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Research Foundation



Mission 2070: A Green New Deal for a Net Zero India

WHITE PAPER

NOVEMBER 2021



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Foreword



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India is now on the path to net zero.

In the ongoing COP26 summit at Glasgow, Prime Minister Narendra Modi has committed India to an ambitious five part “Panchamrit” pledge. Four of these are specific goals for 2030: a) to reach 500GW of non-fossil electricity capacity; b) to generate half of all energy requirements from renewables; c) to reduce emissions by 1 billion tons from now to 2030; and d) to reduce emissions intensity of GDP by 45%. The fifth pledge in Panchamrit commits India to net-zero emissions by 2070. India’s five commitments are a critical foundation in the global pathway to achieving the ambitious 1.5°C global warming target.

This World Economic Forum, Kearney and Observer Research Foundation report details a “Green New Deal”, a possible roadmap for India’s net-zero transition by 2070. There is often a perception of inherent conflict between India’s two major transformations of the 21st century: first, its transformation from an agriculture and services

led economy to a more balanced economy with a thriving manufacturing sector; and second, its transition to a net zero economy. This paper presents a case for why a holistic green growth model is the optimal and synergistic way for India to successfully accomplish both these transformations.

The findings presented in this report are based on the combined qualitative and quantitative research by the Forum, Kearney, and the ORF teams and mark the beginning of a multipronged joint effort across the three organizations to catalyse climate action in key sectors of the Indian economy.

A Green New Deal for a net-zero India can save lives, catalyse entire new industries, create millions of jobs, drive trillions of dollars of economic value and provide a significant heft to India’s role in the frontline of the global war on climate change. The time to act is now and this report aims to decipher the road ahead and offer insights that encourage decisive climate action.

Executive Summary

India's transition to a net zero economy can save lives, catalyse new industries, create over 50 million jobs and contribute more than \$15 trillion in economic impact. It is time for a Green New Deal for India.

“ It is now time for a Green New Deal for India. The government, the private sector, investors, civil society organizations and individual citizens need to step forward and accelerate the Next Green Revolution.

India is at the cusp of two significant transformations. The first is its economic transformation. India will soon be the most populous country in the world – and will be home to one of the youngest populations in the world. The country is also home to a large population that lives below the poverty line. A rapid and equitable economic growth will be critical to meet the growth and lifestyle aspirations of 1.4 billion people. The manufacturing sector will need to grow to supplement the impressive services sector economy and cater to the large population living off the agrarian economy.

The second is its green transformation. India's per capita energy use today is lower than most nations, its use of materials such as iron is still modest, and its manufacturing sector is still relatively under-developed. Unlike developed nations with mature greenhouse gas (GHG) infrastructure, India is yet to build a lot of its GHG inventory. However, as India grows, so will its GHG footprint. While India's growth will need to factor in higher consumption levels across its population, it has a unique opportunity to leapfrog this journey through low/no emissions technologies.

In this paper, we build the case for why India's green transformation is an attractive, vital and mandatory component of its overall economic transformation. A Green New Deal for India will necessarily implicate the five sectors that contribute to almost all its GHG emissions:

Pillar 1 – Energy: The energy sector accounts for ~40% of India's GHG emissions, with coal being the dominant source of total fossil CO₂ emissions. Decarbonizing the energy sector is a foundational priority for India's energy sector and will require a three-pronged approach: replace fossil fuels with renewables; reduce fossil CO₂ emissions from legacy infrastructure through enhanced efficiencies; and remove unavoidable carbon emissions through carbon sequestration.

Pillar 2 – Mobility: The mobility sector is heavily reliant on oil and contributes to almost half of India's oil demand. A green transformation of mobility will need a shift in modal mix from road to rail, as well as a broad-based fuel diversification approach to encourage sustainable fuels (biofuels, CNG, LNG) in the immediate term, electrification in the medium term and hydrogen-based heavy mobility in the long term.

Pillar 3 – Industry: Manufacturing is a key contributor to India's GHG emissions, with the iron and steel, cement, and chemicals and fertilizers sectors having the highest CO₂ footprint. A radical decarbonization of these sectors will need demand-management measures such as circular economy acceleration; continued energy-efficiency improvements; electrification of heat; carbon capture, utilization and storage; low-carbon fuels such as biomass and hydrogen; and innovative technologies with non-fossil feedstock.

Pillar 4 – Green Buildings, Infrastructure and Cities: India's top 25 cities contribute more than 15% of its estimated GHG emissions. India's transition to greener cities, buildings and infrastructure will need a rethink of its approach to urban planning with a focus on transit-oriented urban development and an emphasis on low-carbon buildings and infrastructure construction.

Pillar 5 – Agriculture: The agriculture sector is the largest contributor to nitrous oxide (N₂O) and methane emissions. To reduce agriculture emissions, India will need a national campaign to empower, educate and enable more than 100 million farmers in adopting precision agriculture, sustainable animal husbandry and green energy.

In addition to the five sectoral pillars, India will need four cross-sectoral enablers for its green transition. These include an accelerated approach to green technology innovation, an overarching framework to catalyse green finance, an integrated approach to carbon, capture, utilization and storage, and a plan for climate adaptation.

Across the five pillars and the four enablers, we estimate that a Green New Deal for India could represent upwards of a \$15 trillion economic opportunity by 2070, with the potential to create more than 50 million net new jobs. With concerted action, \$1 trillion of this opportunity could potentially materialize within this decade.

In this context, we argue that it is now time for a Green New Deal for India. The government, the private sector, investors, civil society organizations and individual citizens need to step forward and accelerate the Next Green Revolution.

Introduction

India's green transition is no longer a drag on its growth. Instead, it will be the driver of growth for decades to come.

Since the Paris Agreement on climate change in 2015 there have been major changes to the context surrounding the global effort to combat climate change. Across the world, efforts towards “green new deals” have intensified — policy packages that combine measures towards decarbonization and adaptation with those that would increase livelihoods and create wealth.

In other words, there is a new expectation that the green transition will not be a drag on economic prosperity, but indeed the engine for an economic transformation that will increase inclusion and growth. Much of this updated ambition for the future is based not on changes in the political discourse but on technological and financial innovation that make the Paris promises seem relatively unambitious.

India's commitment at Paris represented a significant shift in its traditional approach to global climate negotiations; it reflected a new optimism about the country's growth path and its place in the world. Political leaders at both state and central levels have, since then, decided that investment in the green transition could create economic growth momentum that has been missing for some years.

This white paper will lay out a framework for creating green growth momentum in India. There are two horizons we have in mind: the short to medium term, to 2030; and the longer term, to 2070. We believe that if the drivers and enablers of growth we outline in this paper are kept in mind, India can leverage green growth to add \$1 trillion to GDP by 2030 – and a massive \$15 trillion by 2070.



1

India and Climate Change

India faces multiple challenges: recovery from the pandemic, climate pressures, a jobs crisis. Investing in a green development trajectory would address many of these at once.

India stands at a crossroads. It faces two transitions, one unavoidable and one aspirational. The unavoidable transition is the demographic bulge. This generation of young Indians will need employment and a path to prosperity, and India's success in delivering livelihoods to this generation will determine whether it emerges from the 21st century a middle-class nation. If India's high growth moment is postponed, then the demographic algebra turns adverse: the country will first grow restless and then grow old before it grows rich.

The aspirational transition, meanwhile, is urbanization and formalization. Indians have voted with their feet, choosing to transform the country into an increasingly urban space, with urban patterns of consumption and production spreading across the country — alongside the desire for formal, reliable employment.

