



India Towards Net Zero: Issues and Challenges

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India Demographic Trends

- India is the largest country in terms of population
- India had over 1.21 billion people (2011 census) and now it is 1.44 billion
- Level of urbanization increased from 27.81% in 2001 to 31.16% in 2011. Currently about 36% population is urban.

Decadal Growth Rate (2001-11)

- Urban – 31.8%
- Rural – 12.2%

Million plus Cities (UA in number)

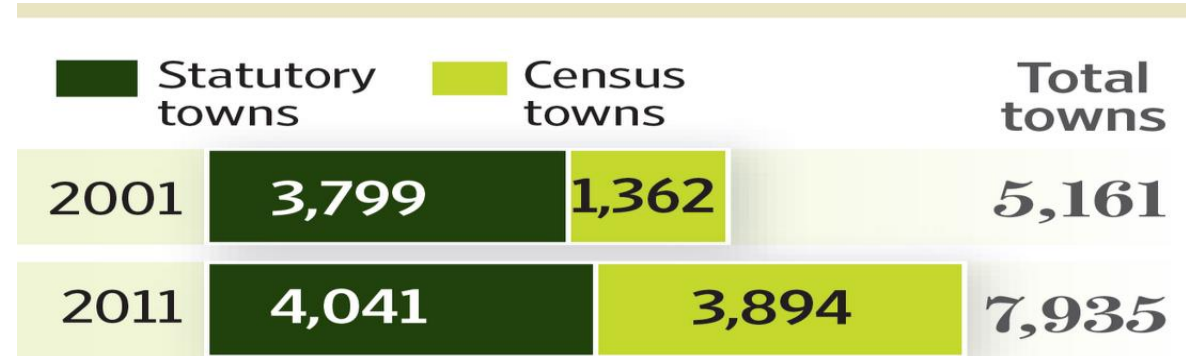
- 1991 – 23
- 2001 – 35
- 2011 – 53
- 2023 – 65



Million-plus Cities and Urban Agglomerations

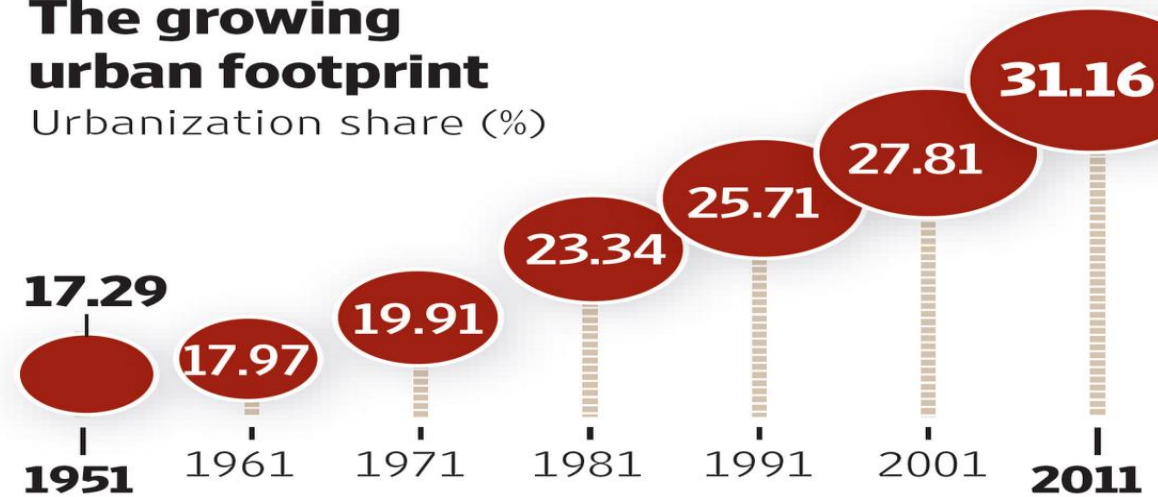
Challenge of Urbanization

- 33% of India's population living in urban areas - contributes 66% of India's GDP
- By 2030, urban areas are expected to house 40% of India's population and contribute 75% of India's GDP.
- **What is needed:** Comprehensive development of physical, institutional, social and economic infrastructure.
- **Goal:** Improving the quality of life and attracting people and investments to the cities. Setting in motion a virtuous cycle of growth and development.
- **Challenge:** Doing all the above with Emission mitigation due to climate change concerns
- **Solution:** Development with Climate resilience



The growing urban footprint

Urbanization share (%)



