A ROADMAP FOR GREEN AND TRANSITION FINANCE IN INDIA

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Editors

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An Introduction to Green and Transition Finance

Neha Khanna and Mannat Jaspal

The green transition of economies has become imperative, and governments, regulators, and the private sector across geographies and sectors are increasingly implementing decarbonising measures and strategies aimed at reducing emissions intensities, greening the financial system, and fostering green business opportunities. However, the financing landscape is skewed towards sectors focused on mitigation, including renewable energy proliferation and transport, which have developed a strong business case and garnered substantial political support compared to other energy-intensive and hard-to-abate sectors. Achieving a low-carbon economy necessitates an inclusive approach to financing the transition,

especially considering the needs of Emerging Markets and Developing Economies (EMDEs), and focusing on hard-to-abate sectors, which have substantial carbon-removal potential.

Process and energy-related emissions from hard-to-abate sectors collectively contribute to over 40 percent[1] of global greenhouse (GHG) emissions. These emissions may arise from production (in the case of steel, cement, aluminium, chemicals, pulp, and paper), energy (such as in oil and gas), and transport (e.g., aviation, shipping, and trucking). Ensuring the effective and timely transition of hard-to-abate sectors is therefore critical to achieve net-zero targets.

Despite per-capita emissions below the global average, India is the third highest GHG emitter in the world.[2] The power sector is the largest emitter, responsible for 37 percent of total GHG emissions in the country, followed by the agricultural sector at 21 percent (including methane from livestock and rice cultivation), manufacturing at 17 percent, and the transportation sector at 9 percent.[3] In 2019, the road transport sector accounted for 91 percent of total GHG emissions from the transport sector, followed by civil aviation at 6 percent, railways at 2 percent, and water-borne navigation at 1 percent.[4]

India's hard-to-abate sectors include large-scale industries such as iron and steel, cement, ammonia, transport, and agriculture, as well as Micro, Small, and Medium Enterprises (MSMEs). In India, the CO_2 emissions from these sectors are expected to increase by almost 2.6 times between 2020 and 2050.[5]

Industrial emissions, which include sectors like iron and steel, cement, fertiliser, and petroleum refining, account for nearly 21 percent of India's total emissions.[6] These emissions originate from both energy use (fossil fuel combustion) and process-related activities (such as calcination in cement production and the use of CO_2-generating compounds as feedstock in chemical production). India is the world's second largest steel producer and the second largest manufacturer and consumer of cement.[7] The iron and steel industry contributes to approximately 5 percent of India's total GHG emissions, while

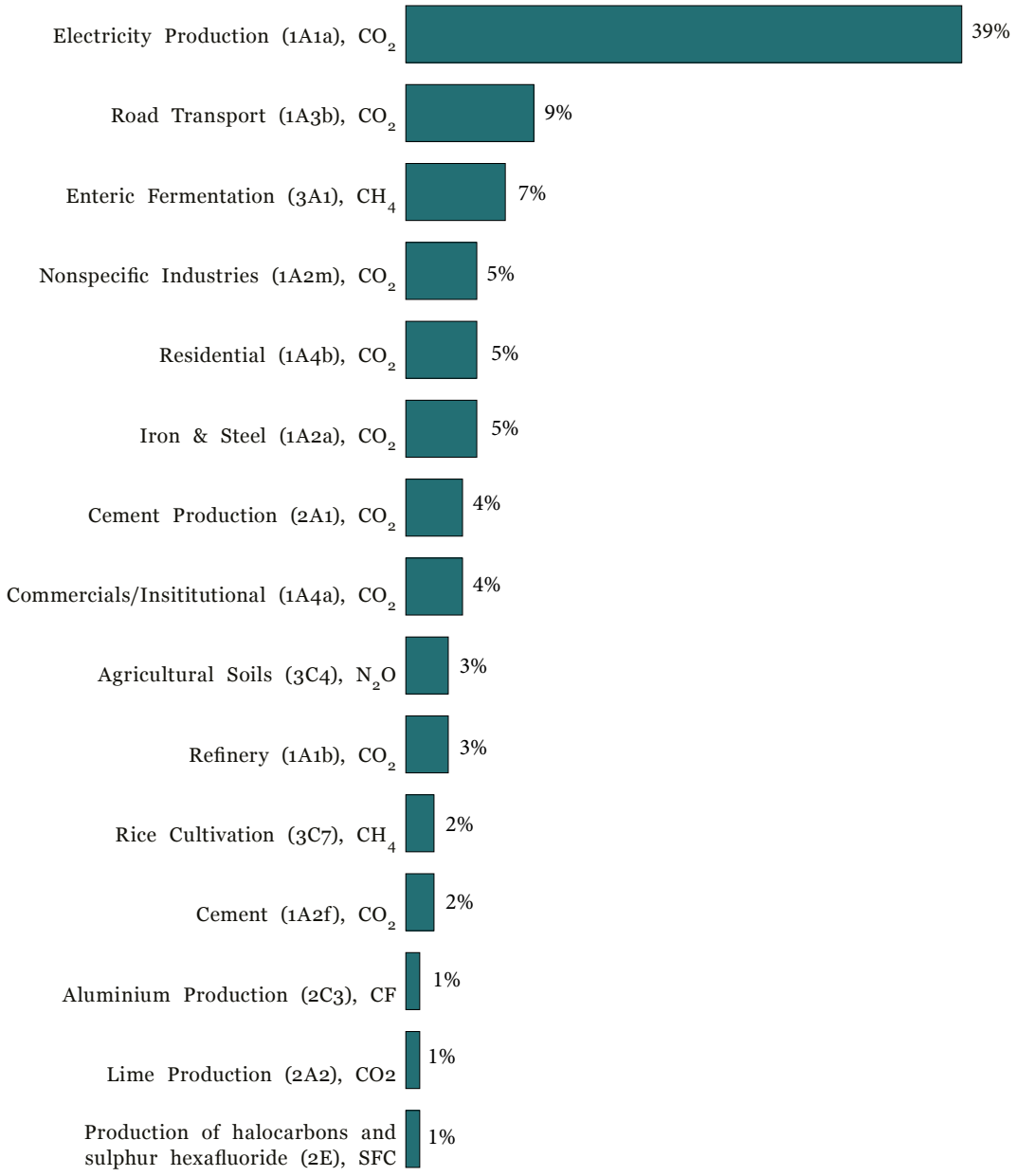
the cement industry accounts for close to 4 percent.[8] Additionally, India is the third largest producer of primary aluminium and the fifth largest producer of bauxite globally, and volumes are only expected to rise with projected growth in demand in the coming years.[9]

Transport decarbonisation is already underway through measures such as electrification, enhanced operational efficiency, modal shift, and the switch to electric and hydrogen vehicles. Energy sector decarbonisation involves transitioning to clean energy sources, including renewable and even nuclear. However, emissions reduction for industry is particularly difficult since most emissions arise from industrial processes themselves rather than energy consumption. For example, almost half of the emissions in the cement industry arise from the decomposition of limestone to lime and CO_2.[10] While switching to clean energy sources such as renewables can reduce emissions in the power sector and other energy-related needs, finding substitutes for emissions-intensive industrial processes continues to be a challenge.[11]

India faces significant challenges in decarbonising its hard-to-abate sectors without engendering de-industrialisation. As India is yet to peak in its emissions, circularity, energy efficiency, and material efficiency will be key to its decarbonisation strategies. In heavy industries, material efficiency and circularity can reduce carbon emissions by an estimated 40 percent globally.[12] Short-term emissions could be potentially reduced by 15-20 percent through improvements in energy efficiency.[13] These factors, however, will not be sufficient for industries to achieve net-zero and must be complemented with a blend of electrification (clean power), clean hydrogen, and new-age technologies such as carbon capture utilisation and storage (CCUS) to abate fossil fuel consumption.

