

**National Conference on Climate Change and Renewable Energy  
Integration towards Net Zero, March 16-17, 2024 at ABV-IIITM Gwalior**

# Climate Change and RE Pathways towards Net Zero

**Dr. (Mrs) Malti Goel**

Chief Executive, Climate Change Research Institute

Former Adviser and Emeritus Scientist

Department of Science & Technology, Government of India

# Climate Change Research Institute

**The Climate Change Research Institute has a vision and mission to disseminate science & technology research in the field of environment and climate change mitigation & adaptation to society**

**It educates and informs youth in schools and colleges about the ecosystem changes and consequences of climate change, for finding solutions.**

**It organizes awareness and capacity building workshops, scientific events of international relevance, lectures, campaigns on topics of scientific & societal interest**

**It disseminates knowledge through News Bulletins, E-magazines and Scientific publications on emerging environmental concerns.**

**Governing Council of CCRI : Prof. D. P. Agrawal Chairman and  
Shri V. S. Verma, Member**





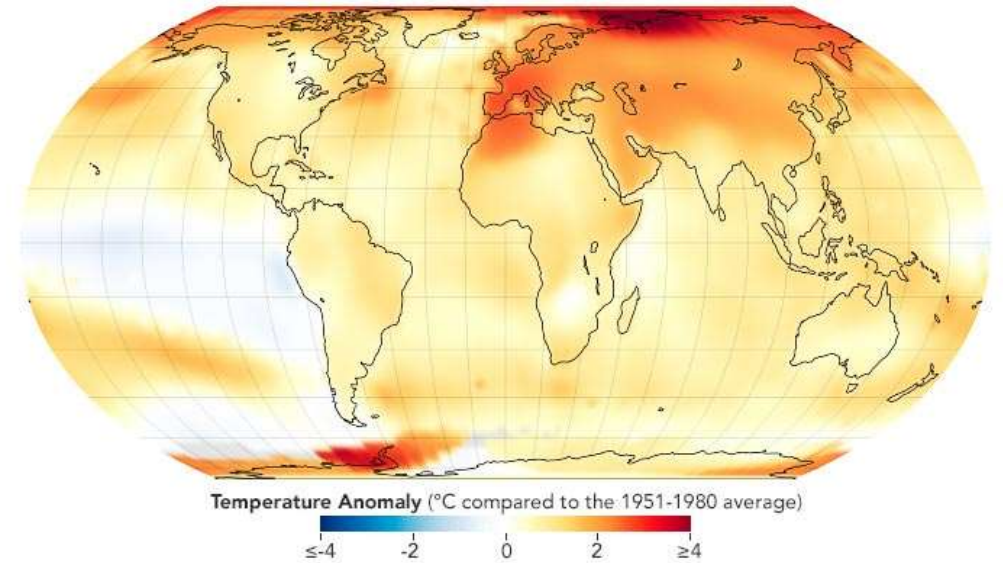
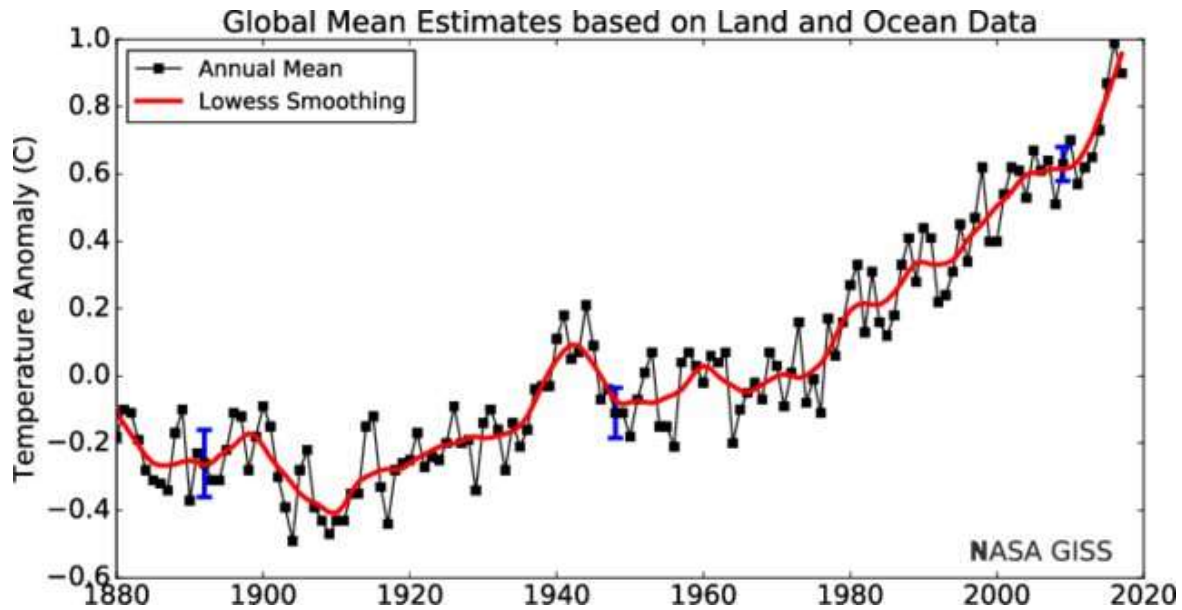
Dr. Mrs. Malti Goel President CCRI at the Inaugural Session of CCSU Workshop



## CONTENTS

- **Climate Change**
- **Net Zero**
- **Renewable Energy**
- **Challenges in Integration**
- **Digitization**

# NASA declares 2023 as the hottest year



Global Temperature Anomaly 2022 compared to 1951-1980 average.