In parallel with these two transitions, India faces two emergencies: one that is immediate, and one that is era-defining. In the immediate future, the country — which has been significantly hit by the COVID-19 pandemic — must plan for its recovery and rebuilding. India is on the frontline of the second emergency, climate change. More Indians are exposed to the negative effects of climate change and extreme weather events than any other nationality. And India's development choices are the most crucial determinant of whether the world will meet the challenge of keeping global temperature rises below 1.5C or even 2C.

These two transitions and two emergencies interact in problematic ways. The jobs and livelihoods imperative is strong and urgent and the country has to offer a decent livelihood to its young population for its stability and prosperity. In an earlier time, this may have been met through carbon-intensive industrialization, but that path is not available today as both global capital and technology-led innovations have identified new pathways. Urbanization and formalization of the economy have also traditionally been associated with an increase in carbon-intensive consumption and production. Meanwhile, government finances are struggling to help craft a post-pandemic recovery and the fiscal space available for catering to other challenges

remains constrained. How can the livelihood aspirations of the youth, the ambitions to control and lower emissions and the unavoidable reality of adapting to a warmer climate be managed?

The complex interaction of the two transitions and the two emergencies complicates any attempt to produce a simplistic forecast on economic trajectories or indeed any commitment about future emissions. However, one fact is clear. India needs to mobilize large and sustained flow of domestic and global capital for its sustainable development and climate ambitions, and it needs to present itself as the best chance for the world to respond to both the Sustainable Development Goals 2030 and global warming and climate change. India must see in these two endeavours an opportunity to attract capital that will also accelerate its post-pandemic recovery.

From a global perspective, India's choices will determine the world's success or failure on climate change. Current per capita emissions are low in India. Yet its contribution to future emissions is considerably greater, as its population is projected to continue to grow and surpass China's around 2025. Some projections of gross domestic product (GDP) see the country grow at a rate well above the world average between 2013 and 2040, at about 6.5% per annum — and if this growth is powered by an increased manufacturing base as well as higher consumption demand, energy consumption and emissions may see a large increase.

A pragmatic political choice to invest in a greener economic development trajectory will bring with it certain benefits. The recovery from the pandemic and the provision of livelihoods would be greatly eased by a more exuberant private investment climate that may double down on this opportunity. Commitment to the green transition would encourage investors to recognize a progressive policy ecosystem helping to reduce risk perceptions and unlocking greater interest. The transformation of specific high-emission sectors — alongside cross-cutting reforms — would serve as enablers for broader and inclusive growth and reinvigorate India's growth story. Investing in India may well become synonymous with the urgently needed global climate mitigation efforts.

“ India's development choices are the most crucial determinant of whether the world will meet the challenge of keeping global temperature rises below 1.5C or even 2C.

2

The \$15 Trillion Pathway to Rapid Decarbonization: A Sectoral Roadmap

India's path to rapid decarbonization can be a net-positive journey, with a net economic impact of over \$1 trillion by 2030 and ~\$15 trillion by 2070.

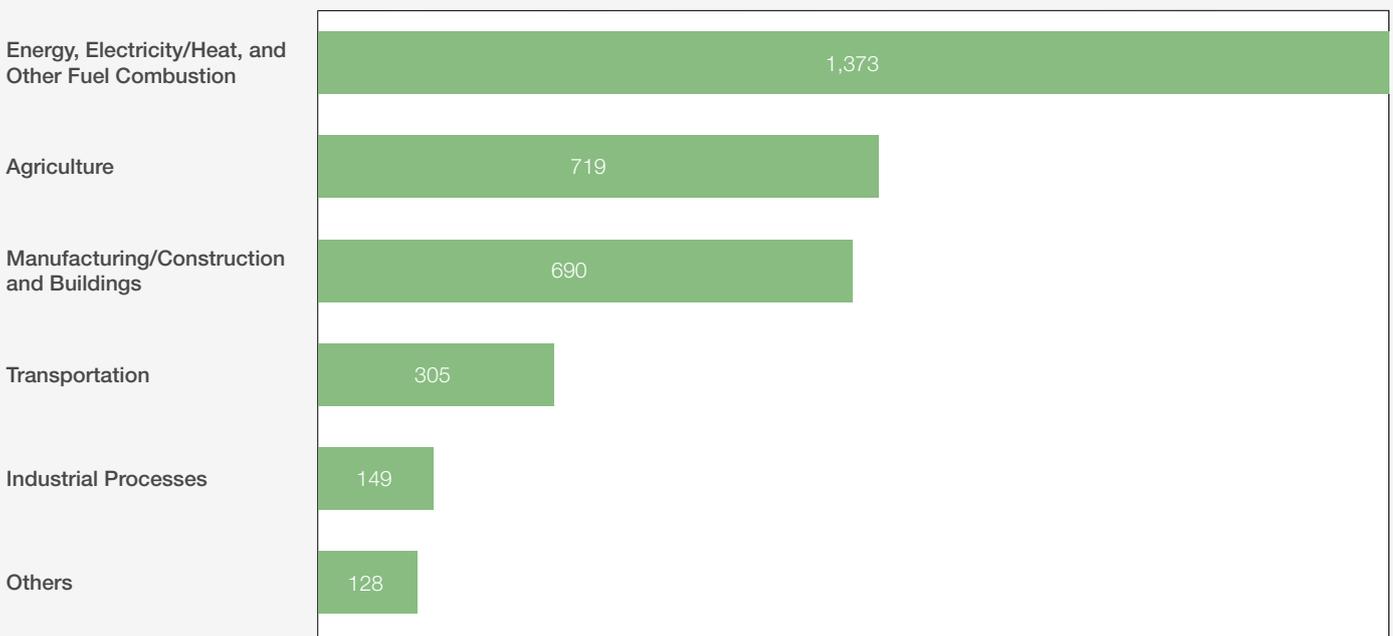
India has an opportunity to take bold action to enable economic prosperity and avert the worst impacts of a changing climate. Supported by the right economic framework, these actions can put India – and the world – on a path to realizing strong, equitable and shared growth.

2.1 India's GHG Footprint Today

India is the third largest GHG emitter in the world, behind the United States and China¹. Five sectors – energy, agriculture, industry, transportation and infrastructure/buildings – contribute to more than 96% of India's GHG emissions today². India's net zero transition will need an ambitious multi-decade effort to transform each of these sectors.

FIGURE 1 Greenhouse gas emissions by sector, India

Greenhouse gas emissions measured in metric tons of CO₂ equivalent (MTCO₂e)



Source: World Resources Institute CAIT Climate Data Explorer

2.2 A Green New Deal for India: A Roadmap for Sectoral Transformation

As India grows richer, its energy as well as material consumption will also grow. In its current trajectory, this growth could imply a significant expansion of India's GHG footprint, something that neither India nor the world can afford. However, this need not be a given. Unlike most developed nations that have built their past five to six decades of growth on high GHG-footprint infrastructure, India has a unique opportunity to leapfrog this journey through low/no emissions technologies. India's LED lighting programme is

a good example of the country leaping forward with a cleaner technology for a large population. However, several challenges lie ahead.

In this paper, we lay out a possible sectoral roadmap for India's transition to a net zero economy by 2070, while addressing some of the key challenges. Our proposed Green New Deal for India comprises five sectoral pillars and four horizontal enablers that would be critical to achieving the low-carbon vision.

