



# DDP BIICS

## Short term priorities and Critical international enablers towards Net Zero

### Policy Lessons learned from INDIA

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**DDP BIICS, 2050 PATHWAYS side event**

# DISCLAIMER

These results are outputs of the academic research conducted under the DDP BIICS project as per the contractual agreement.

The academic work does not in any way represent our considered opinion for climate negotiations and also does not reflect the official policy or position of the Government of India

# Outline

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- Scenario Framework
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- DDP BIICS (India) Results
- Synergies and Trade-offs with non-climate objectives
- Short Term Policies and Actions - Challenges
- Investment Patterns
- Key Enablers
- Reflections and Improvements

# India: Brief Context



2<sup>nd</sup> largest producer of coal, 2<sup>nd</sup> largest consumer of coal in the world

**Employs ~15 million people** directly and in connected businesses,

4 states' revenues depend on coal royalties



Thermal coal (91%), Metallurgical coal (9%), Surface mining (>94%),

Underground mining (<6%)

>220 million ton imported each year



3<sup>rd</sup> largest consumer of energy. Total 1400 Bn Unit of electricity/year,

**But only ~1000 kWh/capita**

Energy mix : Coal (56%) followed by oil (25%)

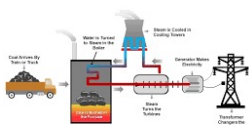
**Coal projected to remain major source of electricity generation in India for some years** (until when?)

54% generation capacity, ~ 72% generation share

39 GW under construction (68% supercritical, 20% ultra-supercritical),

~20 GW de-commissioned in 5 years

**Simultaneous 500 GW** renewables target by 2030 (~5 times 2021 capacity)



Around 750 million people have gained access since 2000

100% Village (600 thousand total) completely electrified by 2019

**Access and Affordability of electricity to all are major issues**



**Agriculture sector** is the main source of non-CO<sub>2</sub> emission (CH<sub>4</sub> and N<sub>2</sub>O) (14% of total national GHG emissions in 2016)

Difficult to mitigate these gases from agriculture, sub sustenance, poor and marginal farmers



15% of CO<sub>2</sub> emissions in 2016 were removed by the **LULUCF sector** (forestland, cropland, settlements)



# India's First NDCs (2005-2030)

1. To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
2. To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
- 3. To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level.**
- 4. To achieve about 40 per cent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).**
- 5. To create an additional carbon sink of 2.5 to 3 billion tonnes of CO<sub>2</sub> equivalent through additional forest and tree cover by 2030.**
6. To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
7. To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
8. To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.

# India's Second NDCs (2005-2030)

1. To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
2. To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
3. **To reduce the emissions intensity of its GDP by 45 per cent by 2030 from 2005 level.**
4. **To have 500 GW of renewable power generation capacity by 2030.**
5. **To achieve about 50 per cent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).**
6. **To Mitigate 1 billion tonnes of CO2 equivalent by 2030.**
7. **Indian railways to become Net Zero by 2030.**
8. **India to become Net Zero by 2070.**

**Climate Finance should be enhanced from US\$ 100 billion 2020-2025 to a trillion US\$ by developed countries. Climate Finance commitments should be monitored.**

**Initiatives already launched by India – ISA (with France), CDRI, One Sun-One World-One Grid (with UK)**



# Development priority, India still raising its ambitions

Mapped more than 150 climate related policies – more 60% were announced post Paris