Source: Census of India

Rising Emissions Across the World and India



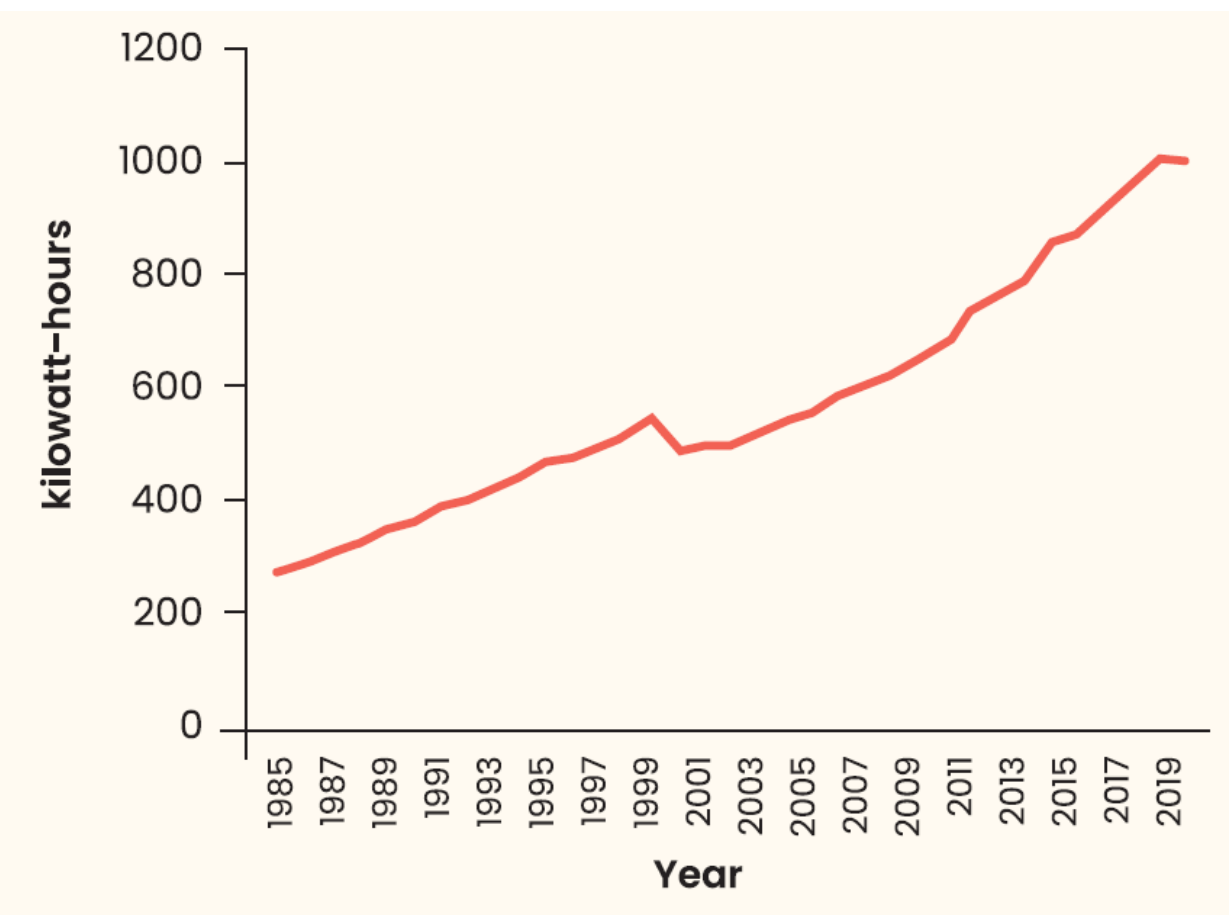
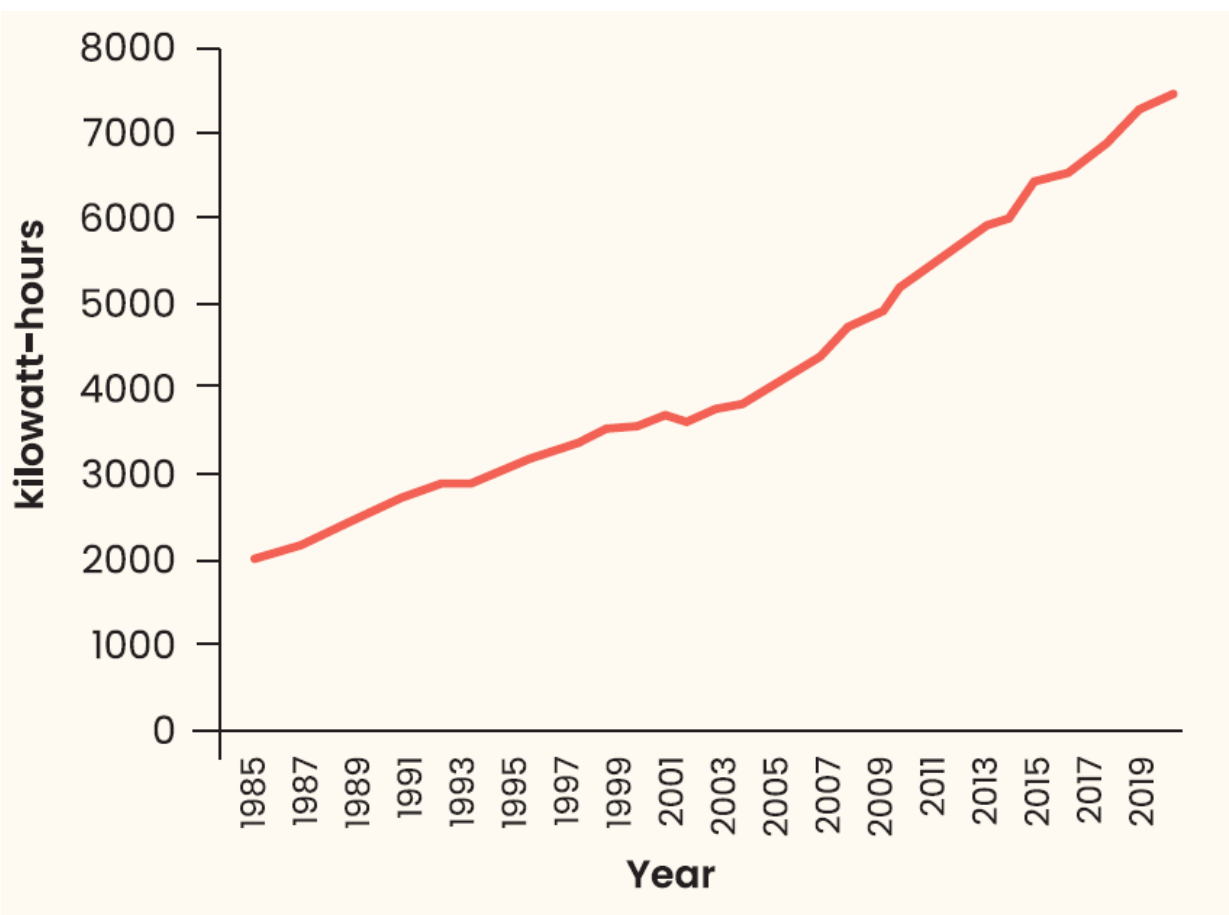
	Population Share (% of Global Population)	Share of Global Cumulative Emissions 1850-1990	Share of Global Cumulative Emissions 1991-2018
	2018	%	%
All Annex-I	18%	71%	46%
USA	4%	29%	18%
Canada	0.5%	2%	2%
Australia	0.3%	1%	1%
Japan	2%	3%	3%
Germany	1%	6%	3%
UK	1%	6%	2%
EU (28)	6%	25%	13%
Russian Fed	2%	7%	6%
All Non-Annex-I	82%	29%	54%
China	18%	6%	21%
Brazil	3%	1%	2%
South Africa	1%	1%	1%
India	18%	4%	5%