FIGURE 2 A Green New Deal for a Net Zero India: Sectoral Pillars and Cross-Sector Enablers

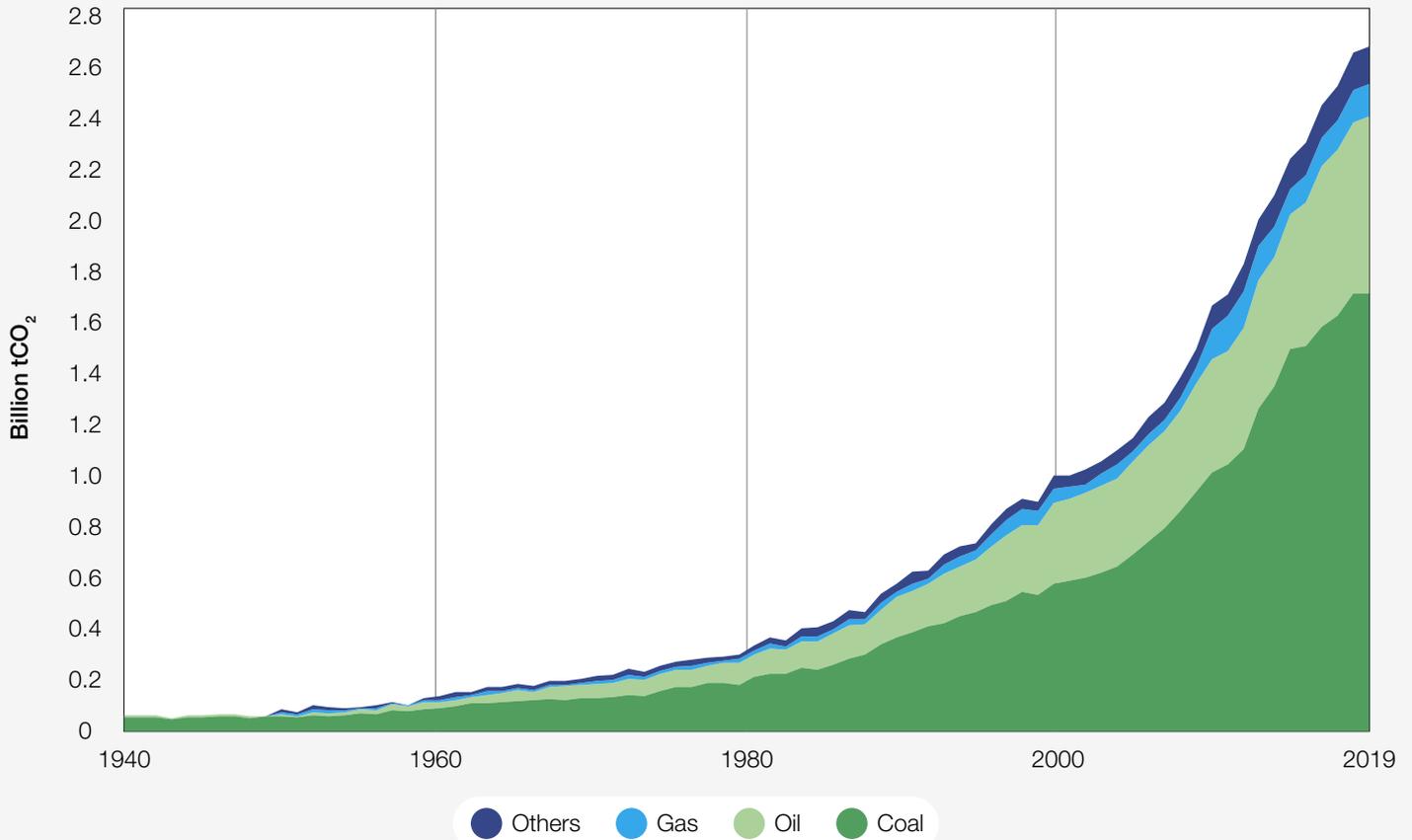


Pillar 1 | Low-Carbon Energy

India is the world's third-largest electricity-consuming nation³. The energy sector (comprising electricity, heat, and other fuel combustion) accounts for ~40% of India's emissions, with the combustion of coal contributing to 65% of total fossil CO₂ emissions. Both oil and natural gas have been steadily gaining share in India's total energy supply⁴. Over the coming decade, Indian energy

consumption is expected to grow at ~4%-5% CAGR, driven by overall economic growth and rising per capita income levels. India's energy sector decarbonization will need holistic interventions across all its fossil-fuel sources (coal, gas, oil). In addition, innovative ways need to be identified to reduce emissions in energy transfer to consumers via transmission and distribution networks.

FIGURE 3 CO₂ emissions by fuel, India



Source: Global Carbon Project

1. REPLACE legacy fossil fuel energy infrastructure with renewables

While renewables are already cheaper than new-build, coal-fired plants in India, new coal plants might still be needed to meet India's growing energy needs. In this context, India's green energy transition can be accelerated with more sophisticated renewable solutions (hybrid+ thermal, storage, bundled solutions). As per recent estimates, achieving India's net zero aspiration by 2070 will need its coal power to be entirely phased out by 2060 and its solar and wind capacity to grow from 100 GW today to more than 7400 GW by 2070.⁶ This accelerated green replacement journey will need substantial investment in new energy infrastructure in the

coming decades to reconfigure the electrical grid and fuel supply chains for new energy flows.

2. REDUCE emissions from legacy fossil fuel infrastructure – through enhanced efficiencies

India's most significant emissions are from coal-firing power plants and oil refineries⁷. Since some of this legacy infrastructure could continue for decades to come, it is critical to reduce their GHG footprint. For at-scale fossil fuel plants that continue to end of life, the use of technology will be the biggest incremental lever for fuel efficiency. Running assets at best-in-class heat rates/yield via reliability centred maintenance and operating parameter optimization, driven by artificial intelligence/ machine learning, can have a significant impact on

reducing emissions and increasing output. Further, reducing energy wastage in the distribution network through digital means of aggregate technical and commercial loss reduction and adoption of smart grids to predict power flows and enable two-way communication with the consumer can help reduce emissions. Pushing for peaking reserves across the grid can enable gas plant operations and reduce carbon emissions from coal.

3. REMOVE unavoidable carbon emissions

Despite the “reduce and replace” efforts above, India’s energy system will continue to have material GHG emissions. Therefore, it is critical to remove

unavoidable emissions. Carbon capture for existing coal power plants, incentivizing green hydrogen at commercial scales and setting up carbon pricing norms for corporates can accelerate the journey.