Transitioning to net-zero for hard-to-abate sectors is a complex task due to the extremely high process temperature requirements, limited commercialised and scalable technological alternatives, and large associated capital costs.

Figure 1: Percentage Share of GHG Emissions, by Category (India, 2019)



Source: India's Third National Communication and Initial Adaptation Communication to the UNFCCC[14]

Achieving this transition will require substantial capital flow. It is estimated that an annual capital investment of approximately US$3.5 trillion[15] is required globally by 2050 to build a net-zero economy and avert a climate catastrophe. India alone will require cumulative investments of US$10.1 trillion by 2070[16] to meet its net-zero goals. Currently, tracked finance flows to mitigation account for only about 25 percent of the total investments needed in India.[17] This indicates that the transition to net-zero will require increased climate investment, not only in clean energy and transportation but also in other hard-to-abate sectors. Scaling up essential technologies and sustainable infrastructure is crucial, with a focus on electrifying low- to medium-temperature industrial processes. However, investments must be supplemented by policies and incentives that enable industries to adopt more efficient and clean alternatives without hindering economic growth. There is also considerable potential for sectors to collaborate, drive innovation, and tackle common challenges through shared knowledge, joint innovation, risk mitigation, and resilience planning.

Transition Finance vs. Green Finance

Financing transition will require a combination of green finance and transition finance.

- **Green finance:** Financing technologies that produce (near-)zero emissions and are aligned with the Paris Agreement. For example, investing in utility or rooftop solar or wind energy projects.
- **Transition finance:** Financing to reduce emissions for hard-to-abate sectors or technologies that are important for emissions reductions in other sectors (as enablers). In most cases, these activities are not aligned with the Paris Agreement but are important due to the lack of suitable 'green' alternatives.[18] Unlike green finance, transition finance allocates capital to companies and activities that are not "green" but are in the process of "becoming green" or reducing emissions (therefore lowering their exposure to transition risks), emphasising both inclusiveness and environmental integrity to avoid greenwashing. Therefore, transition finance caters to the decarbonising priorities of energy-intensive and hard-to-abate sectors that cannot be green in the short term due to the lack of green alternatives which are economical

or technically feasible. For example, financing a project aimed at improving the efficiency of refrigeration and air-conditioning (RAC) equipment or bonds issued by a natural gas company to retrofit gas transmission and distribution networks to reduce methane leakage and facilitate the introduction of hydrogen.

Table 1: Financing Transition, Green Finance, and Transition Finance: Definitions and Examples

	Financing Transition	Green Finance	Transition Finance
Definition	Financing any activity that reduces emission	Financing technologies that have zero emissions or near-zero emissions and are thus already aligned to the Paris Agreement	Reducing emissions for sectors that are hard-to-abate sectors or sectors that are important for emission reduction in other sectors (enabling activities). In most cases, these are activities that cannot be aligned with the Paris Agreement and have no alternatives.
Examples	All mitigation activities: renewable energy, energy efficiency, carbon capture, forests, etc.	Solar energy, wind energy	Steel, cement, aviation

Source: The Role of Coal in a Sustainable Energy Mix for India. A Wide-Angle View[19]

While 'green finance' is a widely understood term, 'transition finance' is newer and has multiple definitions. These have been put in place via taxonomies, regulators, or institutions. Table 2 lists these definitions and taxonomies.

Table 2: Transition Finance Taxonomies

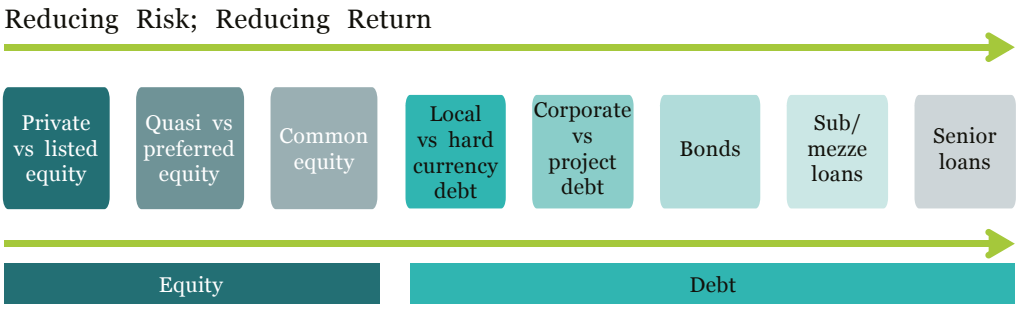
Entity	Document Name
Association of South East Asian Nations (ASEAN)	Transition Finance Guidance[20]
Barclays	Transition Finance Framework[21]
Climate Bonds Initiative (CBI)	White Paper Financing Credible Transitions[22] Discussion Paper on Transition Finance for Transforming Companies[23] CBI has sector criteria available for energy, transport, buildings, etc.[24]
DBS	Sustainable & Transition Finance Framework & Taxonomy[25]
European Union (EU)	EU Taxonomy regulation[26] Taxonomy delegated regulation for Technical Screening Criteria (TSC)[27]
Global Financial Alliance on Net-Zero (GFANZ)	Financial Institution Net-Zero Transition Plans: Fundamentals, Recommendations, and Guidance[28]
International Capital Markets Association (ICMA)	Climate Transition Finance Handbook: Guidance for Issuers[29]
Japan	Basic Guidelines on Climate Transition Finance[30] Technology Roadmaps (Iron & Steel)[31]
Monetary Authority of Singapore (MAS)	Singapore-Asia Taxonomy for Sustainable Finance[32]
Standard Chartered	Transition Finance Framework[33]

Source: Authors' own

A standardised definition of 'transition finance' will require a global aspect as well as a local one, unlike green finance, which has similar characteristics across countries.[a]

In line with the current understanding of both green finance and transition finance, instruments and mechanisms have been developed to mobilise the finance flows. These include instruments across the capital stack.

Figure 2: Capital Stack



Source: Discussion Paper: Financing Industrial Decarbonization by Climate Policy Initiative[34]

Although instruments for green finance are more common, those for transition finance are underway; as of 2022, while the global market for green debt is over US$2.2 trillion, that for transition is just US$12.5 billion.

[a] IFSCA created a working group on Transition Finance which released a report that includes a taxonomy as well. See: https://ifsca.gov.in/Document/ReportandPublication/ifsca-report-on-transtion-finance_final_without_signature_01072024010720240736 47.pdf

Figure 3: The Status of GSS, SLB, and Transition (GSS+) Debt Market (31 December 2022)

	Green	Social	Sustainability*	Transition	SLB
Total size of market (cumulative)	US$2.2tn	US$653.6bn	US$682.0bn	US$12.5bn	US$204.2bn
Number of issuers	2,457	772	507	39	336
Number of countries	85	49	57	12	50
Number of currencies	49	42	41	7	21

Source: Sustainable Debt: Global State Of The Market Report, 2022[36]

In India, these figures are very different. As of 2021,[37] transition bonds were yet to be issued in the country, while green bond issuance stood at US$18.3 billion.