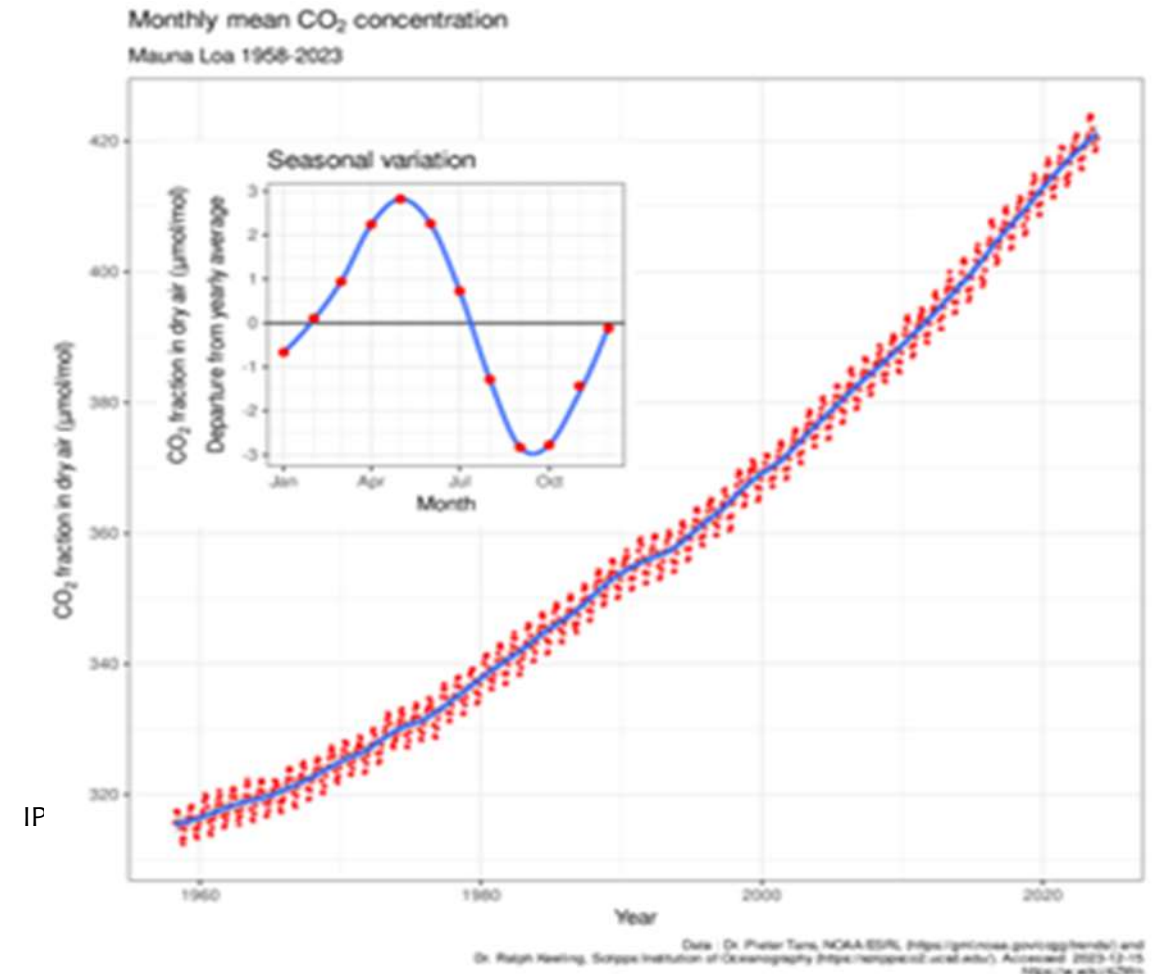
# Global Warming and Greenhouse Gas Emissions

3/16/2024

7

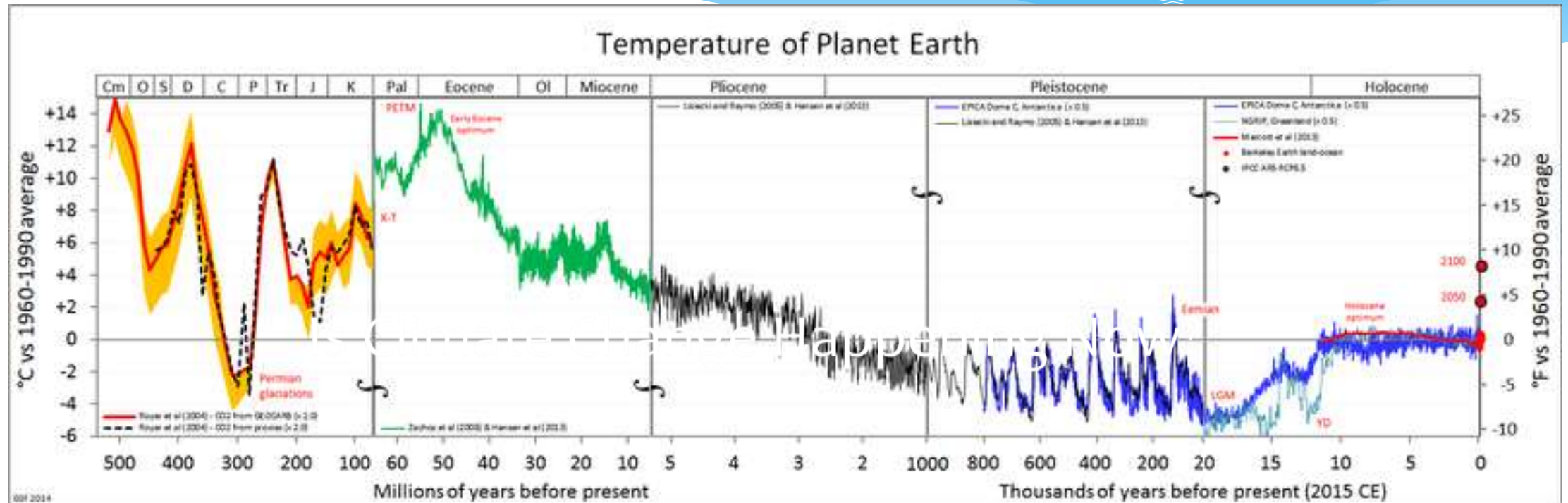
The 6<sup>th</sup> Report of **Intergovernmental Panel on Climate Change (IPCC)**, was released on 9<sup>th</sup> August 2021. The IPCC is an UN body for assessing the science related to climate change. It stated that limiting global warming will require major transitions in the energy sector.