India Fossil Fuel Use

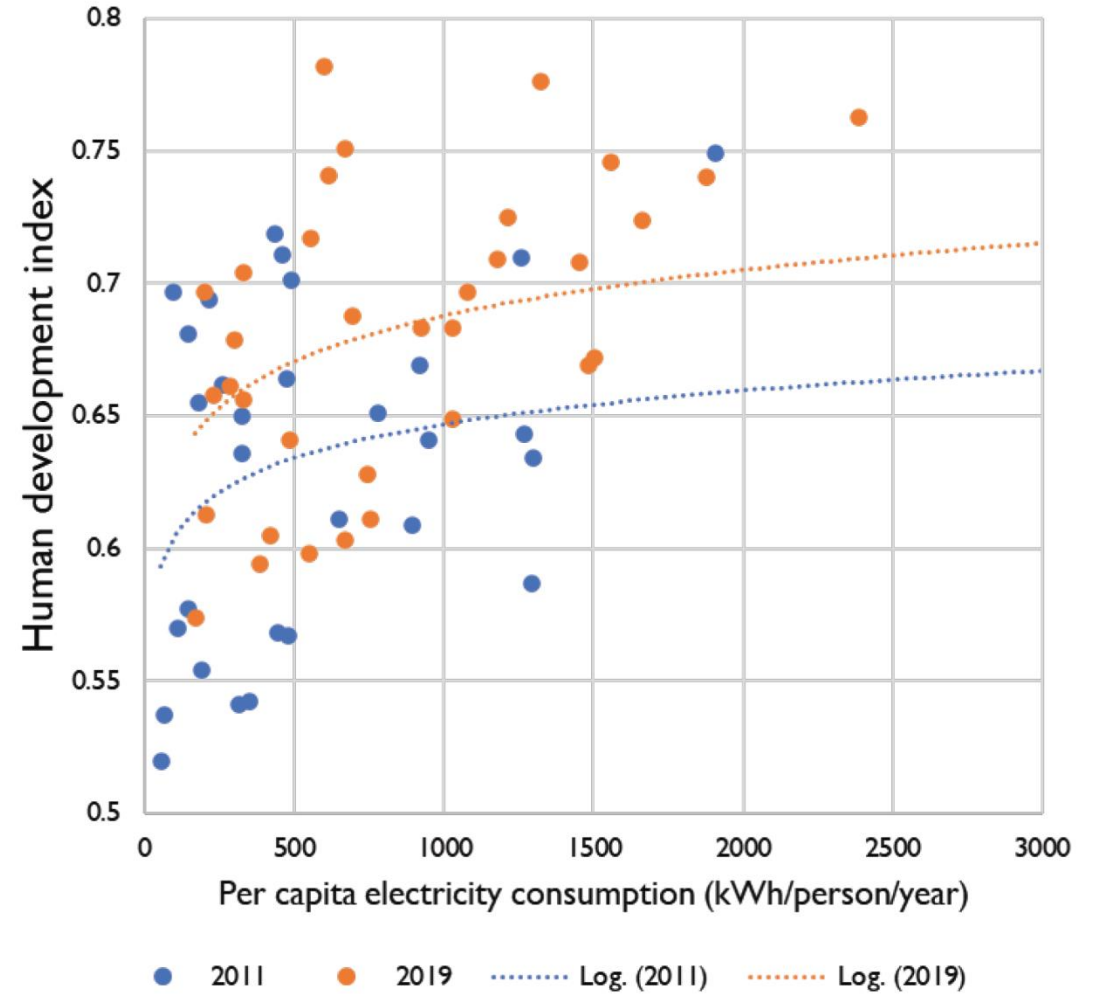
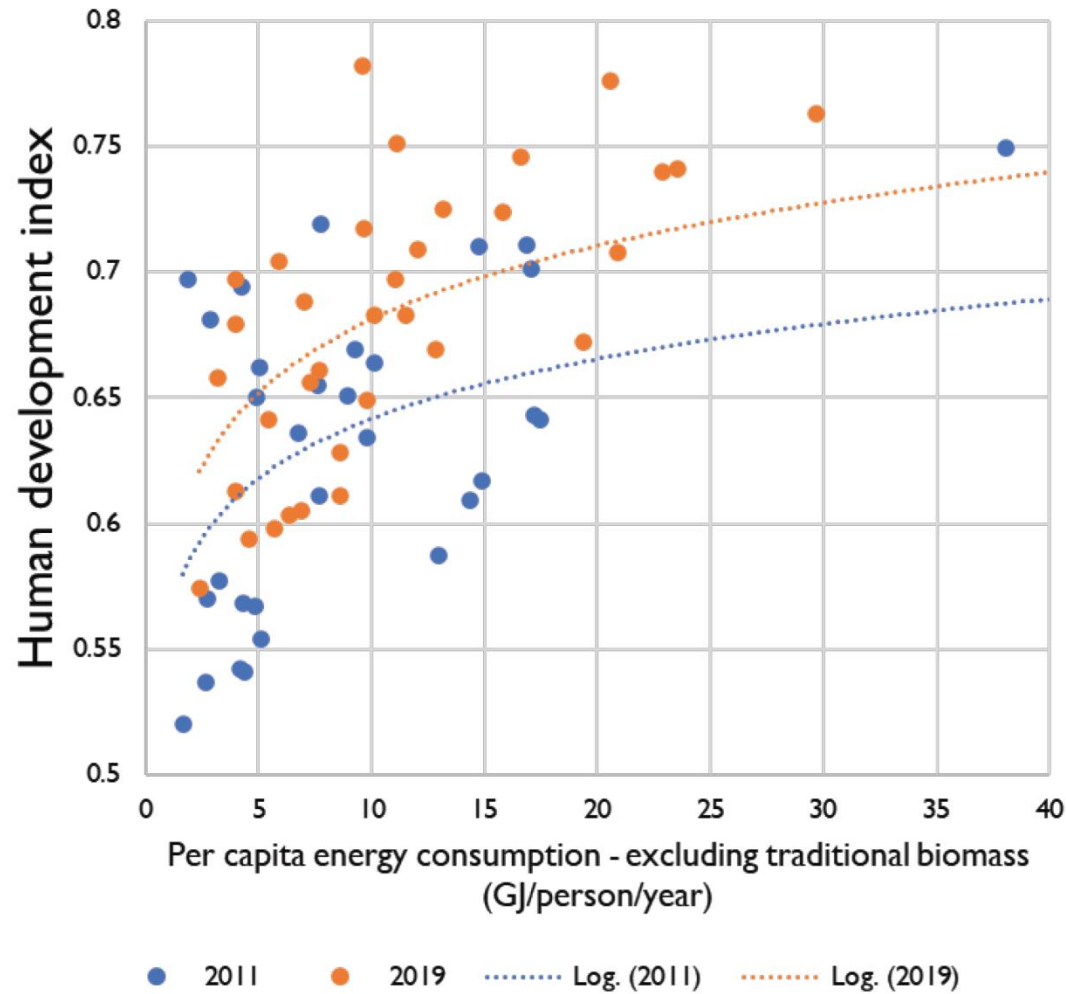


