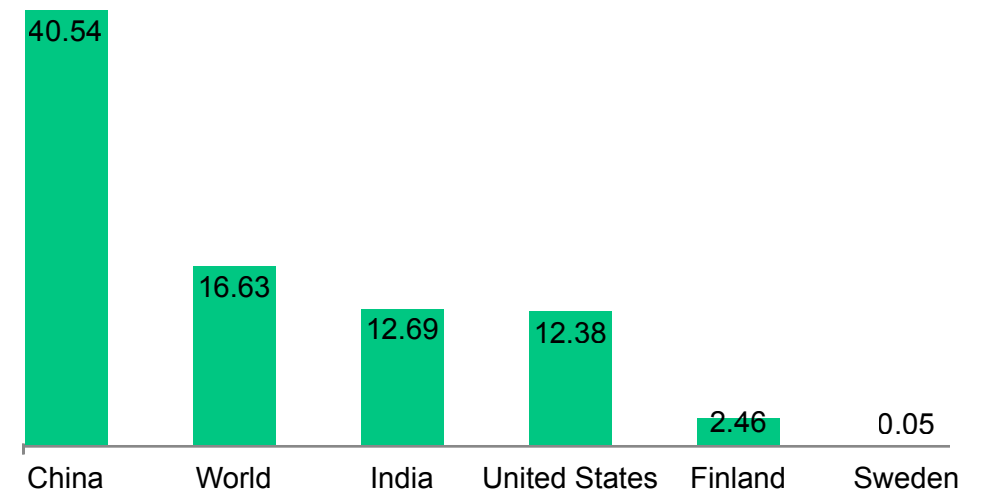
# Solar, Wind, Hydropower and Bio Energy can act as the 4 supporting pillars of India's energy needs



- India can generate **127 GW** of offshore wind energy with its 7,600 km of coastline.
- **More than 95%** of commercially exploitable resources are located in **seven states**: Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu.
- **Tamil Nadu, Gujarat, Maharashtra, Karnataka and Rajasthan** are the top 5 wind-energy potential states in India .
- But the growth rate of wind energy in India of **12.69%** falls below the growth rate of wind energy of the world of 16.63%.
- Solar energy can thus replace traditional forms of carbon based energy by some extent and can help improve energy security.



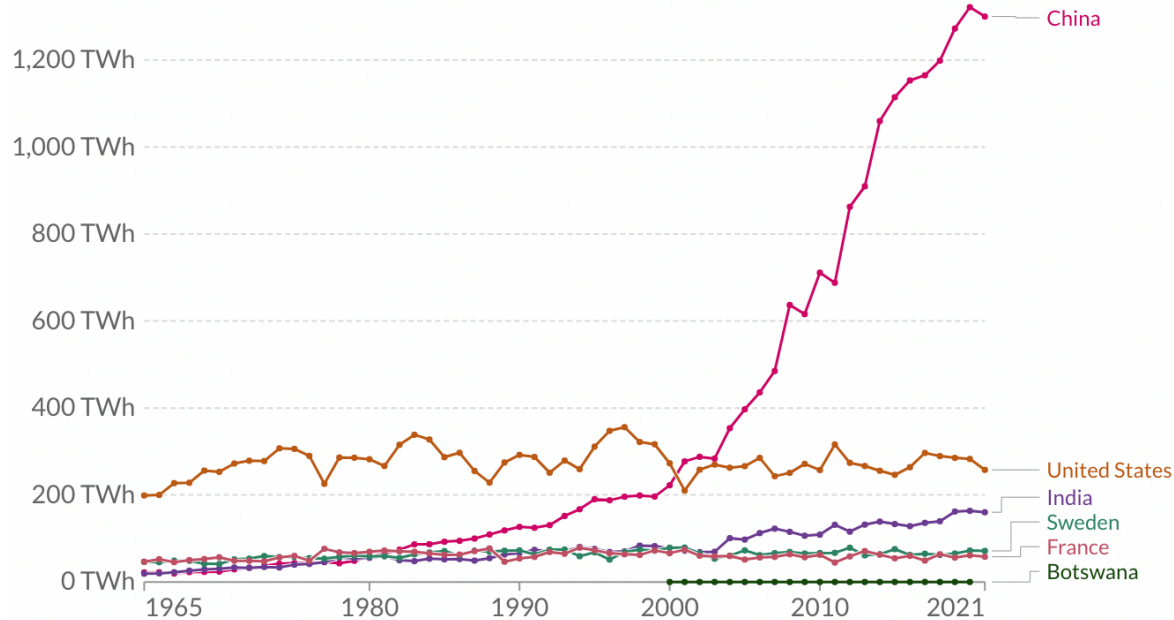
International Rankings of Cumulative Wind Power Capacity



