Policy has a fundamental role in driving the energy transition and making the transition to a net-zero emissions energy system technically possible in India by 2050.

are oriented around it. But the energy transition will also create new regional opportunities for other lower-carbon energy sources and technologies, such as in the renewables-rich regions of the south and west. The implications of these changes at the sub-national level will be far-reaching, both challenging existing industries and presenting opportunities for new industries to grow and add jobs. Diversifying the economy away from fossil fuels and seizing opportunities in the new lower-carbon energies will be essential for all regions and states to play their part in enabling the national transition.

As the world moves towards achieving the goal of the Paris Agreement, it will be important to ensure communities are resilient to future climate impacts, such as a rise in sea level, through investment in adaptation in affected areas. Making progress in the energy transition will require ensuring these communities benefit equally from climate mitigation and the adaptation opportunities presented by the energy transition.

The energy transition provides an opportunity to create a more prosperous and equitable society and deliver a cleaner environment for everyone. Low-income and marginalised areas tend to overlap with high pollution levels, whether disproportionately hosting potentially toxic industrial and waste facilities or being affected by the health impacts of poor air quality, indoor and outdoor. Women in these communities are likely to be most affected through environmental impacts on their health and fertility.[37]

Successfully managing the economic and social impacts will be critical for a smooth and rapid transition to net-zero emissions in the next 30 years. It will require all levels of government to advance policies that ensure all states, regions and income groups are able to participate in and manage the energy transition. Well-designed policies at the national and sub-national level are required to keep overall macroeconomic costs manageable, to address transition challenges and fully harness the opportunities the transition presents and to ensure more resilient and environmentally just outcomes for the most vulnerable and under-served communities.

A comprehensive, coherent and credible policy framework to support the energy transition

Climate change has been called the result of the greatest market failure the world has seen.[38] Markets alone will not deliver the change required in the time available. Policy has a fundamental role in driving the energy transition and making the transition to a net-zero emissions energy system technically possible in India by 2050. It can speed up technology development, commercialisation and diffusion and it can improve the economics of low-carbon goods and services. Policy can also help to progress the building of the necessary infrastructure. Finally, policy is central to managing the wider economic and social impacts of the transition. The key elements of an effective long-term policy framework, covering the range of economic, sectoral and social policies are outlined in Box 2.

Box 2

ELEMENTS OF AN EFFECTIVE POLICY FRAMEWORK

Drive economy-wide change

1. **Set credible and robust decarbonisation targets and a clear trajectory for achieving them** to reduce policy uncertainty and incentivise necessary investments over time.
2. **Adopt economic mechanisms, such as carbon pricing,** to improve business and household energy efficiency, incentivise low-carbon choices as they become available and bridge the remaining cost difference to low-carbon fuels and technologies.
3. **Rewire the economy with low-carbon electricity** by investing in low-carbon generation, optimising system performance, expanding transmission and distribution networks, and investing in electrification infrastructure such as electric vehicle charging networks.

Accelerate sectoral transitions

4. **Encourage better coordination within sectoral value chains** for hard-to-electrify sectors in transport (aviation, shipping, heavy road freight) and industry (steel, cement, chemicals).
5. **Provide time-limited fiscal and financial incentives** to drive investment in and commercialisation of low-carbon molecules such as hydrogen and advanced biofuels.
6. **Create markets and demand for these low-carbon fuels** by, for example, sectoral carbon pricing, emissions performance standards and policy mandates.
7. **Support infrastructure planning and investment** to support the commercial adoption of low-carbon molecules.
8. **Establish governance for carbon removals** to establish both natural carbon sinks and carbon capture, utilisation and storage, particularly during the transition, to keep the world within its carbon budget and prevent overshoot.

Create societal support

9. **Create clear and predictable policies** that keep overall macroeconomic costs of the transition manageable.
10. **Adopt fair and equitable policies** that mitigate regional, sectoral and distributional impacts of the transition.
11. **Establish transparent and inclusive policies** that encourage wide societal innovation and participation in change.

While a comprehensive long-term policy framework is required to drive and sustain the energy transition over the next 30 years, India is not currently on a path to achieve a net-zero emissions energy system by 2050. To accelerate towards that goal requires early policy action this decade in five key areas.

To drive economy-wide change, greater electrification with renewable and nuclear generation is the backbone of the **NZE** pathway and will require accelerated action this decade.

1. **Expand and enhance electricity transmission and distribution networks**

   The electricity transmission and distribution networks must be expanded and enhanced to significantly electrify the economy, primarily with renewables. This includes connecting the renewables-rich regions of the country to demand centres; increasing the number of interconnections between regional power grids to improve reliability; improving network and smart grid capabilities to balance diverse sources of electricity supply and demand; and strengthening networks to support greater electrification of energy end use, such as EV charging.

   Policy plays a fundamental role to support investment in electricity infrastructure, for example: coordinating efforts across regions, states and municipalities (for example, the Green Energy Corridor[39] programme) to deliver integrated grid infrastructure, redirect existing investment and raise additional financing; reforming power distribution companies to ensure their financial viability; and driving wider electricity market reforms, such as location and time-of-day pricing, fair and open third-party access to transmission and distribution networks, and incentives for investment in grid-scale energy storage.

2. **Ramp up renewables investment**

   The transition away from coal will require increased investment in renewables and electricity market reform to accommodate the different characteristics of renewables[40] compared to thermal generation. While solar PV is close to grid parity with thermal generation, investment in renewable energy will continue to require policy support to bridge the remaining gap and provide revenue certainty for investors in the longer term once electricity generated from renewables becomes cost competitive. Policies will also need to incentivise investment to address renewable intermittency (through energy storage, backup generation and demand-side response). Mechanisms that can support investment include competitive auctions to procure efficient and reliable electricity and power purchase agreements based on system-wide requirements rather than specific types of generation.

> “The electricity transmission and distribution networks must be expanded and enhanced to significantly electrify the economy, primarily with renewables.”

To accelerate sectoral transitions, action will be required this decade, particularly in hard-to-electrify sectors.

3. **Increase the use of hydrogen and bioenergy to decarbonise hard-to-abate sectors**

   Hydrogen and lower-carbon production of biomass and biofuels will be required to decarbonise hard-to-electrify sectors, including steel and aviation. Moreover, developing India’s sustainable bio-resource potential can deliver significant benefits beyond the energy system, creating jobs and stimulating the rural economy to support environmentally responsible economic development.

Policy support such as fiscal incentives, research and development programmes and public-private partnerships will be necessary to accelerate the development of these fuels, spur technological progress and drive down costs. For example:

- Lower electrolyser costs combined with policies to support the development of new supply and demand could help reduce the cost of green hydrogen by more than 50% by 2030.[41] In addition, policies to incentivise and facilitate domestic production of electrolysers (for instance, as part of the Make in India[42] programme) could build India's competitive advantage in green hydrogen, meet domestic needs and capture a significant share of the growing global market.
- Developing the bioeconomy will require a systematic and coordinated policy approach to shift away from the open burning of biomass and support more efficient and cleaner uses of commercial biomass. Specifically, there is a need to combine federal and state policies to build on regional strengths, align public and private resources, incentivise local supply chains and take advantage of the different uses for bio-resources in decarbonising the energy system.

4. Develop a vibrant lower-carbon manufacturing industry

A vibrant lower-carbon manufacturing industry in India (e.g. new industrial processes and products, as well as lower-carbon vehicles, technologies and digital solutions) supports domestic decarbonisation, particularly for industry and transport. It also positions India as a market leader in this global growth industry.

This will require a clear and sustained industrial strategy based on a rising carbon