Per Capita Total Fossil Fuel Consumption (2018)	Coal Consumption (tonnes per capita)	Natural Gas Consumption (CM per capita)	Oil Consumption (Mt per capita)
USA	1.91	2.59	2.37
Germany	2.62	1.12	1.14
Australia	4.52	1.84	1.96
UK	0.20	1.20	0.89
China	2.70	0.20	0.42
India	0.73	0.04	0.16

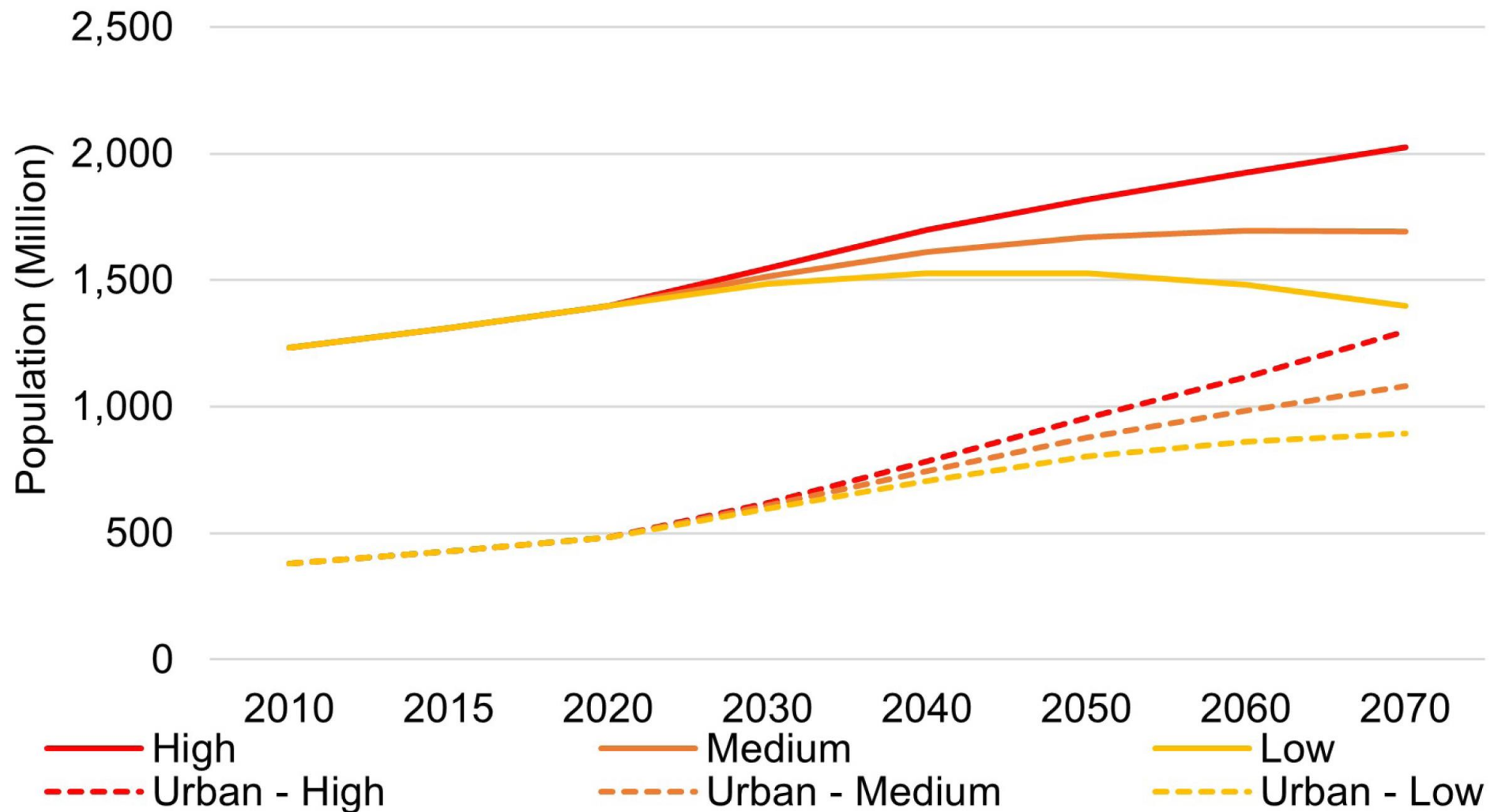
Per capita Energy and Electricity Consumption