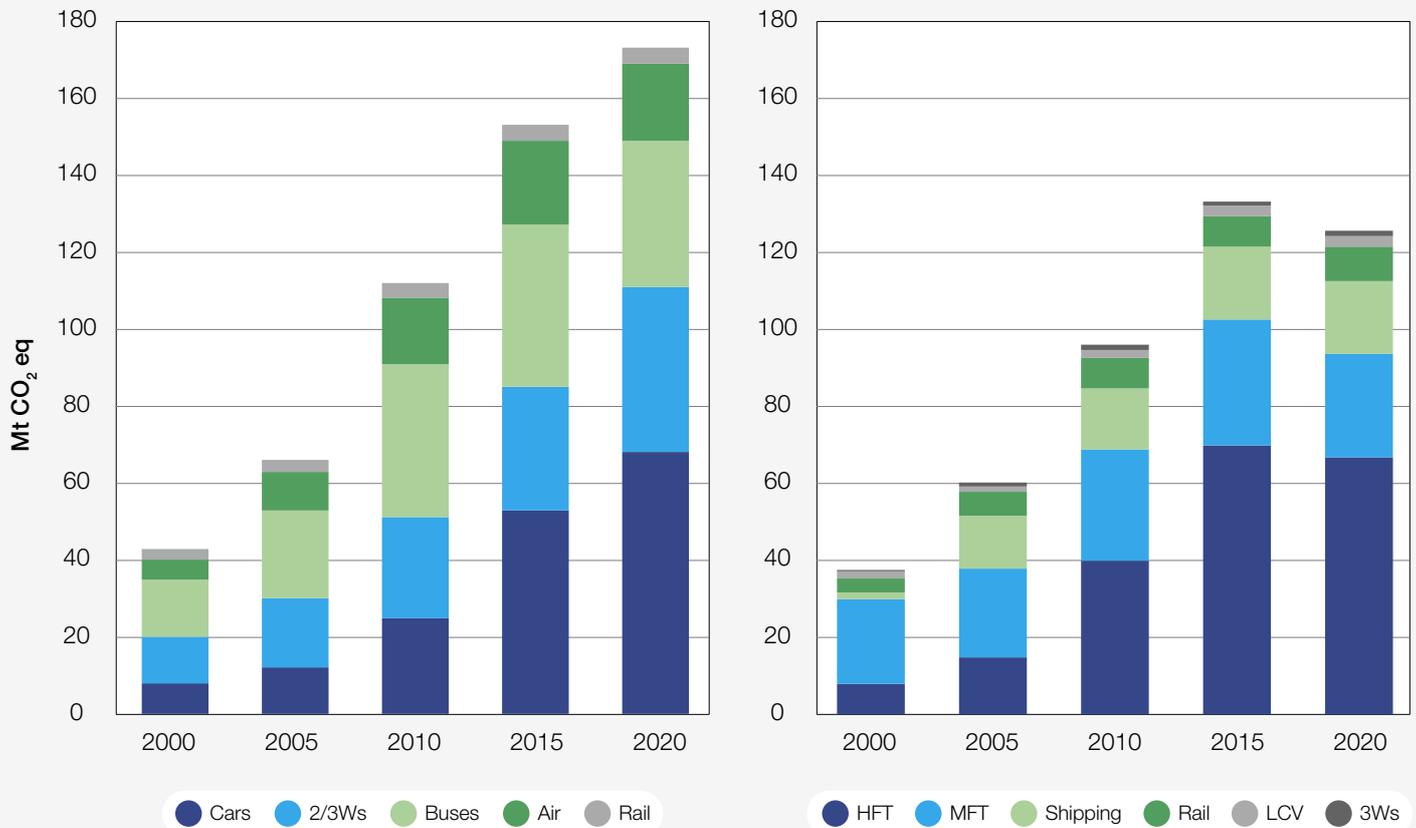
As India embarks on its Replace-Reduce-Remove journey, government policy support will be critical in redirecting existing investment, raising additional financing, reforming power distribution companies, driving wider electricity market reforms (e.g., virtual products, derivative markets for energy, fair and open third-party access to transmission and distribution networks), and in coordinating efforts across regions, states and municipalities (e.g., the Green Energy Corridor programme).

Pillar 2 Green Mobility

India’s transport sector contributes to ~10% of its GHG emissions. In 2020, an estimated 60% of India’s final energy use in transport arose from passenger transport and 40% from freight transport⁸.

FIGURE 4 CO₂ emissions have grown across transport modes over the past 20 years reaching over 300 MT CO₂ eq. in 2020

Tank-to-wheel CO₂ emissions by mode for passenger and freight transport in India (million tonnes of CO₂ equivalent), 2000-2020



1: LCV – Light Commercial Vehicle; MFT – Medium Freight Truck; HFT – Heavy Freight Truck

2: ITF analysis prepared with the support of the IEA Mobility Model. Results are based on energy use data. Emissions related with biofuels are informed by the analysis developed in Prussi et al. (2020) with simplified assumptions about attribution to different production pathways. Data for 2020 rely on estimations that have a higher degree of uncertainty than earlier years. CO₂ intensities for fossil fuels are from IPCC (2019); carbon intensities of electricity generation are from IEA (2020c)

Source: IEA, Kearney

“ At a time when India is substantially accelerating its manufacturing growth, it will be critical to evolve a carbon-neutral, industrial-growth model.

India’s green mobility transformation will be driven by two critical levers:

1. Shift in Transport Modal Mix (from Road to Rail)

Rail is the most energy-efficient mode of passenger transport, with only a 3% share in passenger transport energy use for a 25% share in passenger transport activity. Rail is also the most energy-efficient, land-based mode for freight. Inland freight rail transport activity was close to 30%, yet its share in freight transport energy use was just 9% in 2020. Rail also has a high reliance on electricity, which can be produced from renewables to eliminate GHG emissions. While rail is typically more expensive to build, operate and maintain than road, those investments are more efficient in terms of emissions per rupee spent. Cars, on the other hand, are quite low in energy efficiency and contribute to the highest share in final energy demand for passenger transport. On average, road activities generate per annum three to 14 times more CO₂ per rupee spent on infrastructure than rail activities⁹. As India evolves, promoting rail and other energy-efficient transport can reduce GHG emissions.

2. Green Fuel and Green Vehicles

India’s transport sector is heavily reliant on oil and contributes to almost half of India’s overall oil demand. Oil demand has more than doubled in the past two decades, owing to rising vehicle ownership and road transport usage. Given the lack of domestic reserves, India’s reliance on crude imports continues to rise, reaching about 75% in 2019¹⁰. In this scenario, India will need a four-pronged approach to achieve its transport decarbonization goals:

- **Fuel efficiency:** India will need to continue evolving its fuel efficiency standards in line with global standards, beyond the current BS-VI norms for cars, and the TREM and CEV norms for tractors and construction equipment respectively.
- **Sustainable fuels:** Biofuels (ethanol, methanol, etc.) and gas-based fuels (CNG, LNG, etc.) are cleaner burning than petrol/diesel and are already commercially viable with today’s economics. Similarly, sustainable aviation fuel made from waste and agricultural by-products or power-to-liquid based on hydrogen technology can be 100% less carbon-intensive than traditional jet fuel over its lifecycle. Together, these fuels offer a cleaner interim alternative for India’s transition.
- **Electric vehicles:** Electric vehicles are currently the most efficient technology¹¹ compared to ICEs and other carbon-neutral options (e.g., synthetic fuels). As per recent estimates, the share of electric cars and trucks may need to reach 84% and 79% by 2070¹². India’s transport electrification journey will need a coordinated effort from auto OEMs, charging infrastructure providers and government policy-makers over the coming decades. A mix of financial, behavioural, and infrastructure-related incentives will be key in mass-scale electric vehicle adoption.
- **Hydrogen mobility:** For hard-to-abate, heavy mobility modes such as trucks, hydrogen could emerge as a viable fuel alternative. While hydrogen-mobility technologies are still evolving, India could potentially transition LCVs, trucks and buses from fossil fuels to hydrogen over the next few decades.

Pillar 3 | Decarbonization of Energy-Intensive Industries

India’s manufacturing industries are a key contributor to its CO₂ emissions, with the iron and steel, cement, and chemicals and fertilizers sectors having the highest emission footprint¹³. Given projected economic growth and urbanization, demand from these sectors is expected to grow. Unfortunately, this growth will mean proportionately higher GHG emissions in the business-as-usual scenario. At a time when India is substantially accelerating its manufacturing growth, it will be critical to evolve a carbon-neutral, industrial-growth model.

Abating GHG emissions in energy intensive sectors is significantly more challenging compared to sectors such as power and transport due to three key reasons:

1. More than 40% of emissions in these sectors are from fossil fuel feedstock and switching to alternate feedstock will require a complete change in production process and technologies.¹⁴

2. More than 30% of emissions are from burning fossil fuel to generate high temperatures (~800C). Switching to renewable power for high temperature applications will require electric furnaces – a transition with technology feasibility as well as cost viability challenges.¹⁵
3. These sectors are capital-intensive. Rebuilding for new process/technology with a lower GHG footprint is a significant capital investment that is difficult to finance with today’s inherent sector economics.

With energy/feedstock contributing to a significant proportion of the overall cost of the final product in these sectors, and given inadequate willingness/ability from customers to pay a premium for green products, investments in GHG reduction technologies are often financially unviable.