Figure 4: Total Size of the Indian GSS Market (31 December 2021)

	Green	Sustainability*	Social	Total
Total size of market	US$18.3bn	US$60m	US$50m	US$19.5bn
Number of issuers	72	1	2	75
Number of currencies	3	1	2	3

Source: India Sustainable Debt: State Of The Market Report, 2021[38]

Transition finance can be raised through various instruments, including transition bonds and loans, as well as sustainability-linked bonds and loans. Transition bonds are use-of-proceeds debt instruments that can be utilised either at the entity level or activity level for predefined transition activities or projects. In contrast, sustainability-linked bonds are outcome-based instruments, i.e., the specific activity undertaken to achieve the transition is not the focus; instead, these bonds are linked to pre-identified sustainability key performance indicators (KPIs) and are usually applied at the company level.[39] However, transition finance does not include any financing through ESG+ labelled bonds and loans.

Multilateral banks, such as the International Finance Corporation (IFC), are also providing blended finance solutions to decarbonise hard-to-abate sectors. These solutions mix funds from private, public, and philanthropic investors with financing from the IFC to support high-impact transition projects. The blended finance instruments include a variety of tools such as concessional loans, equity investments, and guarantees.

Current Challenges and Way Forward

A multifaceted approach is required to address the need for finance for green and transition activities in a just and sustainable manner. The current challenges on an economy-wide scale can be categorised thus:

- Technical: Near-zero carbon technologies occupy a niche, with high costs and performance risks making them less competitive than established processes.
- Economic: The risk-return profiles of these technologies are difficult to justify due to their capital-intensive nature and long-term horizons. Perceived risks associated with these sectors compound the problem.
- Institutional: Institutional capacity is weak, and public and private institutions often work in silos, with little coordination.

To increase mobilisation, challenges at the levels of both the real sector and the financial sector will have to be identified and addressed.

Real Sector/Demand Side

The real sector requires an enabling ecosystem to transition to low-carbon pathways. The challenges for the real sector can be divided into three broad categories: policy, regulation, and markets.

- **Policy push**
  In India, the extensive scale and urgent timelines for transition across sectors demands robust support from policymakers. These involve policies that create incentives (e.g., subsidies, tax breaks, grants), increase demand (mandates such as renewable energy targets, public procurement programs, and consumer awareness campaigns), and build confidence (long-term policy commitments and transparent policymaking) among new players to invest in novel and sometimes experimental and expensive technologies.

- **Regulatory support**
  Some sectors, such as the power sector, are more tightly regulated than others. While policy levers will create an enabling environment, regulatory support (setting standards, guidelines, and benchmarks for emissions, energy efficiency, and renewable energy integration) and implementation (effective monitoring and evaluation) from regulators will form the second bedrock of the enabling framework.

- **Market movement**
  Markets can aid transition through providing innovations, supporting ecosystem readiness, and working together to create models and pipelines that can attract and absorb capital. However, one of the key challenges, especially for capital providers, is that, while there is capital, there are no bankable projects or pipelines to direct the capital.

Financial Sector/Supply Side

Financial institutions are increasingly acknowledging the physical and transition risks arising from climate change, for example, the increasing risk of stranded assets from closed power stations or transport infrastructure. Despite their

efforts to keep pace with the growing need for green and transition finance, the uptake has been low. In India, so far, tracked financing flows towards climate change mitigation are barely a quarter of the total required.[40] With increased targets and ambitions, as highlighted in the Nationally Determined Contributions (NDCs) and the commitments at India's G20 presidency, financing flows need to increase rapidly. To achieve this, the financial sector and financial institutions need support as well as a push towards introducing new products and increasing the uptake of existing products that align with green and transition finance.

Financial institutions, including retail and investments banks, capital markets, insurers, and asset owners, operate under diverse contractual and regulatory environments owing to their unique and individual characteristics, such as size, business model, sector coverage, fiduciary duty toward shareholders, and other factors.

The overarching challenges faced by the financial sector include the following:

- **Lack of taxonomy:** Be it green finance or transition finance, there is no standard taxonomy that is in place. The lack of clarity hinders not only the uptake of existing products but also the innovation of new ones.

- **Regulatory guidelines:** While the Reserve Bank of India (RBI) has released draft guidelines, formal guidelines are yet to be launched. Insurance and pension fund regulators are also yet to issue draft guidelines. The only regulator to issue guidelines is the Securities and Exchange Board of India (SEBI), which has released ESG[41] (environmental, social, and governance) rating guidelines and the BRSR[42] (Business Responsibility and Sustainability Reporting) disclosure framework. Without formal and comprehensive regulatory guidelines, financial institutions will continue to face challenges regarding both the financial and reputational risks associated with investments in hard-to-abate sectors.

- **Capacity building:** Given the novelty of the subject and the vast amount of available literature, financial institutions often struggle to find the relevant information and support that is required across

levels. Further, the task of growing green finance and transition finance is compounded by the existing challenge of increasing finance flows to MSMEs. Current capacity building, in the form of trainings, roundtable discussions, and peer-learning sessions, are inadequate.

- **Market-led innovation:** Urgent action is required, and there is a need to innovate while ensuring adherence to guardrails and regulations as well as ensuring that the risk of greenwashing and transition washing are mitigated. Innovation in mechanisms and structures is required to increase the flow to both green and transition activities. Current incentive structures do not adequately support the level of innovation required in the financial sector. Additionally, concessional capital is not readily available, which is necessary to increase lending to sectors perceived as risky or as having poor creditworthiness.

About this Compendium

Given the threat of stringent carbon border adjustments, transition finance is crucial for hard-to-abate sectors to reduce their carbon footprint and mitigate the impact of such measures. These adjustments impose export taxes on products from hard-to-abate sectors, potentially hindering their competitiveness in the global market. By facilitating investments in low-carbon technologies and practices, transition finance helps industries comply with evolving regulations, maintain their competitiveness, and contribute to global emission reduction efforts.

The work done by Observer Research Foundation (ORF) and Climate Policy Initiative (CPI) in this space have highlighted that solving the problem of financing transition in India requires an approach that provides a common platform for both demand- and supply-side players. This compendium incorporates insights from eminent individuals across sectors from both the real and financial sector. Based on their contributions and our understanding, a common framework has been developed, which is detailed in the final chapter. The framework identifies recommendations at a broader level while examining sector nuances where required.

These recommendations have the potential to move the needle in the right direction as they are grounded in real-world insights and practical challenges faced by the industry and financial institutions. Our goal is to harmonise demand-side and supply-side measures to create a conducive environment for transitioning hard-to-abate sectors. We aim to support relevant outcomes and strengthen the collective efforts of various stakeholders to expedite this agenda. The subsequent chapters will delve into specific sectors and case studies, offering insights into the challenges and opportunities in financing India's green transition.

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II
The Supply of Finance

The Role of Banking Institutions

Ashwini Kumar Tewari

The Paris Agreement calls for making finance flows consistent with pathways towards reducing greenhouse gas emissions. In order to limit the average global temperature increase to 1.5 degree Celsius above pre-industrial levels, there is a need to implement decarbonisation measures and strategies that can bring substantial reductions in emission intensity across geographies and sectors, particularly those that are energy-intensive and hard-to-abate.