State Level HDI and Energy / Electricity



India Population Trajectory

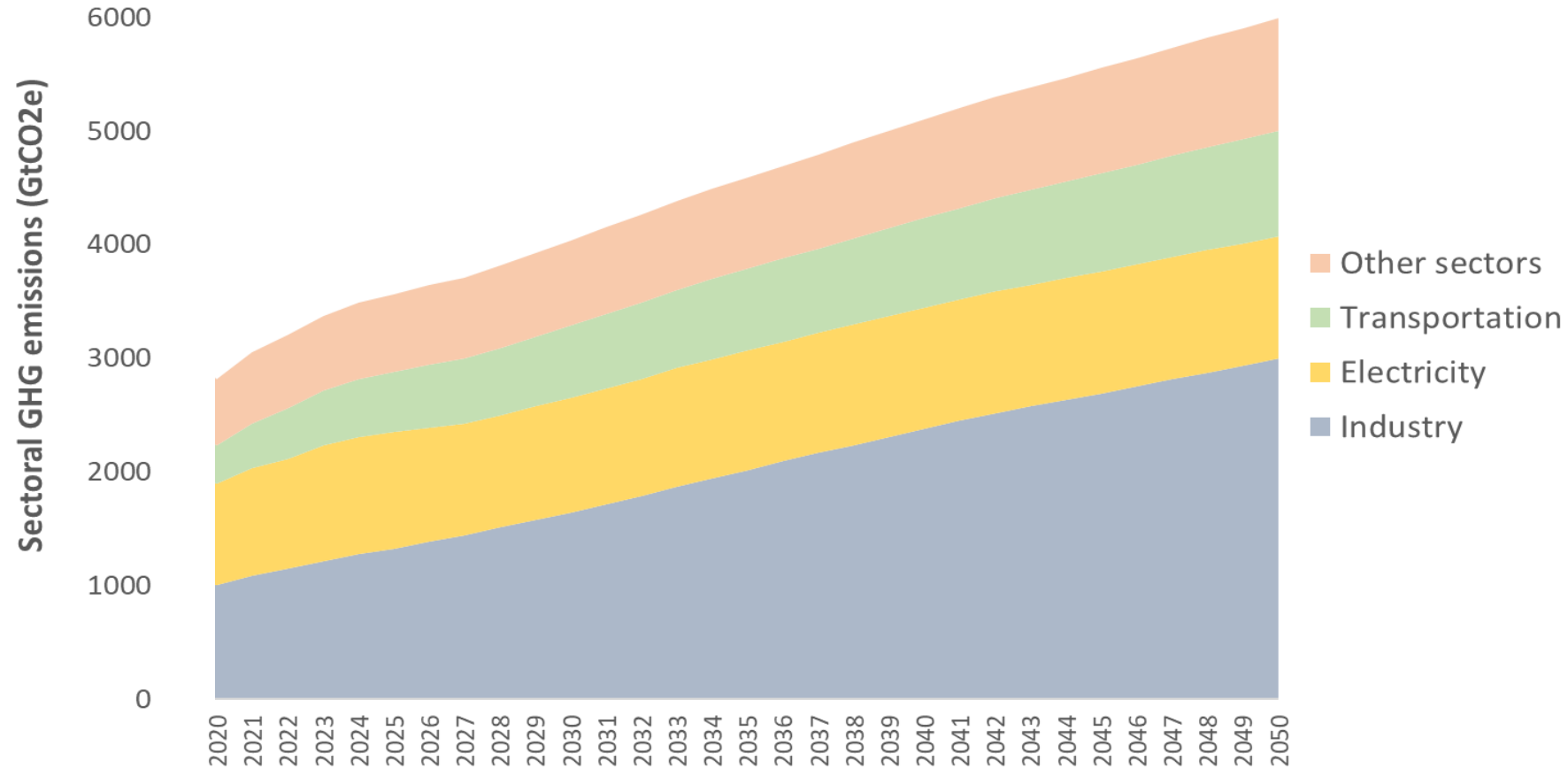


India Emissions Profile



- Energy: Largest contributor, accounting for approximately 70% of India's total GHG emissions
- Agriculture: Agriculture contributes around 16-17% of GHG emissions