The IPCC Synthesis Report 2023 suggests reaching **net zero** GHG emissions primarily requires deep reductions in not only CO<sub>2</sub>, but also methane, and other GHG emissions.





# Is Climate Change Happening Now?



- \* Climate change occurs both as natural and anthropogenic phenomena
- \* While the history of anthropogenic climate change date backs to 175 years, natural climate changes have occurred for millions of years
- \* Understanding of future Climate Change are made from the learning of past climate change



# How do We Infer Past Climate Changes ?

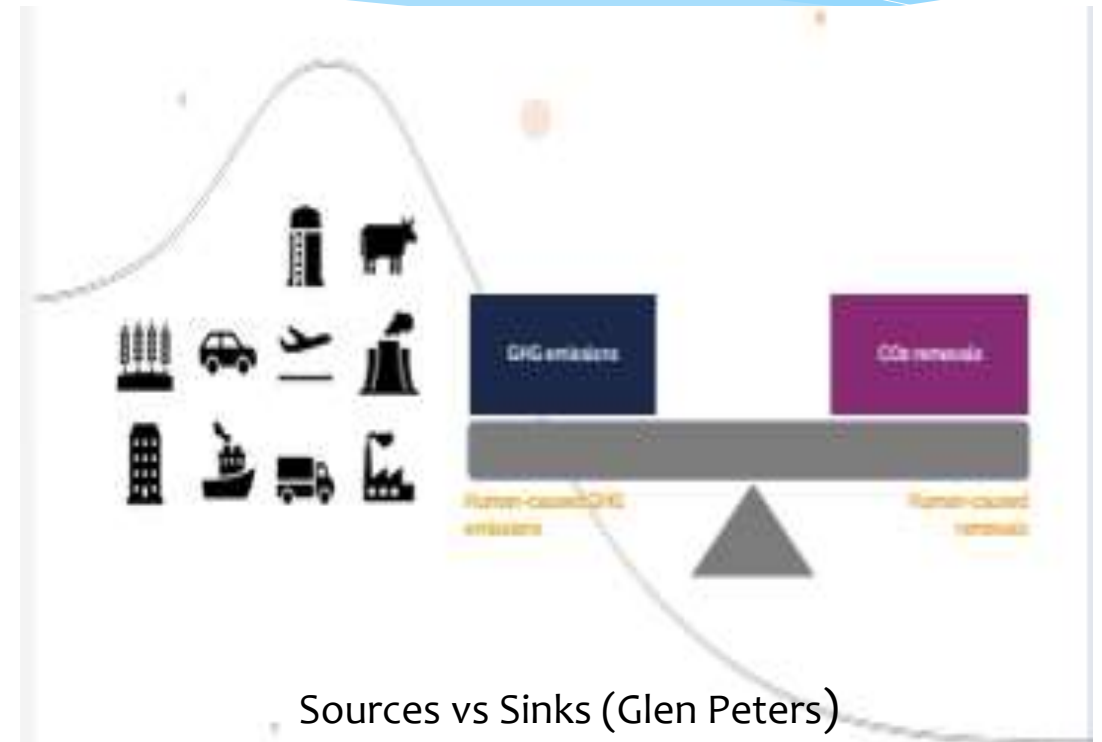
## - Paleoclimate Indicators

- \* Marine Biological proxies - **Coral Reef**
- \* Marine Geological proxies - Ocean sediments
- \* Non-Marine Biological proxies - macro and micro fossils, **Tree rings**
- \* Non-Marine Geological proxies - mineral deposits in caves, lake sediments and **ice cores**