Capital flow is required to achieve this. At a global level, it is estimated that an additional capital investment of approximately US$3.5 trillion per year is required by 2050 to build a global net-zero economy and avert a climate

catastrophe.[1] India alone would need cumulative investments of US$10.1 trillion by 2070 to achieve its net-zero ambitions.[2] Given that tracked finance flows to mitigation account for approximately 25 percent of total flows/ investments required in India,[3] it is safe to say that transition to net-zero will require a significant rise in climate investments not only in clean energy and transport but also in hard-to-abate sectors. Finance flows to adaptation measures are even lesser, with tracked flows amounting to US$5 billion per annum in FY2019 and FY2020.[4]

The role of the financial system in funding the green transition cannot be understated. This includes unlocking private investments and bridging supply and demand for green investments, while considering the entire spectrum of risks including financial, operational, reputational, and regulatory.

India is predominantly a banking driven country as the banking sector plays a pivotal role in driving economic growth and development and thus, in the short to medium term, focus on the banking sector will remain. This article examines the role of banking institutions in financing the green transition, and the current status of their finance flows. It outlines the challenges to greater flows, and explores opportunities that exist for the sector to play a more significant role in climate action.

The Multiple Roles of Banking Institutions in Green and Transition Finance

Banking institutions, with their vast resources and market influence, have a significant role to play in driving the Green and Transition Finance agenda. The role encompasses investments in renewable energy, energy efficiency, sustainable infrastructure, green technologies, and initiatives aimed at reducing carbon emissions and environmental footprint across various sectors.

Financing activities classified as ‘green’ and those needed for transition

Banking institutions play a pivotal role in financing renewable energy projects such as solar, wind, hydro, and geothermal power. They also support energy efficiency initiatives by providing loans and financial products tailored to

businesses and individuals seeking to reduce energy consumption and carbon emissions. This includes financing energy-efficient buildings, appliances, and industrial processes, thereby promoting sustainable practices across sectors. Another sector they focus on is sustainable infrastructure. They support the sector by financing projects such as public transportation systems, smart cities, and green buildings. By channeling funds into infrastructure projects designed to minimise the environmental impacts of climate change-induced events and enhance resilience to climate change, banks play a vital role in fostering sustainable urban development and infrastructure renewal.

Banks support these and other sectors which are important for achieving net-zero by 2070 via loans and supporting bond issuances. In the last few years in India, there has been an increase in the issuance and underwriting of green bonds—financial instruments specifically earmarked for funding environmentally beneficial projects. Additionally, banking institutions in the country have also started to incorporate Environmental, Social, and Governance (ESG) criteria into their investment decisions, in order to direct capital towards companies and projects with strong sustainability credentials. These instruments play a vital role in increasing financing to green activities.

Financial tools such as sustainability-linked loans (SLLs) or sustainability-linked bonds (SLBs), which come with predefined key performance indicators (KPIs) focusing on emissions reduction or clean energy, are also being explored by banks. These instruments, independently verified by third-party evaluators, offer additional assurance for market participation and enhance transparency for private sector engagement. These, along with transition bonds and transition loans, can play a significant role in increasing transition finance in India.

While the above is an external facing activity, banks are also increasing focus on other areas, including:

- **Risk Management and Sustainable Finance Practices:** Recognising the financial risks associated with climate change and environmental degradation, banking institutions are integrating sustainable finance practices into their risk management frameworks. This includes assessing climate-related risks in lending portfolios, incorporating environmental criteria into credit assessments, and

developing innovative financial products to hedge against climate-related risks.

- **Advisory and Thought Leadership:** Banking institutions serve as advisors and thought leaders in the green finance space, providing expertise, guidance, and insights to clients, policymakers, and other stakeholders. By offering advisory services on sustainable investment strategies, corporate sustainability initiatives, and regulatory compliance, banks facilitate the adoption of environmentally responsible practices across the financial ecosystem.

Key Challenges in Transition Financing for Banks

While banks are focusing on the above measures, certain challenges remain. This article groups them in three categories:

1) Policy and legal aspects

a. There is lack of a clear definition of transition activities, which may lead to "transition washing".[a] While there is no universal taxonomy for green activities, there is at least some framework in the form of the guidelines issued for Sovereign Green Bonds[5] and RBI's Framework for Accepting Green Deposits/financing framework.[6]

b. Green elements will need to be incorporated into laws and regulations of the countries, including fiscal, taxation, monetary, credit, and industrial policies.

2) Regulatory aspects

a. Lack of disclosure norms, which may encourage false transition activities.

b. Availability of a robust ecosystem for third-party verification/ assurance and impact assessment and the green credentials of business and projects. This would address potential greenwashing concerns and ensure unhindered flow of capital and funding to the entities.

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[a] 'Transition washing' is a practice where corporations or financial institutions that claim to be transitioning towards more sustainable and climate-friendly operations make claims that are exaggerated or unsubstantiated.

3) Industry and markets

a. The requirement of past data and the unpredictable nature of climate change makes estimation of climate events and their financial impact a challenging endeavour. This is compounded by the fact that estimating the timing, frequency and severity of climate-related events is a challenging proposition given the uncertainties involved in the process.

b. Increasing focus on climate risk, green finance, and transition finance is not yet mandated by the regulator. This activity is thus driven by internal strategy and needs a strong champion. Where such a champion is missing, progress may get stalled.

c. There is a challenge on both the asset and liability sides. On the asset side, there is a lack of established pipeline; on the liability side, the issue is the unwillingness of the consumer to pay a premium for green products.

d. The current lack of specialised products necessitates innovation. This is both costly and time consuming. An additional factor is that there is uncertainty around performance and track record, which adds to the hesitation in launching such products.

Green and Transition Finance Regulations in India: Risks and Opportunities

The evolving regulatory and policy frameworks surrounding green and transition finance in India present both risks and opportunities for banking institutions.

Risks

- Uncertainty and ambiguity: The lack of clear definitions for “transition activities” can lead to confusion and risk aversion among banks. Additionally, evolving regulatory requirements can increase compliance costs and administrative burdens, further complicating the financial sector’s role in supporting the green transition.
- Greenwashing and reputational risk: Misalignment between stated goals and the actual impacts of financed projects can damage a bank’s reputation. Furthermore, difficulty accessing reliable data on the environmental impact of activities presents significant challenges for transparency.

- Competition and market access: International competitors with more established frameworks might have an advantage, and access to international funding could be hindered by differing regulatory interpretations.

Opportunities

- First-mover advantage: Proactive banks that adapt to new regulations can gain a competitive edge by attracting climate-conscious investors and clients. By establishing best practices and expertise, these banks can position themselves as leaders in the emerging market.
- Innovation and new products: Emerging regulations incentivise the development of innovative financial products and services tailored for transition activities. Green bonds, sustainability-linked loans, and climate-focused investment products can attract new customer segments.
- Risk mitigation and long-term sustainability: Embracing green and transition finance principles helps banks manage future climate risks more effectively. Contributing to a low-carbon economy aligns with long-term sustainability goals and social responsibility initiatives.
- Advocacy and collaboration: By collaborating with policymakers, regulators, and other stakeholders, banks can influence policies and regulations that incentivise green investments and create a supportive environment for the green economy.
- Client engagement: Working with clients to develop transition plans and assess their climate risks and opportunities.
- Product development: Developing new financial products and services that support transition finance, such as green loans and sustainability-linked bonds.