	Measures	Pre-Paris	Post-Paris
<b>Power</b>	National Solar Mission Renewable Energy  Retirement of Coal Plants T&D Losses reduction	20 GW by 2020 100 GW of Solar by 2020  No initiative No scheme was present	100 GW by 2022. 175 GW by 2022 and 450 (announced in 2019), now 500 GW (announce at COP26) by 2030. 170 thermal generation units retired by 2018. Ujwal Discom Assurance Yojana (UDAY) scheme, reduce losses to 15%.
<b>Industry</b>	Perform, Achieve and Trade (PAT)	PAT Cycle I (2012-13 to 2014-15) with 478 designated consumers (DCs) across 8 sectors	PAT Cycle II (2016-17 to 2018-19) with 621 designated consumers (DCs), across 11 sectors i.e. 3 new sectors (petroleum refinery, railways and DISCOM).
<b>Transport</b>	Electric Vehicle  Ethanol Blended Program  Metro Rail  Freight Rail  Road Construction Speed	No scheme was launched  5% Ethanol Blending  Metro rail coverage is limited to 4-5 major cities of India. No scheme.  ~11 km/per day	The number of electrified two-and three-wheelers has grown by more than 60% each year on average since 2015. 30:30 target 10% Ethanol Blending by 2022 and 20% by 2030  In 2020, over 650 km of metro rail was operational in 18 cities of India. Dedicated freight corridor: Increase freight rail share to 45%  ~28 km/per day
<b>Buildings</b>	Standards and Labeling programme LPG Connection  Green Buildings  Buildings Energy Efficiency Programme	It covered sectors such as air conditioners, ceiling fans, refrigerators, TVs No scheme was launched  No scheme was launched  No scheme was launched	Currently, the programme covers 26 appliances of which 10 appliances are under the mandatory regime. As on December 2020, a total of 287.4 million households have LPG connections (including PMUY beneficiaries). Green building footprint was 7.61 billion sq.ft. with total number of 5918 green buildings as on October, 2020 Building energy efficiency projects completed in 10,344 buildings including Railway stations and Airports till May 2020.
<b>Agriculture</b>	Neem Coated urea application Energy Efficient Pump Programme	No production of neem coated urea  Only 2209 pump sets have been replaced in pilot project at Solapur district.	Both imported and indigenously produced urea available in the country is neem coated since 2016. N2O emissions reduce by ~20%  74,136 pumps have been installed by EESL
<b>Waste</b>	Sanitation (Swachh Bharat Abhiyan)	No scheme was launched.	More than 6.2 million individual toilets and 0.59 million community and public toilets have been constructed.
<b>Water</b>	Micro-irrigation	Area covered under micro-irrigation was 7.73 million hectare till 2015.	Area covered under micro-irrigation was 8.7 million hectare till November 2019.



# Business, Industry, States, Cities Involvement

- More than 80+ **Indian corporates** have voluntarily announced commitment to the Paris Agreement (global target 2C, well below 2C, 1.5C)
- More than 15+ **Indian corporates Net Zero** targets over last 2 years including
  - Reliance Industries (RIL) to become net carbon zero by 2035
  - Adani Group RE for all data centers by 2030, Ports by 2025
  - Tata Power by 2050
  - Wipro (IT services major) by 2040
  - Dalmia Cement carbon negative by 2040
  - Mahindra & Mahindra by 2040
  - ITC only RE by 2030
  - Birla Carbon by 2050
  - Pepsico (India operations) by 2040
  - JSW Energy before 2050
- **35+ Indian corporates** have also announced **Internal carbon prices** ranging \$10/tCO<sub>2</sub>e (Tech Mahindra) to \$120/tCO<sub>2</sub>e (Wipro)
- **Five states** have committed to carbon neutrality.
- **13 Indian cities** have committed to net zero.



# Scenario Framework

## Current policy scenario (CPS)

- Extrapolates trends of ongoing and planned policies until 2050

## Two deep decarbonization scenarios (DDS)

- Propose alternative visions of transformations consistent with the Paris Agreement to inform short-term policies and the revision of the Indian NDC

### ❖ **DDS1**

- Emphasizes on synchronizing development with deeper climate actions

### ❖ **DDS2**

- Ratcheting climate actions to move towards net zero emissions

# Stakeholder Engagement

November 2019

**National workshop I -  
Initial economy wide  
and sectoral roadmap**

January 2020 to October 2020

**Data collection at  
sectoral level and  
co-production**

2020

**Policy Engagement  
(Interim)**

1. Presentation of State's action towards emission reduction and CC
2. Rejuvenating climate actions
3. Energy Policy and Climate Change
4. Climate Policy and Governance - [Low carbon and climate resilient Gujarat]
5. Gender: Climate Change and urbanization in Gujarat

June 2020

**National Workshop II**

*Validate sector roadmap and results*

- 1. Transport:**
  - a. Energy-Environment-Economy Implications of Modal Shift
  - b. Risk and uncertainty assessment for Critical Railway Infrastructure due to impacts of Climate change.
- 2. Forestry:** Modelling: A tool to predict the future shape of forestry