# What does Net Zero mean?

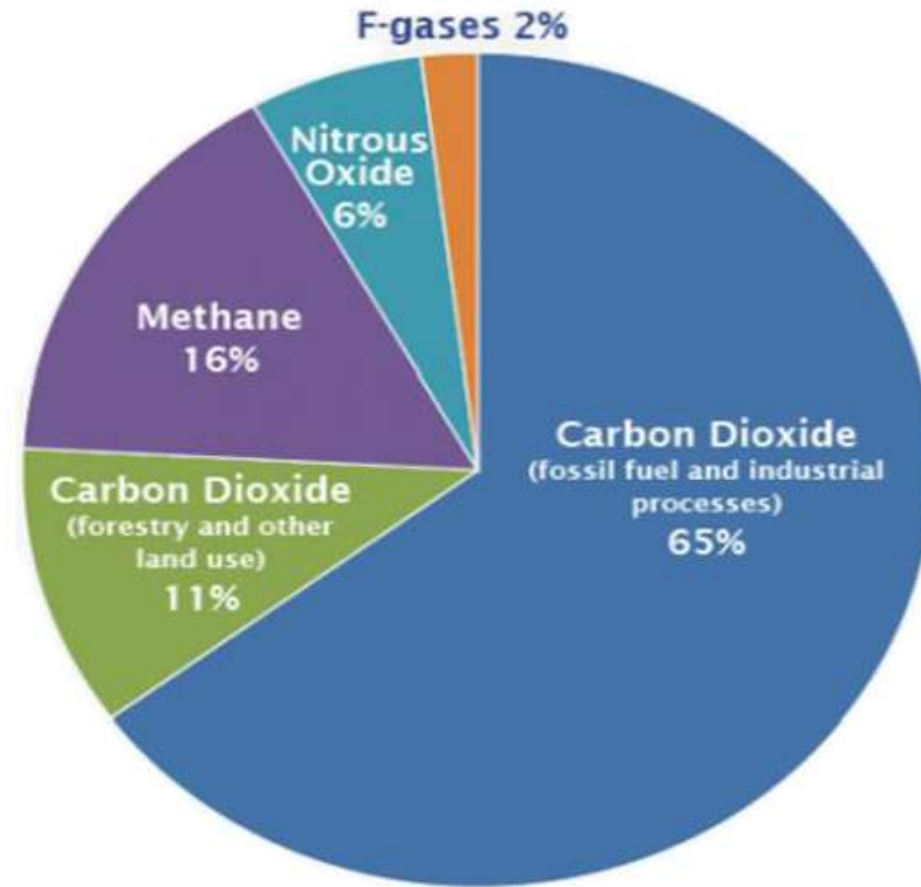
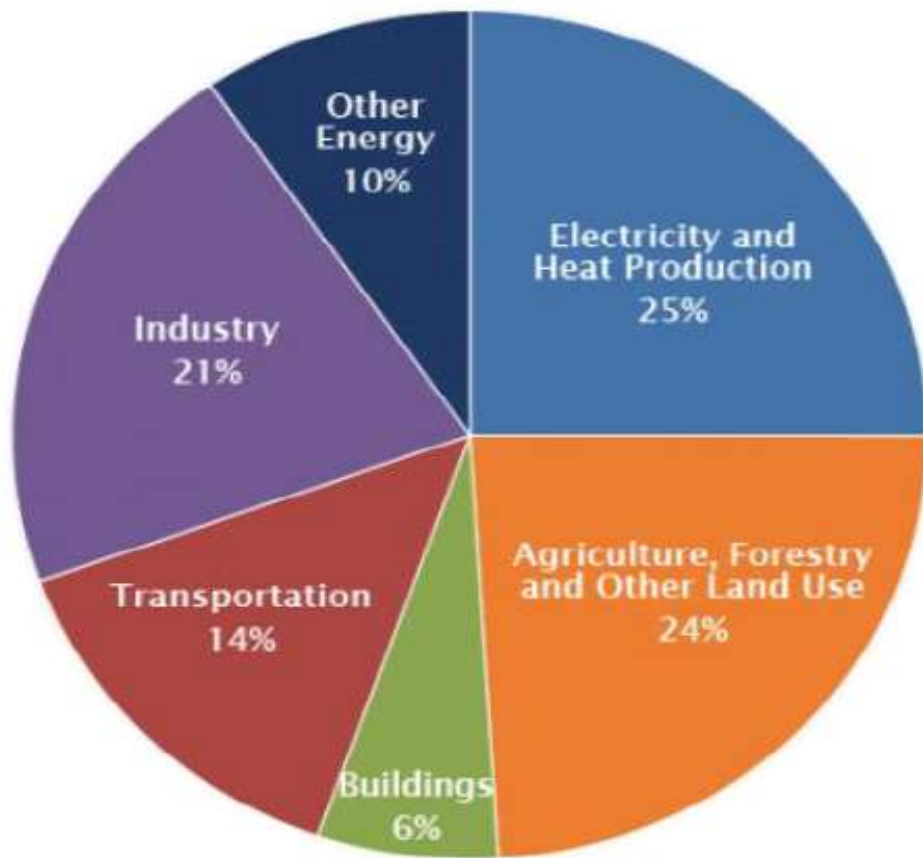
- \* Accumulation of GHGs in the atmosphere is the main driver of anthropogenic climate change.
- \* To mitigate climate change and halt global warming, we need to reach a balance between anthropogenic emissions sources and sinks.
- \* A state known as net-zero emissions would mean balancing excess emissions with creation of sinks



# Why do We Need Net-Zero?

3/16/2024

11



Sources – IPCC,2014, and K. Ofori, 2017

# Net Zero at the Country Level

- \* In the COP 26 held in 2021, 56 Countries committed to reach net zero by 2050
- \* India targeted to reach net zero by 2070
- \* China suggested the target on 2060

Net zero CO<sub>2</sub> emissions 2050 would mean net zero GHG gas emissions will reach by 2070



# India's Commitments to Net zero

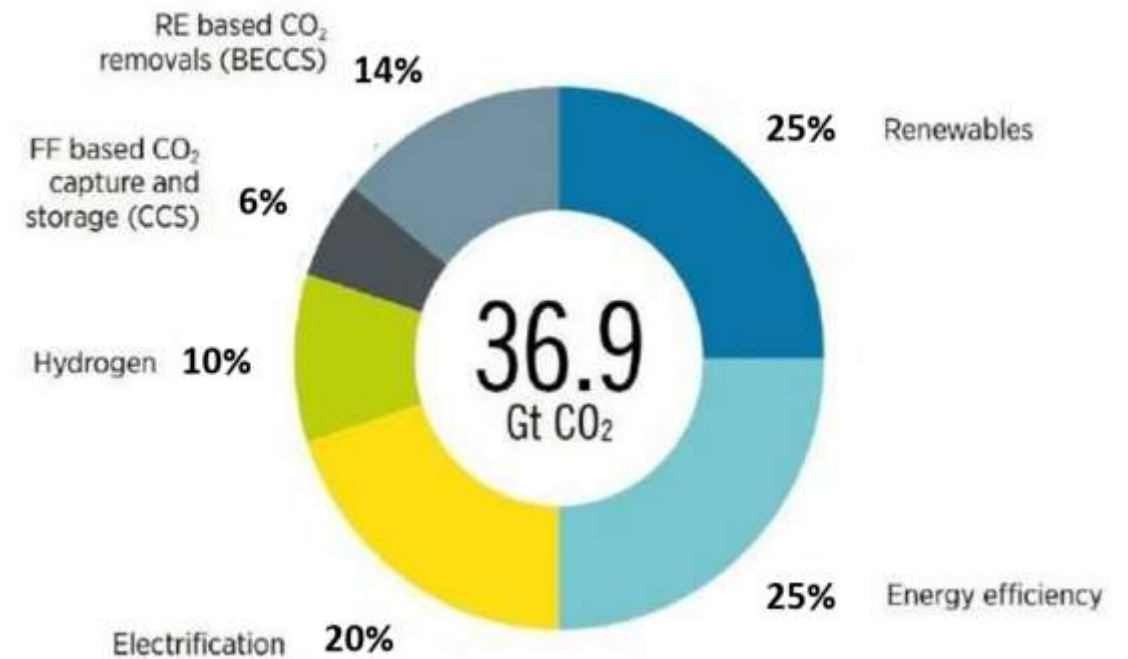
## New Panchamrit Action plan

- India plans to reduce its carbon emission intensity, i.e. the emission per unit of GDP, by 33-35% from what it was in 2005, by 2030.
- The aim is to have 40% of the total electricity capacity from sources other than fossil fuels.
- To enhance CO<sub>2</sub> sinks by 2.5 - 3 Billion tonnes per year by 2030. It may require increasing forest cover to 25% from 22%.