Key Strategies to Boost Green and Transition Financing in India

Given both the risks and opportunities in increasing the mobilisation of green finance and transition finance, there are various actions that may be taken by different stakeholders to address the risks and leverage the opportunities.

The Government/RBI

To bolster the advancement and application of climate finance in India, several strategic measures are proposed. First, a standardised sustainable finance taxonomy akin to the EU Taxonomy[7] should be established, providing clarity on project eligibility for financing within this framework. Concurrently, a reduction in Reserve Bank of India (RBI) provisioning requirements for assets meeting ESG criteria would encourage investment. Moreover, instituting an exemption by the RBI for green and renewable energy power financing from traditional sector financing constraints is crucial. Facilitating access to ESG-focused concessional lines of credit, overseen by the Department of Economic Affairs (DEA) and Department of Financial Services (DFS), can channel significant amounts into the sector. Complementary incentives for circular economy initiatives, particularly in sectors like solar, wind, and electric transportation, are recommended.

To meet the burgeoning demand for climate finance, diversifying capital sources is essential. Relaxing investment regulations for pension funds, insurance funds, and the Employees' Provident Fund Organization (EPFO) would encourage participation in climate and green sectors. Additionally, aligning a portion of Corporate Social Responsibility (CSR) funds with the UN Sustainable Development Goals could bolster climate finance efforts.

Identification of Transition Activities

There is a need for a specific approach to identifying transition activities. Any activity supporting a credible transition towards net-zero greenhouse gas emissions should be considered transitional. The identification approaches should be flexible and dynamic and serve to reduce the cost of market participants and mitigate risks.

- Reporting: Reporting practices to help transition activities which support sustainability should be standardised within the country as well as across jurisdictions.

- Financial instruments: There should be financial instruments to support transition activities. This can include debt instruments such

as transition and sustainability-linked loans and bonds. For example, if the fundraiser of a project can deliver stronger-than-expected emission reduction performance, investors will charge a lower interest rate.

- Building capacity: Banks can offer training programs and resources to educate businesses and individuals on green finance options, promoting wider participation.
- Developing green lending standards: Standardising green project evaluation criteria and ensuring robust greenwashing prevention mechanisms are crucial to building trust and transparency.

Green finance and transition finance are pivotal for addressing the urgent challenges of sustainability, as they can serve as a crucial mechanism for redirecting financial flows towards activities that support the transition to a low-carbon economy. Although India has made significant strides in its transition efforts, the path ahead requires a broader focus beyond solar and onshore wind.

This shift necessitates catalytic investments, risk-mitigation instruments, performance-based financing models, and capacity enhancement within financial institutions. A comprehensive and unwavering approach, supported by robust policies, innovative financial mechanisms, and active private sector engagement, is essential to expedite India's transition journey and promote balanced economic development.

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Capital Markets for Raising Green and Transition Finance

Ajay Tyagi and Rachana Baid

Climate change is a global commons problem requiring concerted actions by all. While recognising this, the United Nations Framework Convention on Climate Change has also acknowledged the principle of 'common but differentiated responsibilities and respective capabilities,' which assigns greater responsibilities to developed countries in mitigating greenhouse gas (GHG) emissions and reducing their carbon footprint. There have also been several deliberations at successive meetings of the Conference of the Parties (COP) on developed countries providing financial and technical support to developing states to fight climate change.

Despite commitments, however, developed countries have failed to transfer any significant and identifiable amounts to the developing countries. Such delays have only worsened the situation, amid the increasing incidence and intensity of extreme weather conditions and natural calamities worldwide. Developing countries are more vulnerable to the massive consequences of these events and face an uphill task in arranging funding to finance their climate mitigation and adaptation requirements.

The Indian Scenario

India is a vast country with a 1.4-billion population,[1] a per capita income of approximately US$2,500 per annum,[2] and significant income disparity. India is also among the countries most affected by extreme weather events.[3] Although India's per capita annual GHG emission in 2021 was only 1.6 carbon dioxide equivalent (CO_2e) metric tons as compared to, say, the 13.8 CO_2e metric tons of the United States (US), China's 7.5 CO_2e metric tons, and the global average of 4.3 CO_2e metric tons, it was the third largest incremental annual emitter of GHG in the world that year.

India has outlined ambitious targets to contain climate change impacts and meet its nationally determined contributions under the Paris Climate Agreement. These targets should also help the country achieve the Sustainable Development Goals by 2030, besides fulfilling its net-zero GHG emissions commitment by 2070[4]—even as it aspires to become a developed country by 2047. Given its geographical size, population and diversity, however, India faces unique obstacles to these targets. For instance, over 75 percent of its districts (home to 638 million people) are categorised as hotspots for extreme climate events.[5] The climate financing strategies have to be appropriately mainstreamed in the overall development model.

Various studies have projected different macro-level estimates of India's funding requirements to combat climate change in the medium to long term. While the exact estimates may differ, all point to a substantial financing requirement. To arrive at the potential modes of financing for this requirement, it is perhaps best to begin by focusing on the medium term (up to 2030). In an October 2022 report, McKinsey estimated that India will require an annual average funding of US$100 billion between 2021 and

2030 to finance its mitigation plan, including the actions needed to meet its international commitments.[6] However, India's current total annual investment for mitigation activities is about US$44 billion. This raises a critical question: Where will the additional funds come from?

At present, the primary sources of climate finance in India are development finance institutions (DFIs), comprising multilateral development banks (MDBs) and bilateral DFIs, commercial and financial institutions, public sector undertakings (PSUs); and union and state government budgets. Apart from the commercial and financial institutions, the other sources are unlikely to meet the additional financing requirements, in any substantial manner, in the foreseeable future. DFIs have limitations in terms of overall resource availability in addition to other pressing priorities such as long-term infrastructure financing. Moreover, extracting any sizeable additional climate funds from the MDBs appears unlikely unless they undergo crucial reforms;[a] the union and state governments are also facing fiscal constraints and their debt-to-GDP ratios are high and unsustainable; and the PSUs have limited capabilities and are resource-constrained.

This leaves private players and financial institutions, both domestic and foreign, as the possible sources of funding. To facilitate investments from these sources, it is essential to have a better idea of the granular, sector-wise funding requirements. This will depend upon a well-defined government plan of action to meet its commitments in the medium term. Several crucial questions will need to be answered: Which are the hard-to-abate sectors? What is the strategy to reduce emissions in these sectors and mandate specific targets for them? Which projects can be appropriately structured to make them investible and commercially viable? Which projects are less investible and will require government or regulatory intervention to de-risk them?

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[a] This point was also brought out in the G20 meeting held in New Delhi in September 2023.

The Demand and Supply Sides of Green and Transition Finance

Although many different institutions have estimated India's climate finance requirements, it is for the government to make a fair assessment and own the numbers; after all, it is the government's international commitment to reduce emission intensity of GDP, by 2030, by 45 percent over 2005 levels.[7] Developing a well thought out plan to move to a low-carbon economy and executing it systematically is necessary to avoid any financial stability risks. The GDP projections for 2030 under different energy-mix scenarios will present various options to reduce the emission intensity of GDP. The carbon-intensive and hard-to-abate sectors should be segregated and made the subject of a more aggressive and measurable plan to reduce emissions. Sector-specific GHG emission targets should be fixed for industrial sectors, such as steel, aluminium, cement, and thermal power, and eligible entities in these industries should be mandated to meet the prescribed targets. For example, if the steel sector currently emits 2.5 metric tons of CO_2e/ton of steel production on average,[8] with a target to reduce this to, say, 1.6 metric tons of CO_2e by 2030 in a phased manner, each eligible entity producing steel of that specification would need to follow the phase-down plan. Even for the sectors that do not fall in the 'hard-to-abate' category, a sectoral granular exercise is needed, with a clear action plan. To monitor progress, the period up to 2030 may be divided into time blocks, with a fixed target for each.