2020 -2021

**Final Presentation and  
Feedback**

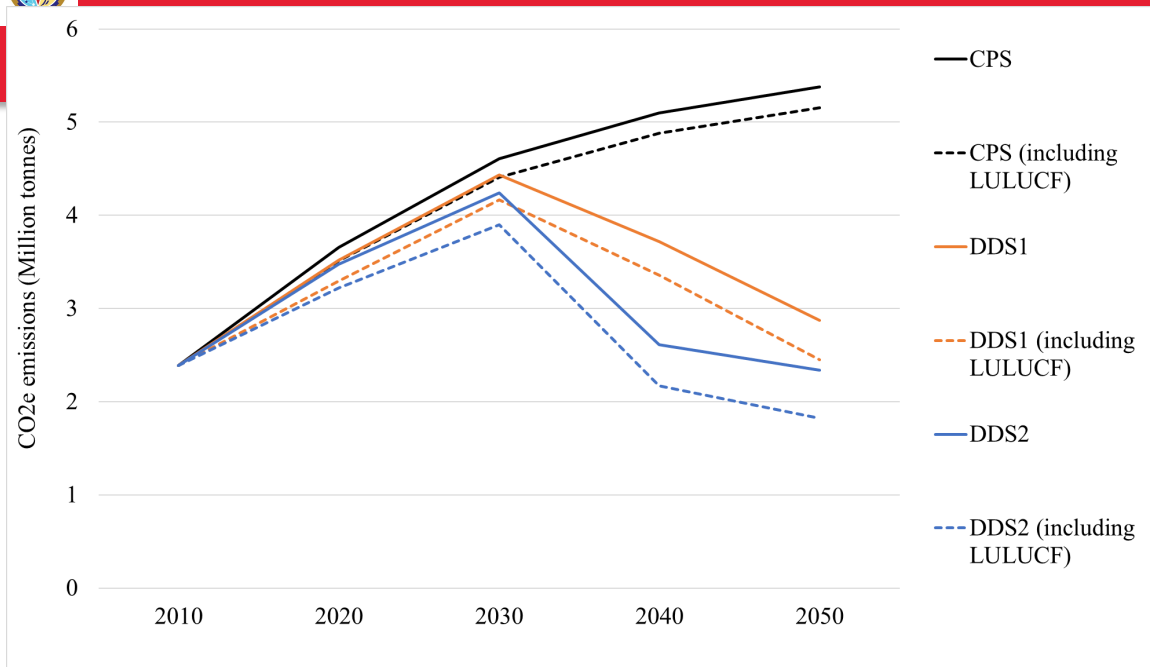
*Ambition report  
Country reports*

1. Co-benefits workshop, China (Dec 2020)
2. ONGC workshop (January 2021)
3. Virtual energy Forum (UNIDO) (February 2021)
4. The EU-India Climate Action: State of Play (April 2021)
5. EU-Business (coordinated by IDDRI) (April 2021)
6. Asia Pacific Climate Week (July 2021)
7. virtual Global Forum on the Environment and Climate Change organized by the OECD/IEA Climate Change Expert Group (CCXG) (September 2021)
8. IUCN-WCC Forestry event (October 2021)
- 9. DDP International Workshop (October 2021)**
- 10. COP26 (November 2021)**
- 11. Jeffries – Investor community (November 2021)**

## Targeted Stakeholders:

Federal Government representatives (MOEFCC, Ministry of Railways, MORTH and others), public sector agencies, Sub-national Government representatives in Gujarat, Kerala, and New Delhi, private players, ISRO scientists and engineers, Academia: IIT and NIT Professors and students

# GHG Emissions: Net zero by 2065-80?

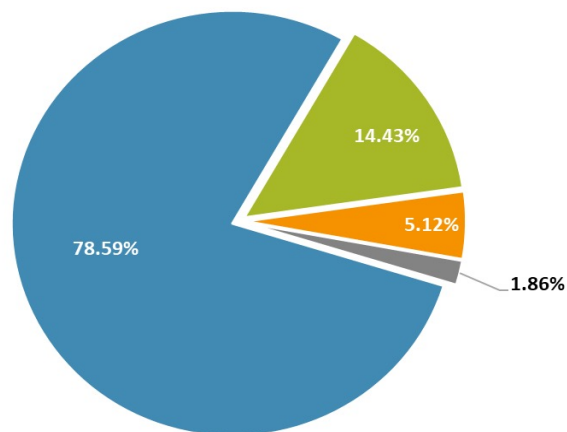


Scenario	Cumulative Budget	CO <sub>2</sub> /capita
<b>CPS (including LULUCF)</b>	142 136	3.1
<b>DDS1 (including LULUCF)</b>	114 104	1.66
<b>DDS2 (including LULUCF)</b>	98 86	1.35