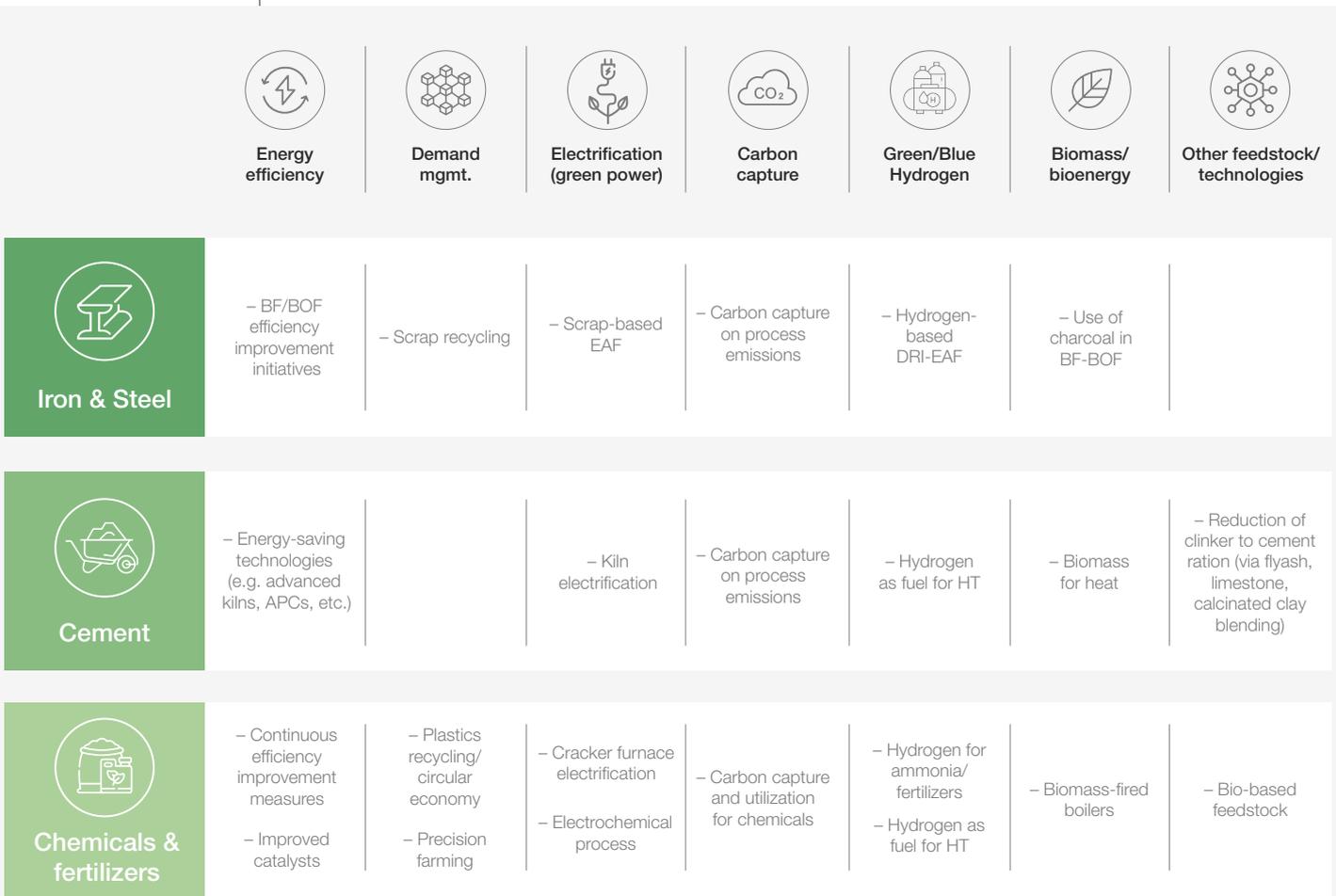
Over the past decade, regulatory mechanisms such as the Perform, Achieve and Trade (PAT) scheme have helped drive adoption of specific quick-win measures where GHG reduction is also EBITDA positive – improved energy and thermal efficiency, waste heat recovery systems, and partial substitution of high GHG feedstock (e.g. clinker reduction in cement). However, radical decarbonization of these sectors will require a combination of:

- a. Demand-management measures such as circular economy
- b. Continued energy-efficiency improvements

- c. Electrification of heat with zero-carbon electricity where applicable
- d. Carbon capture, utilization and storage technologies
- e. Zero-carbon fuels such as biomass and green or blue hydrogen
- f. Deployment of new innovative technologies with non-fossil feedstock

We identify a holistic approach for India's green industry transformation – to rapidly decarbonize and modernize India's heavy industry sector:

FIGURE 5 Routes to decarbonization of industrial sector



Source: Based on Kearney assessment and research

With more than 60 large Indian companies and several multinationals operating in India volunteering for SBTi (Science Based Targets initiative) based emissions reduction targets¹⁶, India's industrial decarbonization plan is off to a good start. But a lot more needs to be done. In the most significant GHG-emitting sectors, only between a fifth and a quarter of abatement needed for 1.5C targets can be achieved through existing commercially viable technologies.

Key success factors for India will include the relative decline in cost of decarbonized versus conventional commodities, availability of resources (such as biomass or geological storage space for captured CO₂), and the feasibility of adapting old as well as new facilities. Enabling the transition will require investment in R&D to make emerging new technologies such as hydrogen affordable, policy support and incentives from government to steer industry towards sustainable technologies and increased global collaboration.

Pillar 4 | Green Buildings, Infrastructure and Cities

India's top 25 cities contribute to more than 15% of India's estimated GHG emissions¹⁷. Further, the top cities are estimated to have average per capita emissions of 2.6 tons of CO₂ equivalent, which is 40% higher than India's per capita emission of 1.8 tons of CO₂ equivalent¹⁸. India will continue to urbanize through this century, with urban population projected to grow from ~480 million today to 814 million by 2050.¹⁹

This relentless growth in urbanization has led to the emergence of unplanned and unstructured urban sprawls. The cost of unplanned urban cities has already manifested in a multitude of ways, as witnessed in deteriorating green cover, urban heat islands, the exhaustion of energy resources and high pollution levels.

In India, there is a growing need to plan cities better and build low-carbon infrastructure as cities evolve. We identify two critical levers for India's transition to Greener Cities, Buildings and Infrastructure:

1. Efficient urban planning

India's city planners can reduce urban carbon generation through a) transit-oriented city development to minimize city sprawl; b) a

decentralized approach to sourcing, treating and managing water supply to improve energy efficiency in water management processes; and c) effective management of waste (including optimization of waste generation/collection/disposal facilities and incineration/gasification of waste to generate energy). Additionally, the creation of large, open, green spaces can serve as localized sinks that contribute to carbon sequestration.

2. Low-carbon buildings and infrastructure

The design of carbon-efficient new buildings (retrofitting existing structures, modular building design, optimal cross ventilation and thermal insulation), the adoption of low-carbon construction processes (using low emissions materials like wood, fly ash, hemp and bioplastics), and the modification and enforcement of building energy codes such as GRIHA, LEED and ICBC to track energy performance of new and existing buildings can help reduce urban CO₂ emissions.

Urban development in India is currently fragmented in national and local policies, regulations and stakeholders. A nationally coordinated approach will be critical to ensure carbon-efficient execution of urban development interventions.