In June 2023, the government notified a framework for Carbon Credit Trading Scheme (CCTS). The scheme entails driving the market by setting GHG emission intensity reduction targets for entities in selected sectors. The entities that exceed the set targets will be issued carbon credit certificates, while those failing to achieve the targets can meet the shortfall by purchasing these certificates from the market. The scheme aims to develop a well-functioning regulated domestic carbon credit trading market, with transparent price discovery. CCTS should be operationalised at the earliest to help the firms/entities achieve the targets in a cost-effective manner.

Once mandated and a pathway prescribed to reduce emissions, entities in different sectors can prepare definitive plans to meet their transition financing requirements, and explore various options for their specific projects. They

would work out the requirements under different types of instruments (such as debt, equity, and hybrid). This will give the lenders and investors a clearer picture. This exercise will also help in identifying the required policy and regulatory interventions to facilitate raising transition finance.

Similarly, the government should coordinate a bottom-up granular exercise to work out the fund requirement to undertake adaptation activities. The sectors likely to be most affected by climate change (for instance, infrastructure, agriculture, forestry, and aquaculture) and the major players involved therein should prepare definitive financing plans for undertaking adaptation measures. Investors are intrinsically driven by the returns on investment. Notably, ESG investment has gained steam in recent years, particularly in the developed countries. This indicates that some investors, especially the institutional investors, are willing to sacrifice, to some extent, returns on investments if they are convinced that the investments will result in better social or environmental outcomes.

Despite the recent regulatory push, ESG investments are yet to pick up in India in any significant manner. As a part of its borrowing programme, the Indian government raised INR 160 billion (US$1.91 billion) as sovereign green bonds (SGBs)[9] in 2022-23 by issuing two tranches of five- and ten-year bonds.[10] The 'greenium' (the premium investors are willing to pay for green bonds because of their sustainability impact) reduced from six basis points in the first tranche to between one and five basis points in the second tranche. Even this insignificant greenium might perhaps be a result of the Reserve Bank of India (RBI) coercing banks to buy the SGBs. Still, although these bonds have found a limited appetite, there is an expectation that the SGBs would create an ecosystem that fosters a greater flow of capital into green projects. SGBs will also provide a pricing reference for private sector entities in India for their Rupee-denominated borrowing for ESG-linked debt.

The Securities and Exchange Board of India (SEBI) has had guidelines for issuing green bonds since 2017, which were updated in 2023.[11] However, the total amount raised under these guidelines so far is only around US$43 billion.[12] As such, even though the increase in ESG-themed mutual funds since 2020 is a positive sign, these have had limited success, with their total assets under management at only around INR 100 billion (US$1.19 billion) as of March 2023.[13]

It would be helpful to segregate green projects into those that can be appropriately structured to make them investible and commercially viable, and others that are less investible and thus require government or regulatory intervention to de-risk the investments. Many projects would likely fall on the borderline of the two categories. The markets and investors will need to do their own due diligence to take a view on such categorisation.

An important assessment to be made is the amount of foreign funding needed in green projects. Developing countries (excluding China) are likely to need two-thirds of their capital requirement to come from international sources during the 2023-2030 period, to meet their goals. India likely faces a similar situation. To be sure, many serious players in India, especially those in the renewable energy sector, have followed the external commercial borrowings route to raise significant foreign funds through a combination of loans and bonds.[14]

Tapping Capital Markets in India

The Indian economy is dominated by banks that account for about 60 percent of the total flow of credit to the non-financial sector.[15] The banks thus need to play a far more active role in financing green projects in the country, and will need to improve their risk assessment capabilities and revisit capital adequacy norms to finance green projects. However, even with improved preparedness, banks may still not be able to finance long-gestation projects due to potential asset-liability mismatch. Notably, many green and transition projects will likely fall in the long gestation period category, with back-end returns. The capital market, with its various instruments, provides a good financing option for such projects.

The Indian capital markets have come of age in recent years, with the total market cap of listed companies at about 120 percent of GDP as of 2023.[16] India's capital market has a best-in-class regulatory architecture. This was seen in recent years amid successive global shocks that roiled the international financial markets. The onset of COVID-19 in March 2020, Russia's ongoing war in Ukraine, and the Gaza conflict that started in October 2023 have disrupted the supply chains and international trade, and altered the global economic order. Green transition agendas are increasingly becoming interconnected with the concerns of national securities.

The robustness of the Indian capital markets and its performance during such a tumultuous period, even in comparison to those of the developed economies, is notable. NIFTY 50 return (in US$ terms) was 14.90 percent (11.19 percent) during 2020-21, 24.12 percent (21.68 percent) during 2021-22, 4.32 percent (-7.80 percent) in 2022-23, and 19.42 percent (18.73 percent) till January 2024,[17] vis-à-vis S&P 500's 28.47 percent in 2020-21, -18.04 percent in 2021-22, and 26.06 percent in 2022-23.[18] Entities seeking to raise equity via the public market can do so through modes such as an initial public offering, rights issue, or a qualified institutional placement. The disclosure regime for raising funds and the one for the end-use utilisation of funds raised is well established under Companies Act 2013, and SEBI's issue of capital and disclosure requirements (ICDR) regulations, 2018 and the listing obligations and disclosure requirements (LODR) regulations, 2015. SEBI's 2021 Business Responsibility and Sustainability Report (BRSR) guidelines[19] simplify the challenge of choosing a reporting framework by introducing a unified, transparent reporting format and thus have proven to be a game changer in the listed space.

The guidelines also provide interoperability with international reporting standards, including the Global Reporting Initiative, the Task Force on Climate-related Financial Disclosures, and the Sustainability Accounting Standards Board. In a bid to have more focused and measurable disclosures, in 2023, SEBI introduced the concept of core BRSR reporting, and the requirement for a third-party assessment or assurance on the disclosures made by the eligible listed companies. A glide path has also been provided for disclosures by the value chain participants, along with the third-party assurance requirement. This augurs well for attracting equity investments to meet sustainable financing requirements. Based on experience and if needed, the reporting formats could be modified in the future, in consultation with stakeholders.

Private equity investments can be made through alternate investment funds, private equity funds, and sovereign wealth funds. In July 2022, SEBI revamped regulations relating to 'social impact funds' (SIFs), which are registered as Category-I alternative investment funds and were previously known as 'social venture funds' (SVFs).[20] The Institute of Chartered Accountants of India has also established social audit standards (SASs), with SAS 500 pertaining to

"ensuring environmental sustainability, addressing climate change including mitigation and adaptation, forest and wildlife conservation."[21] This should provide clarity to the investors looking to invest in these funds. Although the cumulative funds raised under SVFs/SIFs, as of end December 2023, is relatively small—around INR 6.41 billion (US$0.07 billion)—going forward, appropriate regulatory adjustments in consultation with the stakeholders can make these vehicles more relevant for raising private funds for climate financing.[22]

The biggest challenge for meeting the requirements for financing transition is the underdeveloped corporate bond market in India. Typically, green projects, like infrastructure projects, have a much higher debt-to-equity ratio as compared to manufacturing projects. Debt instruments currently constitute about 45 percent of India's annual climate finance, but this is expected to increase in the future.[23] As of now, India's corporate bond market lacks the adequate depth and liquidity. Although it has seen some improvements is the last decade, much needs to be done. The development of the corporate bond market lends itself to extensive research and discussion, with some papers already offering insights on the issue.[24]

Regulatory Changes and Government Interventions

The government's top priority should be to establish a comprehensive and unambiguous taxonomy, including on what should be considered as 'green' investment. Having a clearly defined green taxonomy is essential to attract foreign investments in green projects. Given the sizeable requirement for foreign funding, India's taxonomy may need to emulate existing taxonomies, particularly that of the European Union, while accounting for contextual differences.