Notes:

Carbon budget 2020-2050 in billion ton-CO<sub>2</sub>e. Ton CO<sub>2</sub>e/capita is for year 2050

Cumulative CO<sub>2</sub> budget: India needs room for development, results **within range of global models**.



## Cumulative CO<sub>2</sub> budget reduction 2020-2050:

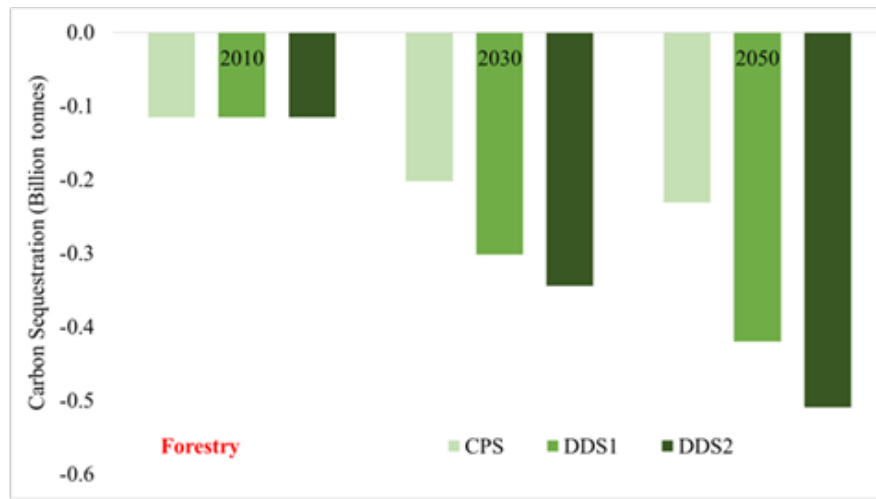
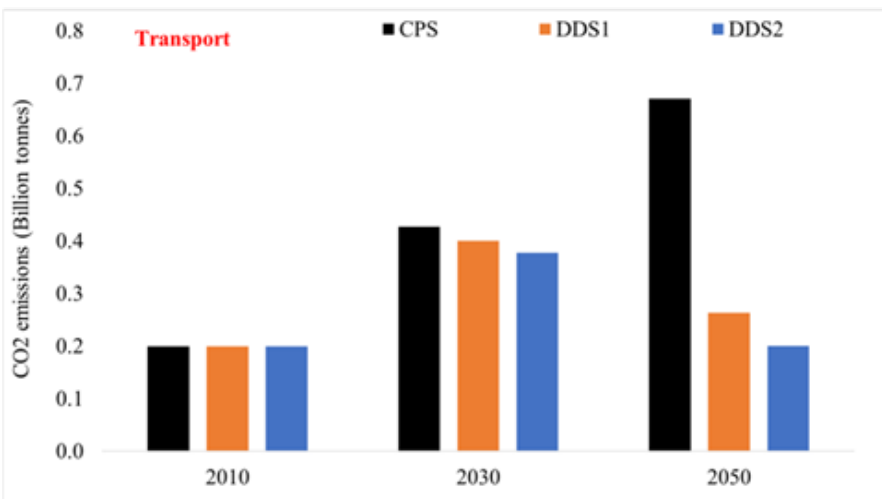
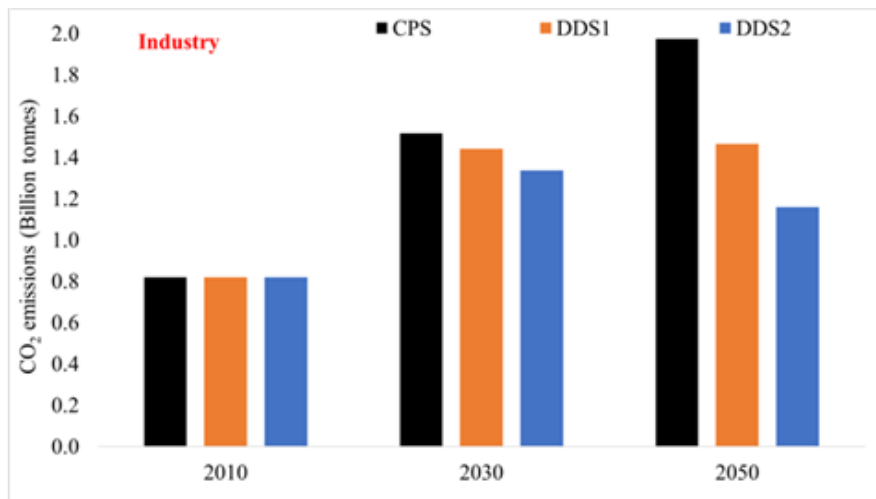
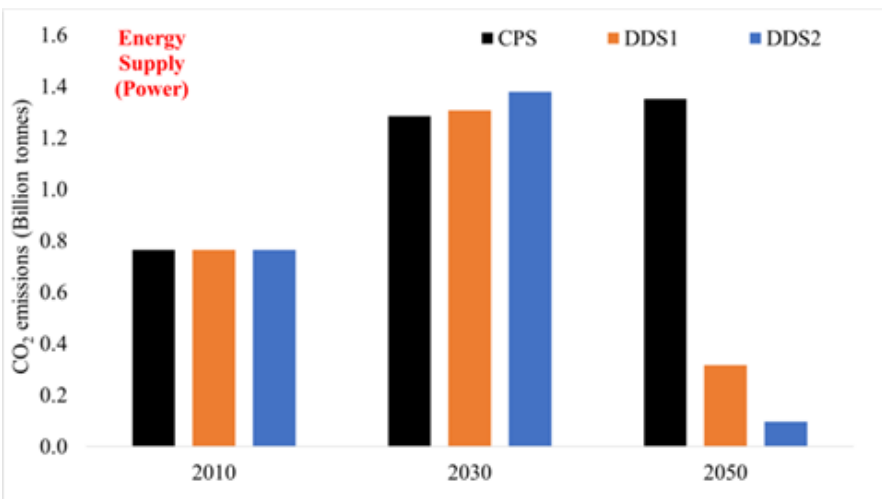
CPS to DDS1 is upto **28 bt-CO<sub>2</sub>**