- Industry: Industrial processes and product use contribute about 8% of total emissions
- Waste: waste sector, including solid waste disposal and wastewater treatment, contributes around 4-5%

Sectoral Emissions Trajectory

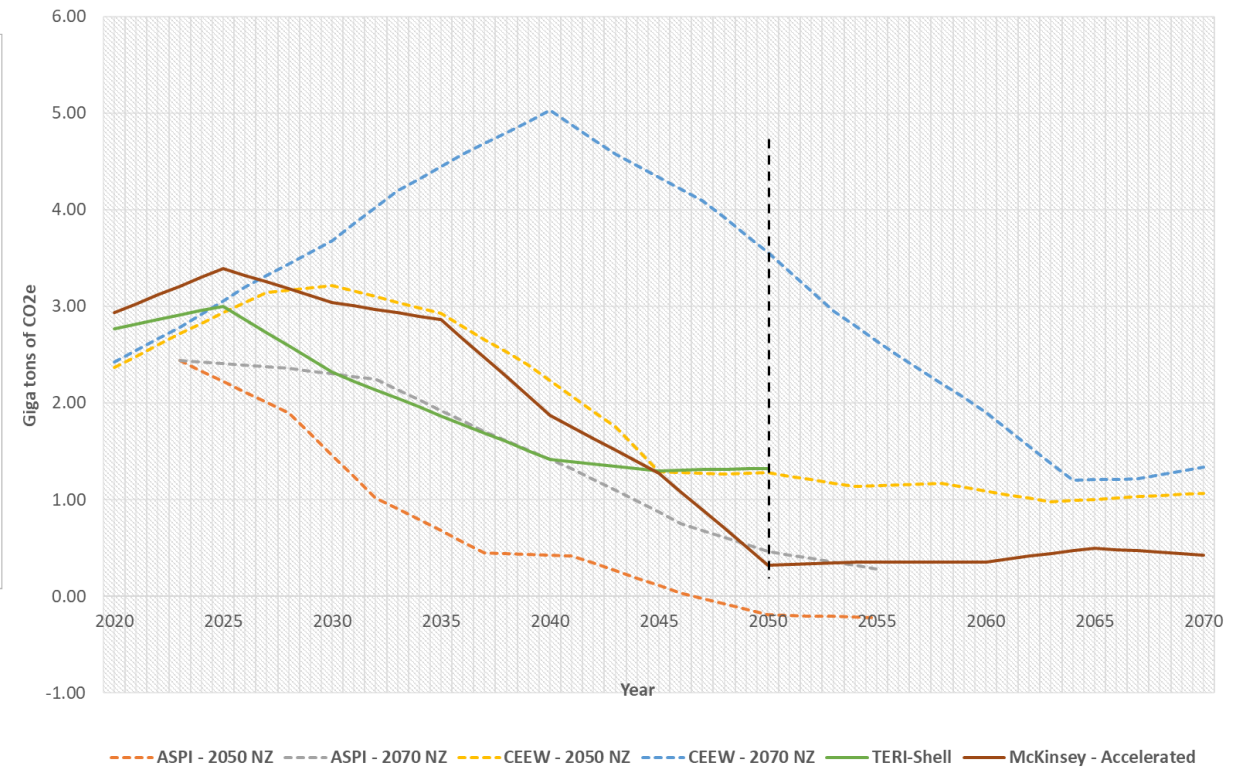
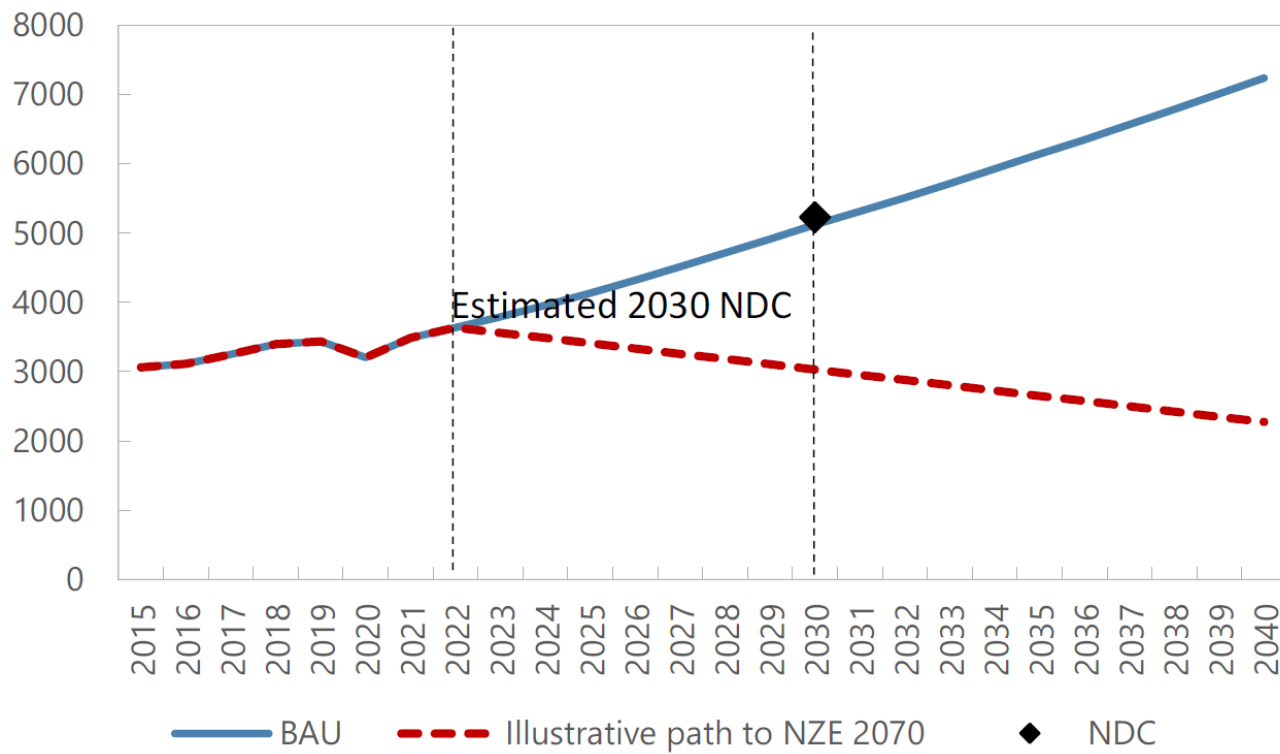