- ✓ Increasing renewable energy capacity to **500 GW by 2030**
- ✓ Procuring **50% of energy requirements** from renewable sources by 2030
- ✓ Reducing the total projected carbon emissions by **1 billion tonnes by 2030**
- ✓ Decreasing India's carbon intensity of the economy by less than **45% by 2030**
- ✓ India would **be carbon neutral and achieve net zero emissions by 2070**

# Clean Energy Technologies - Key Pillars

- \* Improving Energy Efficiency
- \* Diversify Energy Sources to Low Carbon fuels
- \* **Renewable Energy**
- \* Hydrogen
- \* Transformation in Industrial Processes
- \* Carbon Dioxide Removal

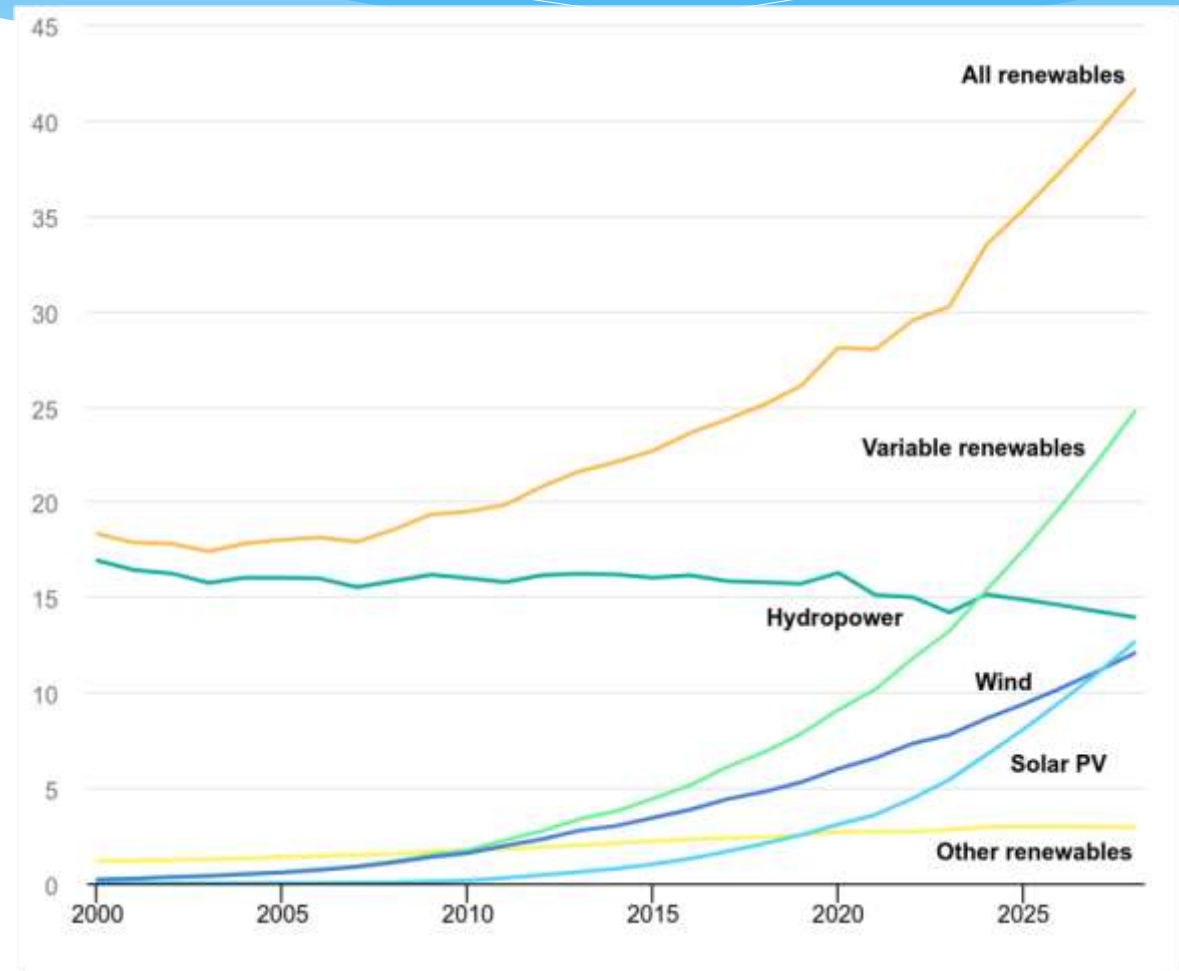


# Renewable Energy Technologies and their Growth

- SOLAR PV
- WIND
- BIOFUELS
- SMALL HYDRO POWER
- WASTE TO ENERGY

New

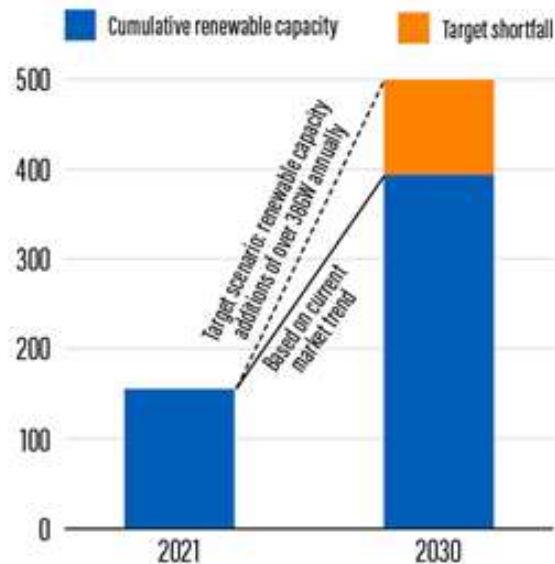
Wind-Solar-Water Hybrid  
Ocean Thermal, Wind and Tidal  
Floating PV  
Solar Thermal  
Geothermal