The government should actively coordinate with the RBI and SEBI to develop the domestic bond market. Raising climate finance in India is critically dependent on addressing this issue. RBI should take measures to deepen the domestic currency hedging market to reduce the hedging costs. Considering the long gestation period and back-ended pay-outs of green projects, this is a crucial prerequisite to increase foreign green investments. The Gujarat International Finance Tec-City (GIFT City), with a framework to raise funds

in foreign currency, has the potential to emerge as Indian corporates' preferred option for green debt issuances. Notably, GIFT City's total green bond listings have already crossed US$10 billion (as of end December 2023). The International Financial Services Centres Authority has formed an expert committee (consisting of representatives from industry, standard setters, and think tanks) to recommend a regulatory framework for transition finance instruments, and measures to promote raising transition finance through the GIFT International Financial Services Centre.

In an emerging economy like India, with multiple aspirational priorities, it will take time for domestic investors to imbibe an ESG investment culture. As such, less investible and risky projects would best be funded by MDBs or the Union government. To incentivise private investment in such projects, the government may consider extending support by, among others, giving credit guarantees for debt raising; reducing withholding tax to about 5 percent for foreign investors; and providing tax concessions on the lines of those given to infrastructure funds in 2015-16. Such benefits will need to be well targeted and the projects selected through due diligence.

Conclusion

India's equities market has the depth and wherewithal to play a role in meeting the country's climate finance requirements, but the debt market needs improvements to realise this potential. The demand for funds should be assessed in a more systematic manner, going into granular sectoral details. On the supply side, about two-thirds of the funding required till 2030 may come from international sources. Several government and regulatory interventions are needed to make climate financing a success, but, crucially, government support will continue to be needed for less investible and risky projects.

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Securitisation as a Key in Green and Transition Finance

Kalpesh Gada

India's massive need for climate finance to achieve its Nationally Determined Contributions (NDCs) is well-documented. It is also acknowledged that such finance is falling woefully short, with actual flows being a fraction of the calculated need. The non-profit research group, Climate Policy Initiative (CPI), has estimated that in 2019-20, tracked green finance was INR 3.09 lakh crore (~US$ 44 billion) per annum, approximately one-fourth of India's requirement.

While investments in clean energy have increased in the past few years, financing in hard-to-abate sectors have not kept pace. The CPI report, "Global Landscape of Climate Finance" estimates that while US$324 billion was invested in renewable energy in 2019-20, only an average US$7 billion is channelled annually to other climate mitigating industries. As many pools of capital as possible are needed to be unlocked to fill this financing gap, using innovative financial instruments. This article delves into the role of one such innovative instrument to facilitate green transition finance in India—i.e., securitisation.

It starts by explaining the concept of securitisation and its role in financial markets. In the second part, it examines the Indian context in detail, outlining the legal and regulatory framework applicable, the prevailing securitisation market size, and the key players with their motivations. The third part looks at the existing market for securitisation of 'transition loans' globally. The final section analyses whether 'transition loans', as applicable to India, are amenable to securitisation, the potential use cases, and likely structures. It also looks at the various challenges that green securitisation faces and suggests ways to overcome them.

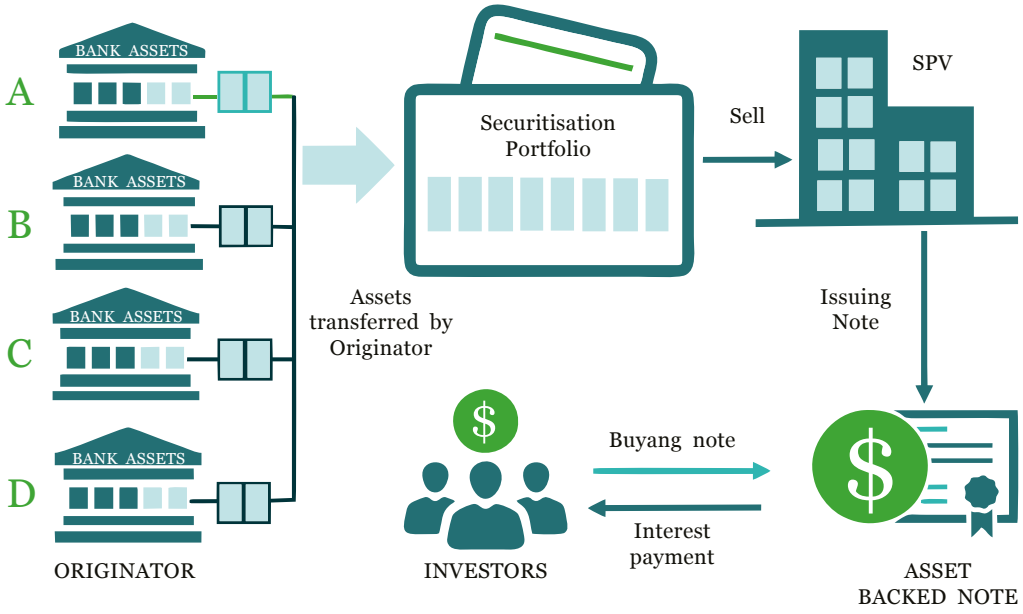
The Concept of 'Transition Finance'

To transition to net-zero, emission reduction in hard-to-abate sectors is extremely important. While investments in clean energy have increased, those in hard-to-abate sectors (transition finance) have not kept pace. Most importantly, there is no universally accepted definition of 'transition finance', to begin with. This article uses the definition adopted by the Securities and Exchange Board of India (SEBI) in its June 2023 amendment of guidelines for non-convertible securities, which became applicable beginning in January 2024. In the amendment, SEBI stated that transition bonds are those that "comprise of funds raised for transitioning to a more sustainable form of operations, in line with India's NDCs." 'Transition bonds' can be extended to include transition finance—loans as well as bonds.

The Potential Role of Securitisation in Transition Finance in India

Can securitisation play a key role in green transition finance in India? The answer requires an examination of some of the building blocks.

Figure 1. The Concept of 'Securitisation': Key Benefits for the Originator, the Investor, and the Broader Financial Markets



Source: Policy Note: Securitisation for Sustainable Development – Accelerating Capital Velocity, MOBILIST[4]

Securitisation is a process through which a set of loans is pooled and repackaged into tradable securities in the form of Pass-through Certificates (PTCs). A typical securitisation transaction has two parts:

(a) A company—typically a bank or a non-banking finance company (NBFC), termed the 'originator'—identifies the loan assets it wants to remove from its balance sheet and creates a 'securitisation pool'. The originator sells this pool of receivables to the 'issuer', often a special purpose vehicle (SPV) created solely for the transaction in question, and receives immediate payment against the same.