including LULUCF, it will be upto **32 bt-CO<sub>2</sub>**

CPS to DDS2 is upto **44 bt-CO<sub>2</sub>**

including LULUCF, it will be upto **50 bt-CO<sub>2</sub>**

# Sectoral Emissions and Carbon Sinks



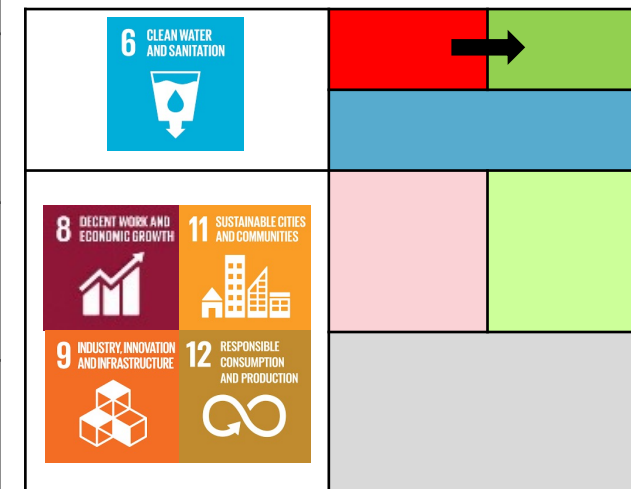
- **Power sector** : Responsible for maximum reduction due to EE (advanced technologies), renewables and CCS
- **Industry**: EE is responsible for reduction; demand reduction and CCS in cement, steel responsible for reduction in 1.5 °C
- **Building and Transport**: EE, technology substitution, fuel switch, modal shift, behaviour change (public transport, WFH)
- **Forestry**: Afforestation, reforestation, TOF, Increase in density of existing forests, soil carbon sequestration