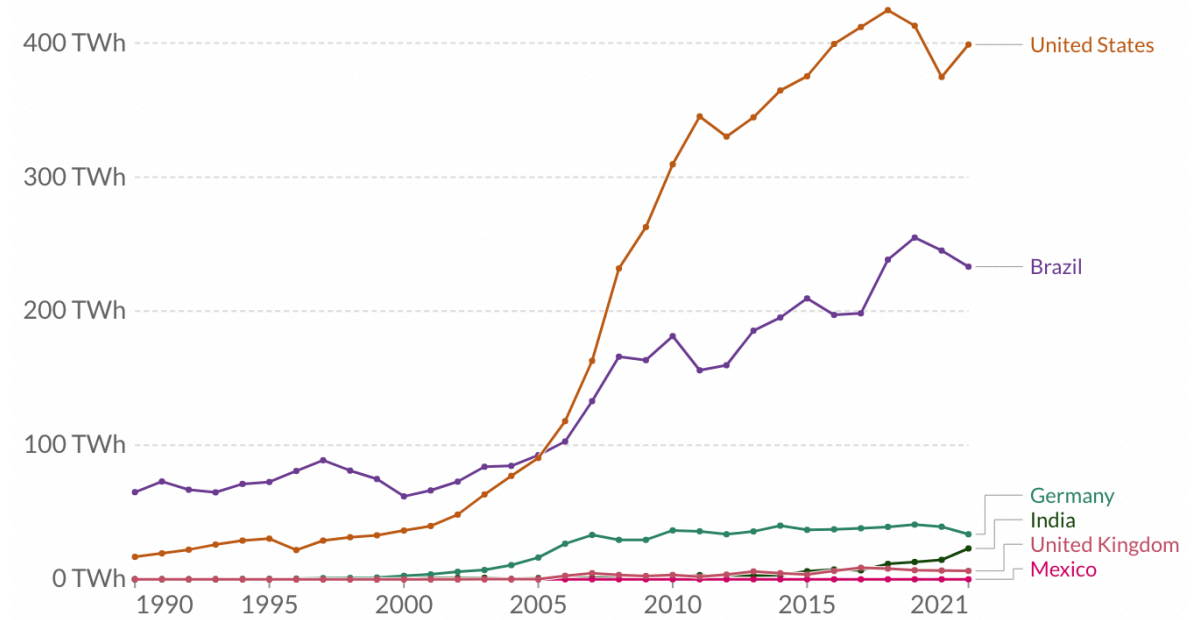
Country-wise Wind Energy % change Chart

# Solar, Wind, Hydropower and Bio Energy can act as the 4 supporting pillars of India's energy needs

- Bio gas has a **low percentage of carbon** and **utilises waste** and thus is a **better option** as compared to fossil fuels.
- The power generated by biomass in India is estimated to be over **18000 MW** but the biomass scope is defined as high as **50000 MW**.
- The current share of biofuels in overall fuel use is **extremely low in India** as compared to other countries.
- The hydropower potential of India is around **1,45,000 MW** and hence is the largest contributor in in the energy mix from the renewable sources of energy.
- Hydropower and Bio Energy thus can act as two strong pillars to meet India's energy needs.