Pillar 5 | Sustainable Agriculture

Agriculture and livestock account for 18% of gross national emissions²⁰. Agriculture typically accounts for ~80% of total nitrous oxide emissions, mainly from the application of fertilizers – both synthetic nitrogen and manure added to soils or left on pastures. It also contributes to an estimated 45% of total methane emissions²¹. Around 80% of agricultural methane are emissions from livestock production, including enteric fermentation and manure management. The second largest contributor of agricultural methane emissions is rice production, with the remaining emissions from the burning of savanna and the use of crop residues for agricultural purposes. Both nitrous oxide and methane are significantly more powerful than carbon dioxide in driving warming over a span of 20 years – making sustainable agriculture an urgent priority.

While the agriculture sector contributes to climate change due to GHG emissions, it is also severely

impacted by the effects of changing climate. Climate change is threatening India's agricultural growth with frequent dry spells, heatwaves and erratic rainfall. With a growing population and the need to enhance food production, the challenge of meeting the increasing demand for food production while controlling and reducing the GHG emissions from agriculture is likely to be a tricky balance to achieve.

In the coming decades, the shift to sustainable agriculture will be one of the most complex transitions for India. It will require a campaign to empower, educate and enable more than 100 million farmers to adopt precision agriculture (especially in terms of modernizing rice cultivation, reducing nitrogen/urea usage, and scaling low- and no-tillage practices), sustainable animal husbandry (a series of measures to reduce methane emissions from livestock), and green energy (shifting diesel pumps to renewable energy and adoption of electric farm equipment).

2.3 Cross-Sectoral Enablers to Accelerate Green Transition

In addition to the five sectoral pillars, India will need four cross-sectoral enablers in its green transition:

Enabler 1: Green Innovation

The global as well as the Indian decarbonization journeys are impossible without accelerated technology R&D as well as new business model development in every aspect of the economy. In the energy sector, this will include, among others, technology development for lower-cost renewables, commercial-scale battery storage, new energy sources (e.g., nuclear fusion), distributed generation and transmission optimization. In mobility, the technologies for alternative fuels and electric transport continue to evolve and will need to reach commercial maturity soon. Similarly, technology innovation will be a key foundation for industry, agriculture and buildings/infrastructure as well. In addition to technology, significant business model innovation will be critical to enable the ecosystem – including new EV-charging models, business models for

distributed power and finance mechanisms for the global green transition.

Given that the world is still in the early stages of the green industrial revolution, India has a once-in-a-generation opportunity to emerge as a global green innovation hub. Key enablers to achieving this will include incentives and R&D subsidies for the private sector to help position India as a global tech and entrepreneurial hub. Also key will be the development of green tech business incubators and R&D centres in close collaboration with universities, attracting innovative foreign businesses to establish or expand their presence in India and create jobs in high-growth sectors, and support for the emergence of a domestic market for low-carbon, high-value added products and services (i.e., by developing standards for maximum emissions).

Enabler 2: Green Finance

Catalysing India's green transition will require a multifold increase in government as well as private capital flows to build India's new green infrastructure, develop new technologies and encourage individuals to move to greener consumption patterns. However, the availability of capital to finance India's green transformation has been a challenge. A mature green finance sector will be critical for India's net zero transition. Here we broadly align the definition of green finance with the OECD definition for green growth as "achieving economic growth while reducing pollution and greenhouse gas emissions, minimizing waste and improving efficiency in the use of natural resources."²²

To catalyse an at-scale green finance sector, India will need to:

- Adopt a clear and consistent taxonomy for green finance: A well-designed taxonomy can reduce transaction costs and facilitate the development of a pipeline of green projects.
- Explore a formal carbon pricing framework for India: A carbon price provides a relatively simple and direct way to ensure that more of the costs of climate change are brought into the economic calculus behind investments and consumption, including resource and fuel use. A formal carbon-pricing framework could also be a significant source of fiscal revenues. Estimates indicate that a carbon tax of \$35 per tonne of

CO₂ emissions levied by India in phases could lead to a reduction in emission intensity by 22% against a business-as-usual level²³ and yield a revenue of more than 2% of GDP by 2030²⁴.

- Mobilize domestic savings and institutional capital: India can unlock a huge potential to mobilize domestic investments by adopting a holistic portfolio of measures including the enabling of Green Infrastructure Investment Trusts (InvITs), tweaking priority sector lending targets to include sustainability as a separate category, facilitating deeper bond markets, and encouraging innovation in green finance instruments.
- Proactively attract global capital: India has an opportunity to tap into deep pools of international capital by reducing frictions and challenges that raise the cost of capital for Indian projects. A potential roadmap will need to include measures to reduce hedging costs, adapting External Commercial Borrowing guidelines, and the pragmatic use of innovation and de-risking instruments to help more projects reach expected risk/return profiles²⁵. India will also need to use the COP and G20 fora for advocating regulatory changes that enable savings from the developed world to flow to green projects in the developing economies. If India is the frontline of the climate battle, the cost of capital must not hinder this global effort.

“Catalysing India's green transition will require a multifold increase in government as well as private capital flows to build India's new green infrastructure.”

Enabler 3: Carbon Sequestration

Given India's ambitious economic growth agenda, there are natural limits to GHG emission reduction. To enable its net zero transition, India will need an equally ambitious sequestration agenda that includes:

- **Natural and man-made sinks:** Reforestation, afforestation, and agro-forestry practices can help create natural reservoirs that remove CO₂, supported by geological and mineral sequestration.
- **Carbon capture, utilization and storage (CCUS):** Adoption of CCUS

technologies for industrial plants can help reduce industrial emission at source.

- **Direct air carbon capture and storage (DACCS):** Scaling currently nascent technologies to recoup CO₂ from the air can unlock almost infinite decarbonization potential
- **CO₂ utilization:** The captured CO₂ can be productively used across applications such as synthetic fuels, CO₂ curing for concrete and boosting crop yield.

Enabler 4: Climate Adaptation

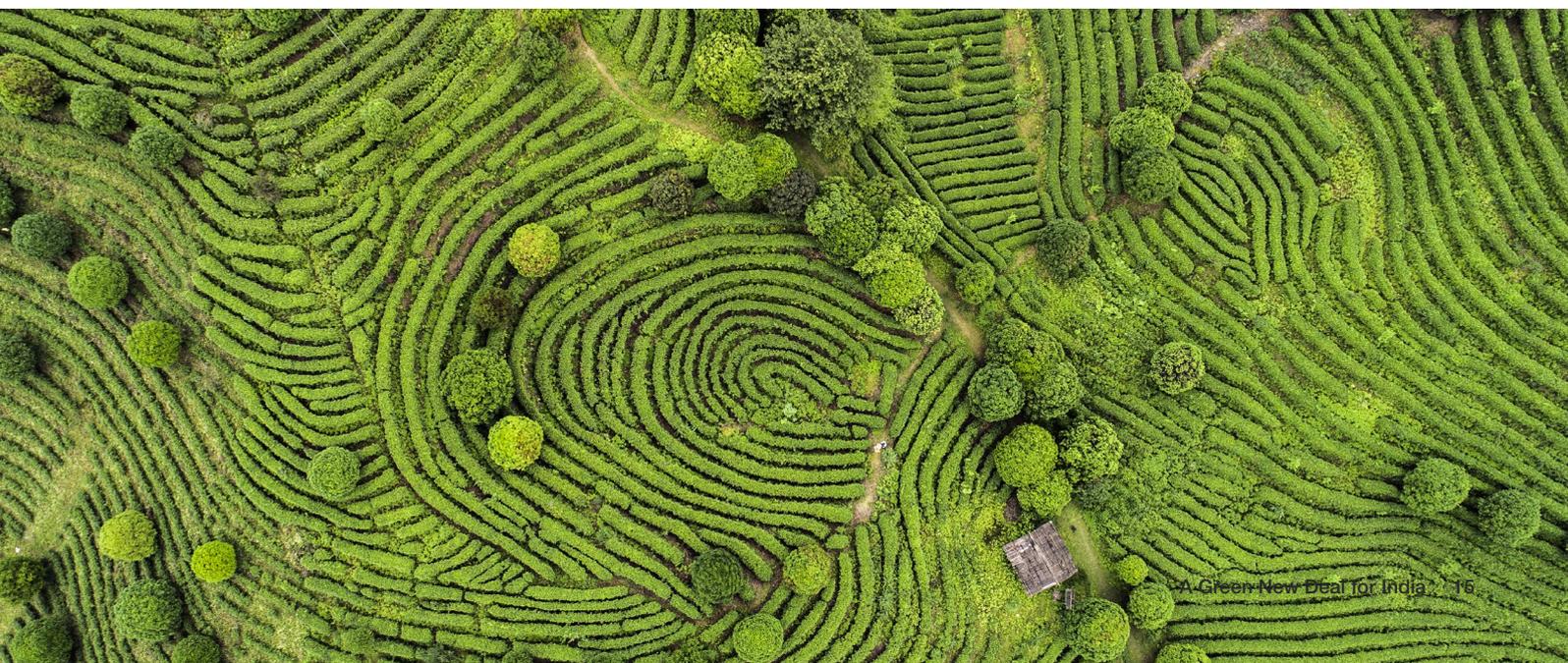
Reducing carbon emissions and sequestering carbon are no longer enough to entirely halt the impacts of climate change. For most parts of the world, especially for India, it is time to start adapting to a warming world. India is expected to be one of the first places to experience heatwaves that cross the survivability limit for a healthy human being sitting in the shade. Without targeted climate adaptation, millions of Indians could be exposed to a lethal heatwave as early as 2030²⁶.