**Despite all the developmental concerns,
India has pledged it would achieve net-zero carbon emissions by 2070.**

India Emission Mitigation Targets

- India's commitment to address climate change is based on 'Panchamrit' strategy, a five-fold approach.
 - Non-fossil fuel energy capacity: pledged to achieve a total of 500 GW of non-fossil fuel energy capacity by 2030
 - Renewable energy share: 50% of its energy requirements will be met from renewable energy sources by 2030
 - Carbon intensity reduction: reduce the carbon intensity of its economy by 45% by 2030, compared to 2005 levels
 - Carbon emission reduction: to reduce its total projected carbon emissions by 1 billion tones by 2030.
 - Net zero by 2070: long-term goal of achieving net zero emissions by 2070

Net-zero Scenarios Across Modeling Studies



For discussion only
 Compiled from various sources
 With due credit to various studies

Four Independent Objectives to be Achieved



Emissions reduction

Reducing emissions of greenhouse gases¹



Affordability

Ensuring that energy, materials, and other products remain affordable and cost competitive with traditional alternatives

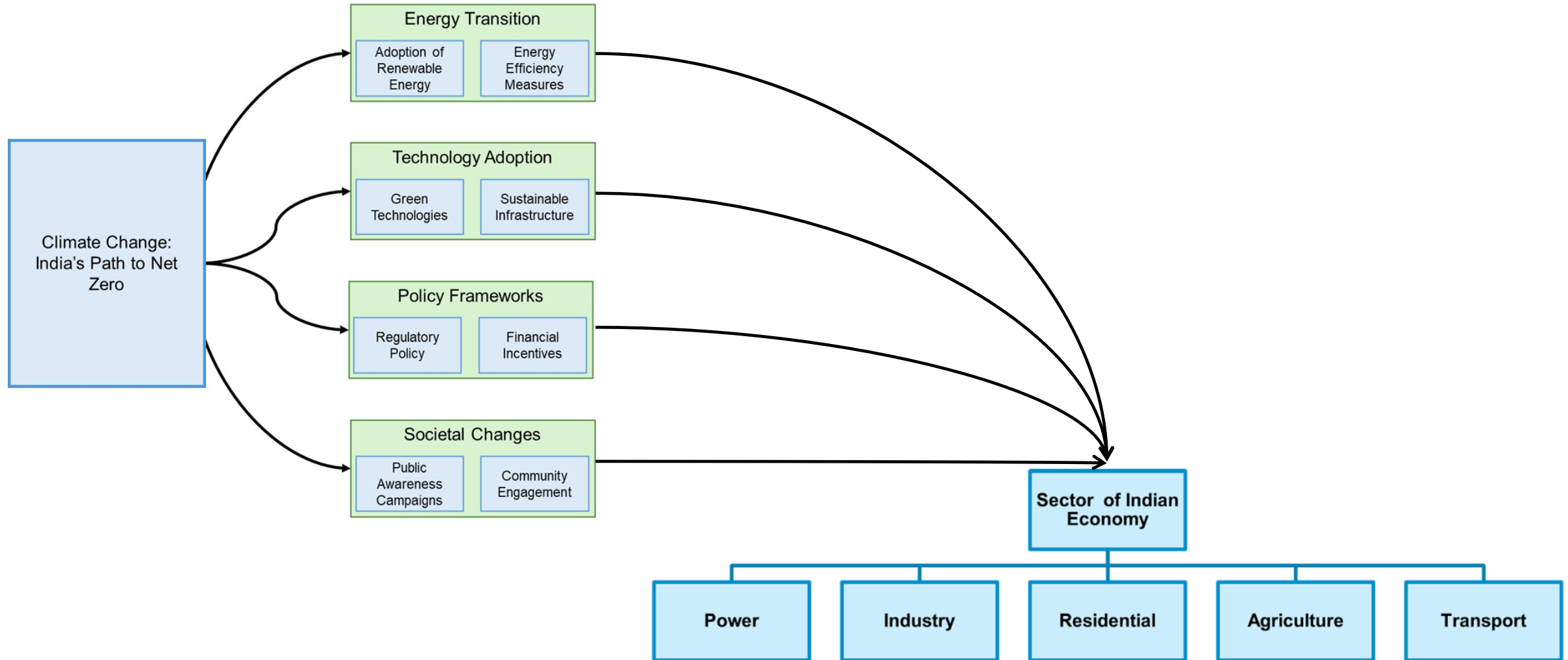
Industrial competitiveness

Ensuring that individual countries, regions, and companies remain competitive and benefit from opportunities during the transition

Reliability

Ensuring that energy, materials, and other products are supplied securely during the transition and that energy systems are resilient

Path to Net Zero



Power Sector (Issues, Actions and Challenges)



Issues

- Low per capita energy consumption. One third of the world's average
- 40% CO₂ emissions from electricity with heavy reliance on coal 50% of the installed capacity.

Actions

- Renewable Purchase Obligation and Renewable Energy Certificates
- Green Access Policy, 2022
- National Mission for High efficient PV
- Development of Mega and Ultra Mega Solar Parks

Challenges

- Delaying action on reducing the use of fossil fuels in the power sector will be costly
- debt-distress of state DISCOMs
- Given India's energy needs, substantial decarbonisation is difficult

Industry (Issues, Actions and Challenges)



Issues

- Less energy efficient than equivalent sectors in other countries
- metals, minerals, machines, and rubber and plastics
- industrial sector will need to grow for India's desired development trajectory

Actions

- Perform Achieve Trade Scheme
- Energy Conservation Building Code
- Green Hydrogen
- National Motor Replacement Program
- Standard and Labelling

Challenges

- capital-intensive nature of the sector and stranded assets problem
- likely need to include demand management measures

Residential (Issues, Actions and Challenges)



Issues

- Ensuring 24-hour reliable access to electricity for all citizens
- Solid biofuels (e.g., wood) is the most common source of fuel in rural India
- Regional and Urban Rural disparity

Actions

- Unnat Jyoti (Affordable LEDs)
- Street light programme
- Econivas Samhita
- Municipal Energy Efficiency Programme
- Building Energy Efficiency Project
- Super efficient AC

Challenges

- Need to boost living standards
- Due to lack of finance and high cost retrofits to residences and new appliances out of reach for many households