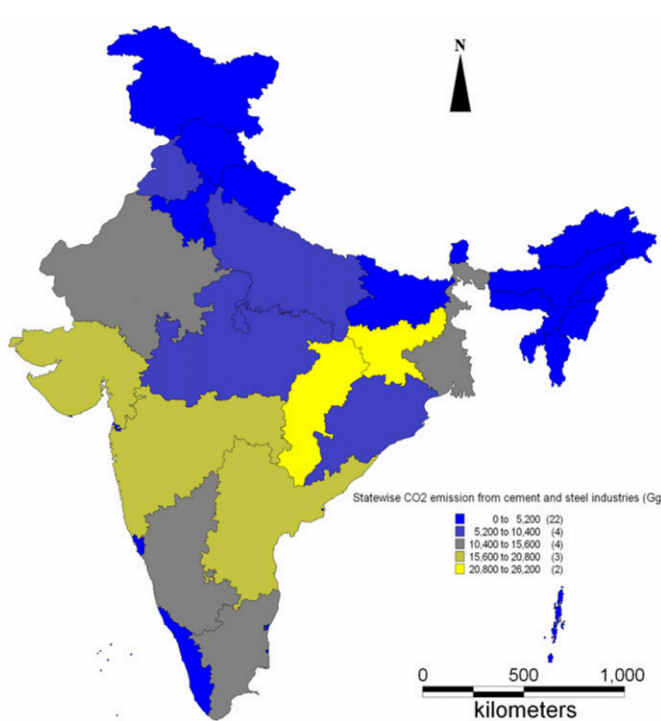
HydroPower Energy Generation



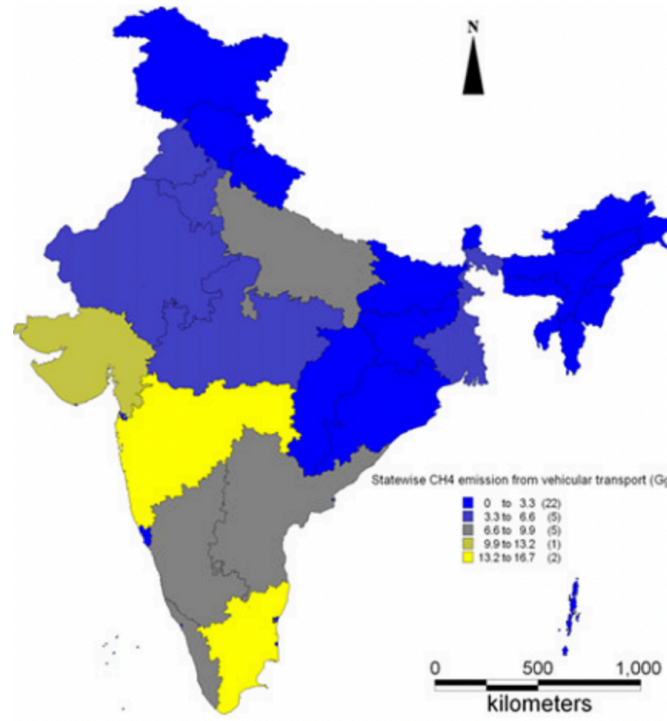
Biomass Energy Generation

# Government can target states with abundant resources, most emissions and incentivise a shift towards to non-carbon resources

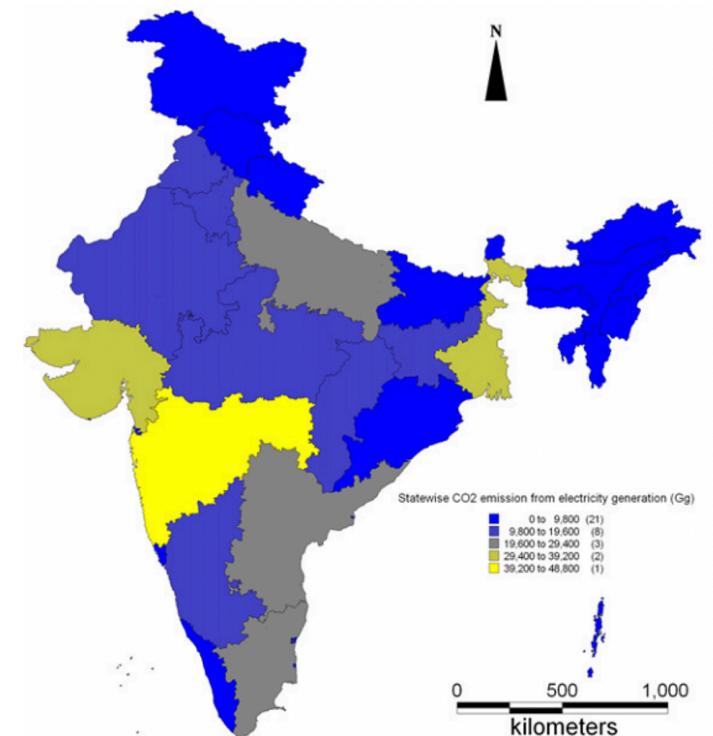
- It follows from the graph that relatively developed states like Maharashtra, Gujarat are the hotspots of carbon emissions in the three sectors .
- Choosing these states and exploiting resources most readily available there should be our government's plan.



Industry Emission Map (Yellow is the most intense)



Transport Emission Map (Yellow is the most intense)

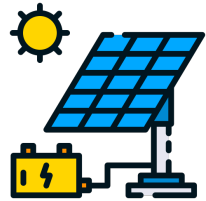


Electricity Emission Map (Yellow is the most intense)



# Making Policies based on these selection processes can help reduce Carbon Footprint by a large extent

## Renewable energy, target states, aims and policies to incentivise the use of renewable resources



Solar Energy

### Target States

- Karnataka
- Rajasthan
- Gujarat
- Andhra Pradesh

### Aims

- Harnessing Solar energy from extremely hot states
- Reducing use of fossils and carbon footprint

### Government Policies to incentivise use

- Electricity subsidy for installing solar rooftop systems.
- Creating SEZ (special economic zones) to incentivise firms to build solar panel manufacturing units in these target states.
- Some tax exemption for households for installing and maintaining rooftop solar panels.

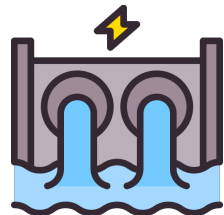


Wind Energy

- Gujarat
- Rajasthan
- Tamil Nadu
- Kerala

- Harnessing Wind energy from coastal states
- Reducing use of fossils and carbon footprint

- Bringing Renewable Energy under GST and lowering GST rates to minimum 5% on inputs like Turbine Blades, motor etc.
- Energy research and development (R&D) activities aimed at increasing wind energy supplies or improving production
- Concessional custom duty exemption on components of wind electricity generators



Hydro Energy

- Sikkim
- Arunachal Pradesh
- Assam
- Meghalaya

- Harnessing the potential hydropower from mountainous terrain and perennial streams
- Reducing use of fossils and carbon footprint

- Tariff rationalisation measures for bringing down hydropower tariff.
- Budgetary Support for Hydro Electric Projects
- Bonus funds to a state for abiding by and improving hydro energy standards.