While adaptation is critical, it will also be challenging since heat exposure is a pervasive risk and will need large-scale shifts in how millions of Indians live and work (e.g., changes in shift hours, government-sponsored shelters for the homeless, etc.). Adaptation will be particularly challenging for the urban poor, who will likely require public support, for example, in the form of emergency shelters. Both public- and private-sector stakeholders will need to coordinate on a plan for climate adaptation including:

- **Accelerated adoption of cooling plans:** The India Cooling Action Plan,²⁷ released by the Ministry of Environment, Forests and Climate Change in March 2019, is a pioneering effort

in the global context. Other select states and cities have also released their heat action plans but, given the severity of climate risk, almost all of India will need a heat-action plan, with local governments making cooling a priority.

- **Indoor Work Transition:** India's agricultural, construction, mining and outdoor workers are most exposed to the immediate risks of climate change. At a time when India is significantly accelerating its infrastructure and construction activities, it will need to accelerate in parallel the tricky transition of outdoor work to indoors (by further developing services and indoor manufacturing sectors).
- **Air conditioning and other cooling measures:** Given the here and now effect of climate risk, India will need to accelerate the development and adoption of low-carbon, but cost-effective, air conditioning and other cooling measures. This will include the integration of air-conditioning technologies into all housing, including affordable housing projects, as well as the potential build-out of air-conditioned emergency shelters across the nation.



2.4 The Economic and Job Creation Potential of the Green New Deal for India

Our vision for a Green New Deal can transform not only India's GHG emission profile but also its economy. The five sectoral pillars and four enablers offer a wide range of investment opportunities in key infrastructure milestones required to achieve a net zero India by 2070. Kearney estimates indicate that the Green New Deal for India could collectively present a ~\$15 trillion investment opportunity as detailed below:

- **Energy Transition:** Transitioning to a low-carbon energy ecosystem will be the single largest economic opportunity in the Green New Deal, accounting for between ~\$5-\$7 trillion of the overall ~\$15 trillion opportunity. A large majority of the investments under this pillar – ~\$4-\$5 trillion, will be geared to building new solar and wind capacity, at least 50 times and potentially up to 75 times today's current such capacity in the country. Further key investments in the energy ecosystem will include the transition to a national smart grid infrastructure, the upgrade and optimization of current generation, transmission and distribution infrastructure across the country, new capacity build-out for nuclear and hydroelectric power, and ecosystem-wide investments in energy storage.
- **Mobility Transformation:** India's mobility transformation contributes to a potential ~\$2-\$4 trillion investment opportunity in the Green New Deal. Key drivers will include the shift in mode of transport from road to rail, and the electrification of the entire transport system. We envision India's electric vehicle share reaching upwards of ~80% by 2070 – a transition that will need more than ~\$1-\$1.5 trillion in investment for the charging and associated infrastructure. Additional investment opportunities in mobility will include biofuels and gas-based fuels as well as infrastructure for a hydrogen-based heavy mobility ecosystem.
- **Decarbonizing Industry:** We anticipate the overall industry decarbonization pillar to offer a ~\$2-\$3 trillion investment opportunity for India. This projection assumes a significantly larger share for manufacturing in India's economic growth, and that a significant portion of new investments under the Make in India and Atmanirbhar Bharat (self-reliant India) umbrella will be for green industrial processes. The retooling and electrification of industrial processes and the build-out of a hydrogen-based infrastructure for industry will be the two key drivers of investments in this space.

- **Green Buildings, Infrastructure and Cities:** The Green Buildings, Infrastructure and Cities pillar could potentially offer a ~\$2-\$3 trillion investment opportunity for India. This projection assumes that a large part of India's ambitious infrastructure agenda, including the Smart Cities Mission and the recently launched Gati Shakti programme, will eventually be for green infrastructure. With India's urbanization expected to almost double by 2070, we anticipate significant value creation in the green buildings space as well as India builds out the building space to accommodate its urban population.
- **Sustainable Agriculture:** The interventions in agriculture – precision agriculture, sustainable animal husbandry, and green energy – are likely to involve changing the behaviours and farming practices of more than 100 million farmers in India and will involve substantial but gradually phased investments across the farm ecosystem in India.
- **Enablers:** In addition to the sectoral economic opportunities, the four enablers can drive substantial new value creation – collectively to the tune of ~\$2 trillion. Among the enablers, we anticipate carbon sequestration to be one of the most significant, with a potential ~\$1-\$1.5 trillion opportunity to invest in natural sinks, CCUS and potential at-scale DACCS technologies. Enabling green technology innovation in India could potentially help position the country as a global export hub for green tech and potentially catalysing entire new industries.

On the job creation front, the transition to a low-carbon economy can foster material net job creation as it tends to be more capital- and labour-intensive compared with traditional fossil fuel energy developments. As per Kearney estimates, India's path towards its net-zero ambition could facilitate the creation of over 50 million jobs by 2070. The largest source of employment creation will be from the transition to sustainable energy ecosystems (more than 50% of the overall estimated net job creation), dominated by renewable power generation, followed by power networks and electrification infrastructure (including in the mobility and industry sectors). The Green Buildings, Infrastructure and Cities pillar would be the next largest source of employment creation, with the potential to offer upwards of 25% of the projected job creation from the Green New Deal for India. Net job losses will arise in coal mining and processing, as well as coal power generation and crude oil extraction, processing and refining.

“ The transition to a low-carbon economy can foster material net job creation as it tends to be more capital- and labour-intensive compared with traditional fossil fuel energy developments.

An Action Plan for Stakeholders: The Time to Act is Now

A Green New Deal for India will need all stakeholders – government, private sector, investors, civil society and citizens – to step forward and catalyse the next green revolution.

India's decarbonization journey represents upwards of a \$15 trillion economic opportunity by 2070, with the potential to create as many as 50 million net new jobs. With concerted action, the first \$1 trillion of this opportunity could potentially materialize within this decade. Given this context, it is time for a Green New Deal for India.

Catalysing the next green revolution will require the government, the private sector, investors, civil society organizations and individual citizens to come together and shape the future.