Renewables 2023 Report IEA

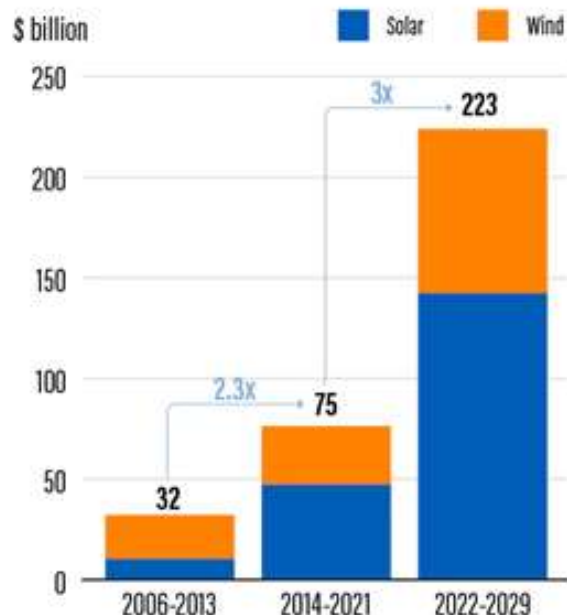
# India Sets an Ambitious Goal of RE

## RENEWABLE POWER CAPACITY, INDIA, CURRENT FORECAST VS TARGET 2021-2030



Source: Globaldata power intelligence center

## INDIA'S FINANCING NEEDS FOR 2030 WIND AND SOLAR TARGETS



Source: BloombergNEF

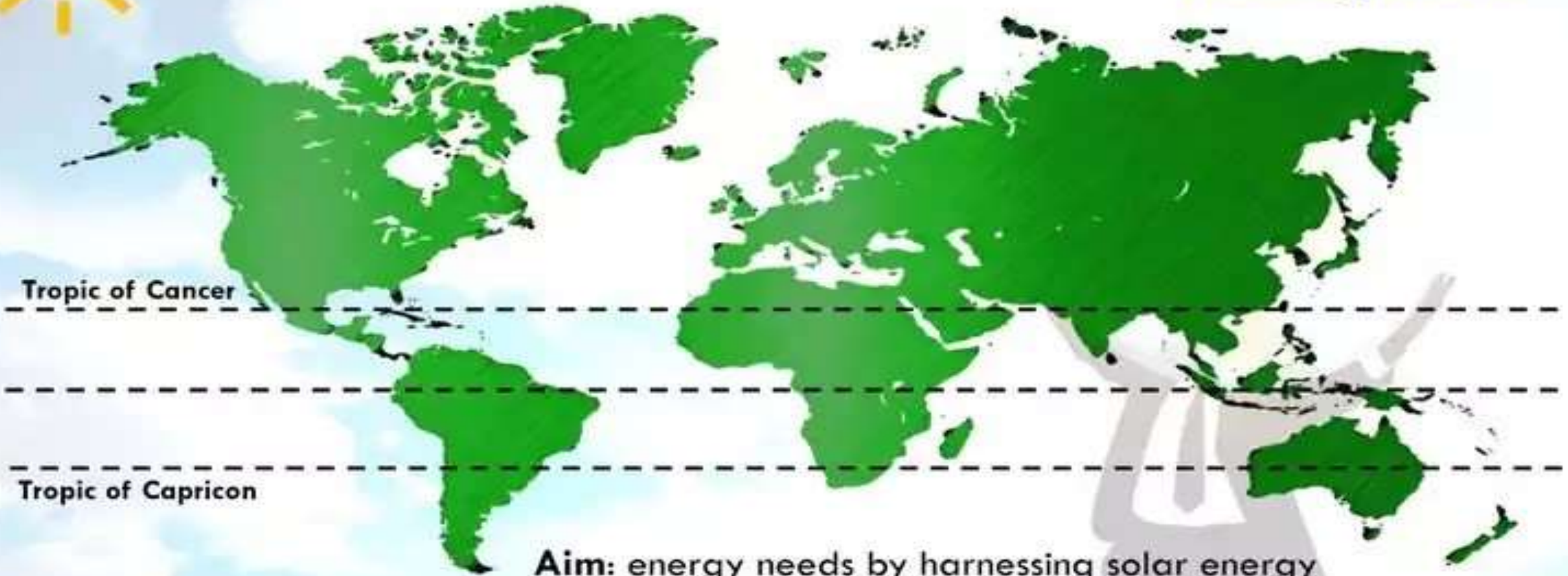
In a major policy initiative India took lead to launch **INTERNATIONAL SOLAR ALLIANCE (ISA)** at COP 21 in Paris in 2015 to promote solar energy in tropical countries rich in solar resource.





# INTERNATIONAL SOLAR ALLIANCE

Knowledgekart.in



Tropic of Cancer

Tropic of Capricorn

**Aim:** energy needs by harnessing solar energy

**Objective:** Global deployment of over 1,000GW of solar generation capacity and mobilisation of investment of over US \$1000 billion in into solar energy by 2030.

# Hydrogen Energy

- Hydrogen is an abundant source of energy and is carbon free.
- An Electrolyser splits water into hydrogen and oxygen when external energy is supplied.
- **Green hydrogen** is produced from water when **RE** or any other alternative source free from GHG emissions is used.
- Green Hydrogen is crucial for sectors such as fertilizers, refining, methanol, maritime shipping etc. for reaching Net Zero
- India has set a target to produce 5MT Green Hydrogen Hub by 2030.