- cross-subsidization in India's electricity market

Agriculture (Issues, Actions and Challenges)



Issues

- Given food security needs agriculture exempted from energy intensity reduction
- Demand for electricity by the agriculture sector is usually met at night. This may need to be changed.
- Fertilizer use and residue burning (nitrous oxide)

Actions

- Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (Energy Security for Farmers)
- Sustainable Agriculture Mission on use of Residue in Thermal Power
- National Livestock Mission

Challenges

- Subsistence farmers face high rates of poverty
- Subsidies may distort farming practices
- Trust-deficit and lack of awareness impair wide adoption of mitigation-oriented solutions

Transport (Issues, Actions and Challenges)



Issues

- largely oil-dependent transport sector
- Fuel and emissions are highly specific to the mode of transport
- vehicle ownership rising very fast with increase in population and real incomes

Actions

- Faster Adoption and Manufacture of (Hybrid and Electric Vehicles (FAME)
- Corporate Average Fuel Economy (CAFE)
- 100% Railway Electrification
- Bharat-VI emission norms
- Production Linked Incentive Scheme for Advanced Chemistry Cell

Challenges

- transition enabling policies are focused on road passenger vehicles
- with rising income, the demand for domestic air travel will increase
- pace of deployment of support infrastructure for EV



Future Path to Net Zero

- Under current policies, India's GHG emissions are still on an upward trajectory
- When to peak is a difficult decision
- Moving away from fossil fuels not easy due to heavy dependence on coal
- Non availability of funding and suitable technologies within India
- Making sure that growth is fair and equal and that the poor are not affected
- Balancing energy poverty, sustainable development, and effective climate change measures due to regional disparity

Major Findings and Conclusions

- Need to set concrete sectoral targets and short-term trajectory milestones and long-term targets (Time line)
- Transforming Energy Sector is necessary. Rapid and green electrification with focus on transmission, distribution and storage improvement as electricity sector offers required flexibility (Alternatives needed)
- Coal continuance seems inevitable. Options including CCSU are a must. (Research)
- Invent new methods of transition due to unique situation (Practically difficult)
- Differentiating Regional and Urban-Rural is required for just and equitable development (Equity)
- Focus on Social and developmental realities (Poverty and Justice)
- Fund research and development specific to India. International cooperation for funding and technologies. (Developed or developing)
- Strong Policy and Regulatory Framework. (Political will)
- Behavioural Change and Public Awareness. (Public Participation)

Bottom Line: Net-zero by 2070 target of India appears optimistic in present circumstances but it is worthwhile to go on this path due to other likely benefits.

References



This presentation is compiled from many sources for discussion purpose

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Thank you..

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