Government

The Government of India has already initiated select commendable steps to enable the nation's green transition. But as this paper illustrates, a lot more is still to be done. The government will need to anchor India's Green New Deal with an aspirational vision for a net zero economy, clear targets and roadmaps for each sector, a framework of regulations and incentives to catalyse change and innovation, a balanced approach to carbon pricing and a collaborative process for stakeholder engagement.

Corporates

India's green transition presents its corporate sector with a once-in-a-century value creation opportunity. Every company in every sector will be directly impacted by India's transition to a net zero economy. However, this transition will be neither easy nor painless. In the global war on

climate change, India's corporates will need to step up and set ambitious decarbonization targets, measure and publish their carbon footprint, review every aspect of their business to reduce carbon intensity, engage in cutting-edge decarbonization R&D, innovate business models, and invest significantly in the climate change agenda.

Investors

The environmental and social governance (ESG) movement is accelerating across the world. While there is a continued debate on the merits and demerits of ESG investing, it is clear the investors can play a significant role in facilitating the global decarbonization journey. Investors can push for greater carbon transparency from their investees, catalyse climate-positive corporate action, commit capital to green finance efforts, and expand investment time horizons to enable the adoption of longer payback capital investments in sustainability.

Civil society and citizens

Civil society and citizens will need to play an integral role in India's green transition. Civil society organizations, along with the media, will need to inform and educate the public and continue informing the national discourse on climate change. Individual citizens will need to be willing to switch to greener products, adopt more sustainable diets, reduce their mobility footprint, and vote for and support a green national agenda.

Conclusion

India's transformation will need technology, finance – and leadership. If successful, it would blaze a trail for the emerging world.

The five pillars and four enablers for a green transition in India are all dependent on the continuing advancement of the three drivers of Indian growth: technological development, financial innovation and strong political leadership. These three drivers have put India in a position where it can put together two challenges, such as development aspirations and the climate crisis, and emerge with a solution.

In the recent past, technological innovation reduced the physical cost of building the components of solar energy generation plants; financial innovation allowed for the front-loaded costs of these plants to be adjusted for; and political leadership ensured

that these plants were integrated into the legacy power network. Because of technology, finance and leadership, India has the lowest per-unit installation cost of renewable energy in the world.

It is time to expand the benefits of technology, finance and leadership to the other pillars of an Indian Green New Deal discussed above. Over time, as India restructures its mobility sector, its land use, and its cities in keeping with a new green development paradigm, it will demonstrate its own global leadership and create templates for other emerging economies to follow. India's green growth is not for itself alone: it will have a multiplier effect, blazing a trail that combines inclusive prosperity with decarbonization.



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Endnotes

1. Jonas Karstensen, Joyashree Roy, Barun Deb Pal, Glen Peters, Robbie Andrew, “Key Drivers of Indian Greenhouse Gas Emissions”, *Economic & Political Weekly*, Vol. 55, Issue No. 15, 11 April, 2020 (accessed 19 October 2021)
2. World Resources Institute CAIT Climate Data Explorer, <https://www.climatewatchdata.org/ghg-emissions>, (accessed 18 October 2021)
3. International Energy Agency, “India Energy Outlook 2021”, February 2021 (accessed 19 October 2021)
4. National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India, “Energy Statistics India 2021”, 2021 (accessed 18 October 2021)
5. International Energy Agency, “India Energy Outlook 2021”, February 2021 (accessed 19 October 2021)
6. Vaibhav Chaturvedi and Ankur Malyan, Council on Energy, Environment and Water, “Implications of a Net-Zero Target for India’s Sectoral Energy Transitions and Climate Policy”, Working Paper, October 2021 (accessed 18 October 2021)
7. Center for Science and Environment (CSE), “Reducing CO₂ Footprints of India’s Coal Based Power”, Factsheet, 2020 (accessed 18 October 2021)
8. International Transport Forum, “Decarbonising India’s Transport System: Charting the Way Forward”, International Transport Forum Policy Papers, No. 88, OECD Publishing, Paris, 2021 (accessed 18 October 2021)
9. United Nations Centre for Regional Development, “Expanding Railways – A Vital Means to Meet the Growing Transport Demand in Asia”, 8th Regional Environmentally Sustainable Transport (EST) Forum in Asia, Colombo, Sri Lanka, 19-21 November, 2014, pp. 13 (accessed 18 October 2021)
10. Ministry of Petroleum and Natural Gas, Economic & Statistics Division, “Indian Petroleum & Natural Gas Statistics 2019-2020”, January 2021 (accessed 18 October 2021)
11. Climate Action Tracker, “Decarbonising the Indian transport sector: Pathways and policies”, December 2020, pp. 14 (accessed 18 October 2021)
12. Vaibhav Chaturvedi and Ankur Malyan, Council on Energy, Environment and Water, “Implications of a Net-Zero Target for India’s Sectoral Energy Transitions and Climate Policy”, Working Paper, October 2021 (accessed 18 October 2021)
13. Narrative report, Climate Group, “A Spotlight on Decarbonising Heavy Industry in India”, 2021 (accessed 18 October 2021)
14. Strengthen National Climate Policy Implementation: Comparative Empirical Learning & Creating Linkage to Climate Finance – SNAPFI, “Transitioning India’s steel and cement industries to low carbon pathways”, 2021 (accessed 18 October 2021)
15. Biswas, Tirtha, Karthik Ganesan, and Arunabha Ghosh, “Sustainable Manufacturing for India’s Low-carbon Transition: Four bets for Hard-to-abate Sectors”, 2019 (accessed 19 October 2021)
16. The Science Based Targets initiative, “Companies taking action”, <https://sciencebasedtargets.org/companies-taking-action?country=India#table> (accessed 19 October 2021)
17. Citycarbonfootprints, “Global Gridded Model of Carbon Footprints (GGMCF)”, <https://citycarbonfootprints.info/> (accessed 15 October 2021)
18. Data Commons, “CO₂ Emissions Per Capita”, https://datacommons.org/tools/timeline#&place=country/IND&statsVar=Amount_Emissions_CarbonDioxide_PerCapita (accessed 15 October 2021)
19. United Nations, Department of Economic and Social Affairs, Population Division, “World Urbanization Prospects: The 2014 Revision, Highlights”, 2014 (accessed 18 October 2021)
20. World Resources Institute CAIT Climate Data Explorer, <https://www.climatewatchdata.org/ghg-emissions>, (accessed 18 October 2021)
21. Food and Agriculture Organization of the United Nations (FAO), O. Sirotenko, “Agriculture, Forestry and Other Land Use Emissions by Sources and Removals by Sinks”, 2014 (accessed 18 October 2021)
22. OECD, “Green Finance and Investment”, https://www.oecd-ilibrary.org/fr/environment/green-finance-and-investment_24090344 (accessed 19 October 2021)
23. Shakti Sustainable Energy Foundation and Ernst & Young LLP, “Discussion Paper on Carbon Tax Structure for India”, 2018 (accessed 19 October 2021)
24. Ian Parry, Chandara Veung, and Dirk Heine, International Monetary Fund “How Much Carbon Pricing is in Countries’ Own Interests? The Critical Role of Co-Benefits”, IMF Working Paper, 2018 (accessed 19 October 2021)
25. FICCI and City of London Corporation, The India-UK Sustainable Finance Working Group, “Practical actions to finance India’s sustainable recovery”, January 2021 (accessed 19 October 2021)
26. Natural Resources Defense Council, “Expanding Heat Resilience Across India: Heat Action Plan Highlights”, November 2020 (accessed 19 October 2021)
27. Ozone Cell, Ministry of Environment, Forest & Climate Change, Government of India, “India Cooling Action Plan”, March 2019 (accessed 19 October 2021)



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