\*

# Challenges in Integration of Renewable Energy

## CHALLENGES

- \* Intermittence and Variability
- \* Lack of Flexibility in base load
- \* Cost of Production
- \* Lack of Trained Manpower
- \* Digitalization for Marketing
- \* ESG

## BENEFITS from 24x7 Integration

- \* Emission Free Clean Generation
- \* Ease of Execution
- \* Financial Viability
- \* Capacity Building
- \* Local 'Digital Compass'
- \* B2B Models

# Digitization

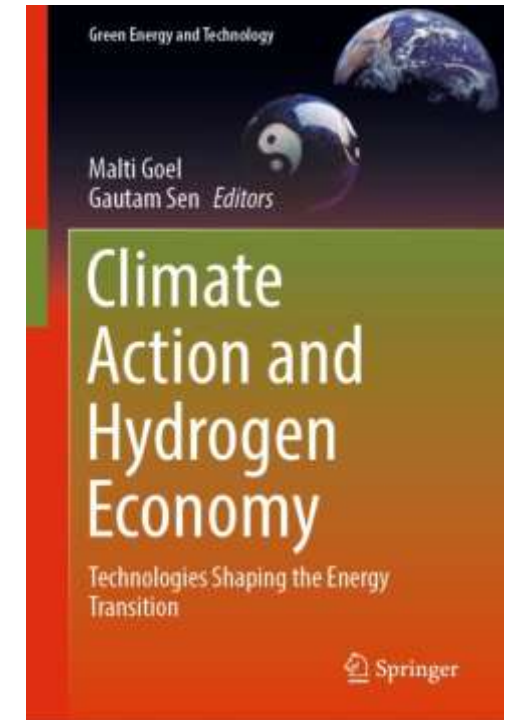
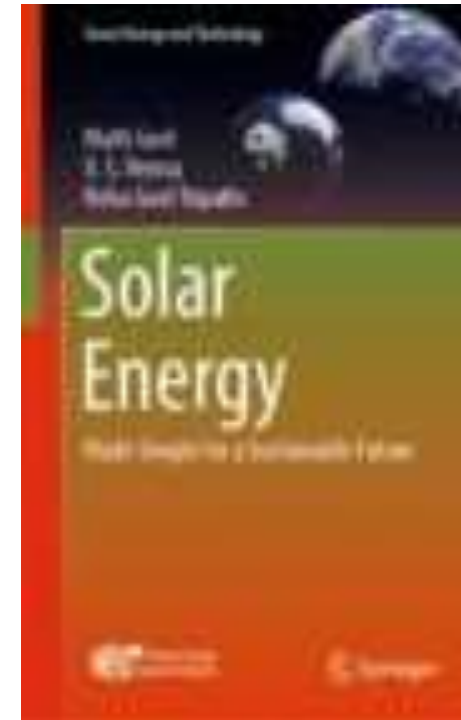
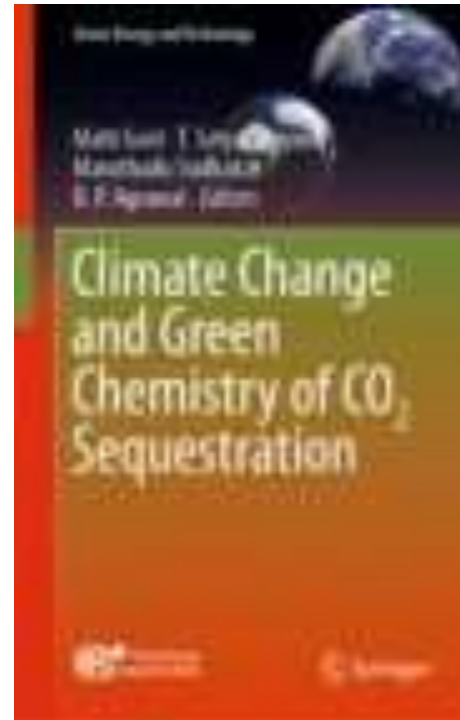
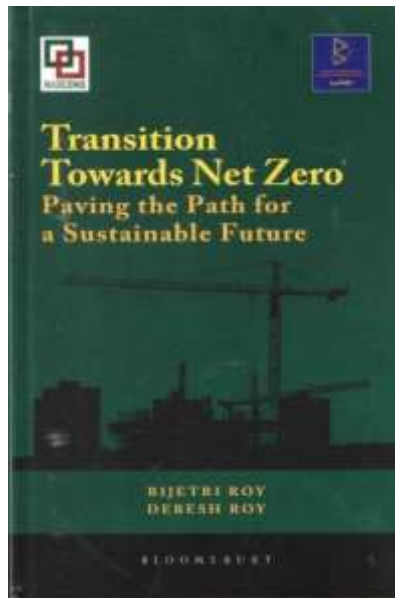
- ❑ Digitization in power sector can play a crucial role in fostering innovation, investment, and scalability to achieve the clean energy transition.
- ❑ It would require application of digital technology to enhance the effectiveness, dependability, and sustainability of contemporary energy systems.
- ❑ The minimum requirements are identified as:
  - ❖ Creation of an energy data base
  - ❖ Building necessary digital infrastructure
  - ❖ Skill development in consumers
  - ❖ Cyber security safeguards