# Non-Climate Objectives



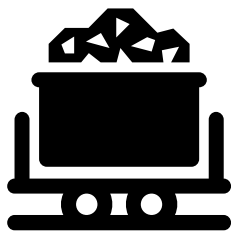
SDG	Power	Industry	Transport	Agriculture	Forestry	Comments
<b>13</b> CLIMATE ACTION						<b>High synergy.</b> The synergies will be cross-sectoral. As stated earlier, India's NDC integrates climate change mitigation and adaptation measures into its national policies, strategies and planning. <b>[NDC 3]</b>
<b>7</b> AFFORDABLE AND CLEAN ENERGY						<b>High.</b> SDG sub-targets complement the NDC goals for renewables and energy efficiency. <b>[NDC 3, 4]</b>
<b>15</b> LIFE ON LAND						<b>High.</b> SDG sub-targets complement and are synergistic with NDC goals in agriculture and forestry sector. <b>[NDC 5]</b>
<b>3</b> GOOD HEALTH AND WELL-BEING						<b>High.</b> Achievement of NDC targets will lead to improve local air quality.
<b>16</b> PEACE, JUSTICE AND STRONG INSTITUTIONS						<b>High.</b> String institutions are required for timely implementation of policy instruments. <b>[NDC 8]</b>
<b>17</b> PARTNERSHIPS FOR THE GOALS						<b>High.</b> Majority of the technological solutions (EV, hydrogen, CCUS) require strong international collaboration. <b>[NDC 8]</b>

## Moderate synergy



	High synergy
	Moderate synergy
	Neutral
	Moderate trade-off
	High trade-off
	Model Analysis
	Out of model analysis
	Not Applicable

# Policy, Actions and Challenges



## Coal

- Future of coal in each scenario hinges on how the development of power sector in the coming decades

### Challenges:

- *A minimum of 200 Mt of coking and non-coking coal imports*
- *Stranded assets in the form coal investments already made (e.g. mines, transport, jobs)*



## Power

- Sectoral deep decarbonization (carbon neutrality) is significantly dependent on decarbonized electricity
- Nuclear could play a big role in replacing coal based base-load power.
- CCUS could be to start tapping into near-term opportunities; for long term negative emission technologies like BECCS and DAC

### Challenges:

- *Early action in the current decade will determine the cost of transitions in long-term lock-ins*
- *Grid integration, flexibility, battery cost (production, critical minerals)*
- *Stranded assets in the form coal investments already made (e.g. plants, mines, transport, jobs)*

# Policy, Actions and Challenges (2)

## Industry

- Interventions include deepening and widening energy efficiency at sectoral (addition of new sector) and ownership level (LPS to MSMEs)

### Challenges:

- *Industry will be one of 'hard to abate' sectors'. Mitigation action implemented by large plants in energy intensive industries will not be enough.*
- *Need CCUS; however there considerable amount of uncertainty of storage potential for CO2 sequestration.*
- *Production, storage and transport of hydrogen*

## Transport

- Interventions in urban transport such as urban transit infrastructure, metro rail projects and green mobility technologies along with the behavioural shift towards clean, convenient and affordable transport options
- Sustainable freight transport options including multimodal logistic parks, dedicated freight corridors, efficiency improvement, biofuels and electrification

### Challenges:

- *Infrastructure, anxiety stress, battery cost (production, critical minerals)*
- *Feasibility of biofuels*
- *Multimodal approach to freight transport that integrates all modes of transport*
- *Electric mobility for freight would also require technology advancement*



# Policy, Actions and Challenges (3)

## Forestry

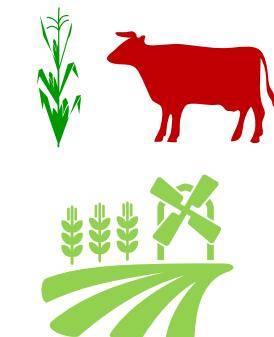


- Agro-forestry, Afforestation and Reforestation especially reforesting degraded forestlands present as one of largest mitigation opportunities for India till 2050
- Increasing soil carbon in croplands presents a win-win scenario for improving yields and food security as well as for climate change mitigation