Acknowledgements

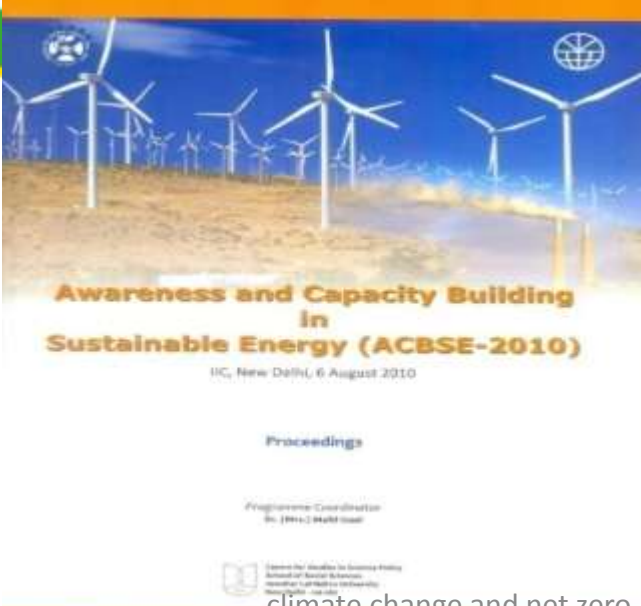
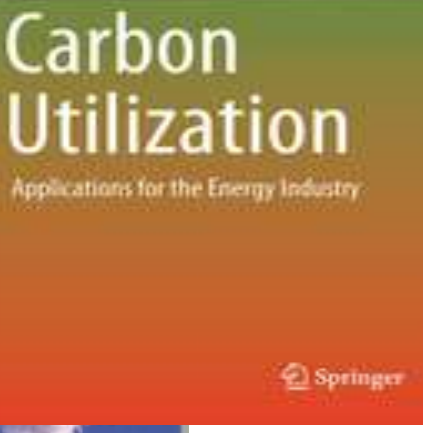
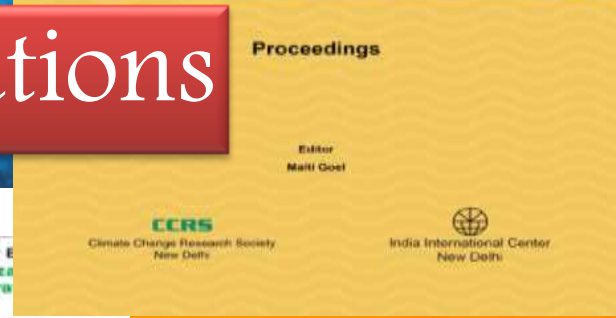
## Chapter 3

**Renewable Energy Policies and Pathways in India towards Net Zero Goal - Dr (Mrs) Malti Goel**

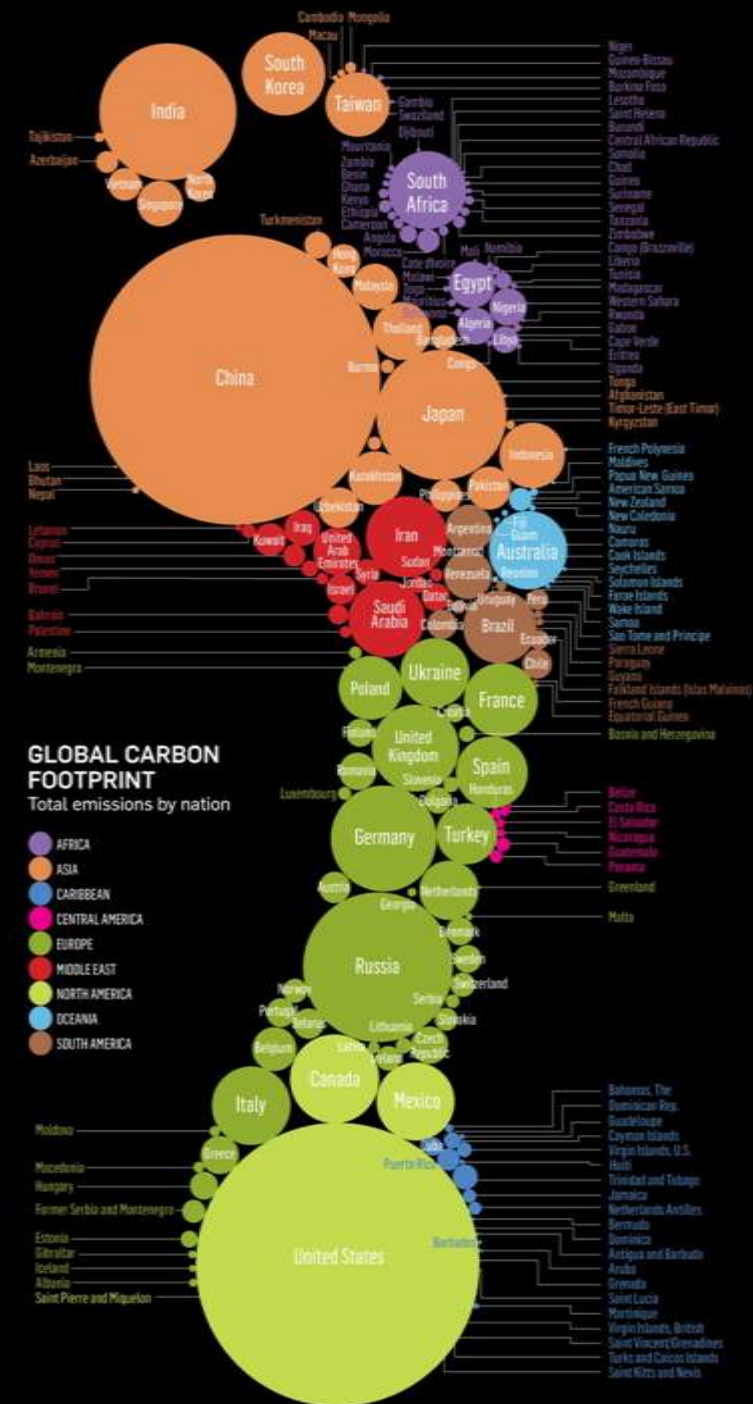




# Our Publications



*Thank you for  
your attention*





# Whole System Science

**Climate change presents a tremendous opportunity for discovery that will move us towards a better understanding of the physical workings of our planet and of our role as its exploiters and guardians...**

**- Nature Climate Change**