### Challenge:

- *Developing and maintaining carbon sequestration, given India's high population, and livestock density as well as under emerging threat of climate change*

## Agriculture



- Agriculture is India's hard-to-abate sector (~18% of GHG) that needs specific attention from policymakers for not only mitigation actions but also from impacts, resilience building and climate change adaptation perspective
- Developments: Nano-urea, hybrid cattle, crop yield increase, organic farming

### Other challenges

- *Vulnerability of low income and rural population to climate change induced disasters*
- *Impact of global and local financial crisis*
- *Impact of future pandemics*



# Overall Investments

India puts in about **USD 100 billion each year** for climate adaptation and ring-fencing its population and systems. This is **likely to touch USD 300 billion by 2050**.

In accordance to Article 9 (paragraph 3) of the Paris Agreement, the developed countries need to provide **financial assistance to developing countries of USD 100 billion annually till 2025**, and much more beyond 2025 to the green climate for both mitigation and adaptation actions.

- Power Sector
- **Enhanced NDC**: Averaging around US\$ 246 billion per year during 2021-2030 (Total ~ US\$ 2.46 trillion)
- **1.5 °C compliant**: Average projected to be US\$ 224 - 364 billion per year during 2021-2030 (Total ~ US\$ 2.2 - 3.6 trillion)
- **Net-Zero by 2050**: Average projected to be US\$ 224 - 410 billion per year during 2021-2030 (Total ~ US\$ 2.2 - 4.1 trillion)
- **Net-Zero by 2065**: Average projected to be US\$ 168 - 196 billion per year during 2021-2030 (Total ~ US\$ 1.7 - 2 trillion)
- **Net-Zero by 2075**: Average projected to be US\$ 140 - 168 billion per year during 2021-2030 (Total ~ US\$ 1.4 - 1.7 trillion)

Power sector and all other sector investment needs are almost equal

# Key International Enablers

- ❖ India will not be net zero by 2050 under any scenario.
- ❖ For the world to be net zero by 2050, the developed countries therefore need to have ambitious plans to be net-negative energy systems. Additionally, more work is required on the management of carbon sinks (natural and geo-engineered).
- ❖ Need to involve multi-national/transnational businesses and industry in climate change discussions and actions (for technology transfer, financial investment and capacity building).
- ❖ Some of the top Indian businesses have committed to become net zero and internalize carbon price gradually, but it must be an international consolidated expression by large businesses.
- ❖ International support and facilitation is required to create a vibrant carbon market in India, and link it with other carbon markets around the world. This will enhance economic efficiency of GHG mitigation all over the world. **The Paris agreement Article 6 covering Internationally Transferred Mitigation Options (ITMOs)** could also be a relevant mechanism for this.

# Key International Enablers (2)

- ❖ **Coal is a global concern** with 12 countries (China, India, USA, Germany, Russia, Japan, South Africa, South Korea, Poland, Australia, Turkey and Indonesia) accounting for 88% of global coal consumption.
- ❖ There must be a global solution for coal phase-out, including technology and financial transfers.
- ❖ Individual coal-dependent countries, especially developing countries, would be concerned with their **energy security and economic-social-political compulsions and may continue with coal**.
- ❖ Developed countries and **India will need to collaborate for incentivizing** solar (power, building), wind (power), BECCUS (power, industry, agriculture), and green hydrogen fuel transformation (industry, transport) technologies in the next 2-3 decades.
- ❖ India has bilateral S&T cooperation agreements with 83 countries. **Technologies are required to upscale DDS scenarios for even earlier net zero by India**.
- ❖ South-South collaboration is also possible between India, other developing and least developing countries especially in South East Asia and Africa for solar and bioenergy.



# Reflections – Solution spaces

1. Acknowledging that **climate action needs financing**.
2. Create a **common technology development pool** in which industrialized and developing countries are equal partners. These technologies should include battery storage for the power sector and for electric vehicles (EVs), CO2 capture utilization and storage (CCUS), hydrogen, advanced bioenergy and nuclear power. An important aspect for India is the question of energy security and making it clean. Coal is the mainstay of the Indian energy system.
3. Involving **business and industry** in climate change discussions and action.
4. Net-zero is for the basket of all **six GHGs and not CO2 alone**.
5. Bringing back the **adaptation discussion** to the table along with net-zero.



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