(b) The 'issuer' finances the acquisition of the securitisation pool by issuing PTCs that are then sold to capital market investors. These carry a pre-defined schedule of principal and interest, making them akin to a fixed income instrument.

There can even be multiple tiers of PTCs, called 'tranches'. For instance, in a typical three-tranche structure, the 'senior' tranche is paid out first followed by the 'mezzanine' tranche, with the 'subordinate' or 'equity' tranche having a claim on the residual cash flow, after the scheduled payout on the higher tranches has been made. After the transaction execution, on an ongoing basis, the underlying borrowers continue to pay their loan instalments as earlier (also called 'pool collections'), which are transferred to an account of the Issuer/SPV. These 'pool collections' are used to service the PTCs.

Conceptually, securitisation offers various benefits. For the originator, it promises one or more of the following: (i) regulatory capital relief (wherever the capital requirement on the originator's residual exposure to the transaction is lower than that on the entire asset pool held prior to securitisation);[a] (ii) access to a broader range of investors (which could include some who may not be comfortable taking a direct exposure to the company); (iii) lower cost of financing, given that PTCs typically carry a credit rating higher than standalone debts of the originator; and (iv) reduced asset-liability mismatch (given that securitisation offers a completely tenure-matched funding route).

For investors as well, securitisation is potentially beneficial in multiple ways: (i) it provides access to highly rated assets without calling for deep analytical expertise or technological infrastructure that is often a prerequisite for exposure to the underlying asset class directly; (ii) the multiple tranches offer multiple risk-return points to choose from; (iii) the senior PTC tranches are typically rated higher than the standalone rating of the originator; and (iv) it allows for greater customisation, both of pool composition as well as the size and rating of the PTC tranche.

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[a] Most securitisation transactions in India are carried out by banks and NBFCs, which are entities regulated by the RBI. For such 'Regulated Entities', the amount of capital that is required to be held on a 'securitisation exposure' is stipulated by RBI. See: *Master Direction – Reserve Bank of India (Securitisation of Standard Assets) Directions, 2021,* Updated 5 December 2022, https://www.rbi.org.in/scripts/bs_viewmasdirections.aspx?id=12165

For the overall financial system too, securitisation is beneficial since it effectively creates a secondary market for loans. The recycling of capital—with assets moving from the loan market to the capital market—helps accelerate capital velocity. The process effectively allows for a sharper specialisation of roles in the financial markets. Primary loan market players (banks and NBFCs), with their stronger connect with borrowers, can focus on loan origination, underwriting and collection/recovery, while the capital market institutions get access to robust, credit-enhanced, rated and tradable securities, backed by filtered, seasoned loan portfolios.

Characteristics of the Indian Securitisation Market

To assess the role securitisation can play in green transition finance, it is critical to understand securitisation in the Indian context: its legal, regulatory and accounting framework; its issuance volumes; the current asset classes; and the key players in the market and their motivations.

- **Indian securitisation market is tightly regulated:** The applicable regulations include the Master Direction – Reserve Bank of India (Securitisation of Standard Assets) Directions, 2021, and the SEBI's (Issue and Listing of Securitised Debt Instruments and Security Receipts) Regulations, 2008. Both of these documents lay down the rules regarding the kind of loans that can be securitised, the minimum holding period (MHP) for loans before securitising, and the minimum and maximum stakes that originators need to maintain in securitised exposure. Synthetic securitisation (that only involves a risk transfer, but not actual sale of receivables) is not allowed in India. In this aspect, its rules are different from those in some developed markets, such as that of the United States (US).
- **The market is completely domestic:** Cross-border securitisation (i.e., Indian originators selling assets directly to overseas SPVs along with issue of PTCs in foreign currency) is not permitted in India. This is again a significant difference between the Indian and many other markets. This is important in the context of securitisation of transition loans (or for that matter, even pure green loans) considering that much of the demand for labelled securities is from climate-focused investors in the developed economies, while the domestic demand is minuscule.

- **Transaction structures as well as asset classes are far simpler:** Partly due to regulatory restrictions, and also for historical reasons, the transaction structures prevalent in India tend to be far simpler than those in the more developed markets, especially that of the US.
- **Market size is small and focused:** The estimated securitisation issuance for FY2023 in India was INR 68,640 crore, a mere 0.4 percent of the total outstanding loan portfolio of INR 170 lakh crore of banks and NBFCs. Those selling comprise entirely of NBFCs and housing finance companies (HFCs), with the top five originators typically accounting for 50-60 percent of the volume. In terms of the underlying asset class, the market is dominated by retail loans, with corporate loan securitisation, termed as collateralised loan obligations (CLOs), conspicuous in their absence.
- **The primary motivation is priority sector lending (PSL) targets:** The buyers are primarily banks, keen to invest in securitised debt to meet their PSL targets. Capital market players like mutual funds have been only occasional investors in securitised debt while insurance companies invest even less frequently. Thus, the market for non-PSL assets has traditionally been muted, although it has picked up in recent years.

Securitisation of Green and Transition Loans: The Global Scenario

There is growing interest in green securitisation globally. Green securitisations may take different forms, including:

- **Green collateral transactions,** where some or all of the underlying portfolio comprises green assets (such as renewable energy projects, energy-efficient mortgages or electric vehicles); in such transactions, the key condition is that the underlying loans getting securitised should be for financing 'green assets' but, subsequently, there is no compulsion on what the proceeds of the transaction are used for.
- **Green use of proceeds (UoP) transactions**, where proceeds of the securitisation are deployed in projects with green characteristics, often in accordance with a sustainable finance framework. In such transactions, the underlying pool is made up of loans for financing

'brown' or carbon-emitting projects or assets, but the proceeds need to be used only for funding green assets. In other words, such green UoP structures can be used to support the transition from brown to 'less brown' or green.

Environmental and social securitisation is a growing segment globally, with the US market being the most active. At the end of the first quarter of 2021, the cumulative issuance of US green securitisations stood at US$115.5 billion (107.9 billion euro). Following the US were China and the European Union, with Chinese deals at the end of 2020 being valued at RMB 115 billion (16.1 billion euro),[7] and those of the EU, according to a 2022 report from the European Banking Authority,[8] just below 10 billion euro.

In 2023, the 'most innovative deal of the year' award at the prestigious GlobalCapital's European Securitisation Awards went to Project Bocarte, which had energy transition at its core. As reported by GlobalCapital, "this synthetic securitisation transaction by the Spanish financial services giant, Banco Santander, was worked out by the US-based Newmarket Capital, which manages capital on behalf of institutional investors. It provided for first loss credit protection on Banco Santander's 1.6-billion euro portfolio of project finance loans, of which almost 50 percent comprise renewable energy assets across Spain, the UK, and the US.[9]

Such securitisation is also catching on in Asia. For example, Bayfront Infrastructure Management Pte Ltd is a Singapore-based platform owned by Clifford Capital Holdings and the Asian Infrastructure Investment Bank (AIIB), designed to help institutional investors access Asia-Pacific infrastructure debt. Its latest infrastructure asset-back securities transaction in September 2023, with a portfolio size of approximately US$410 million spread across 40 individual loans/bonds, 33 projects, 15 countries, and 10 industry sub-sectors, offered five classes of notes (Class A1, Class A1-SU, Class B, Class C and Class D) to institutional investors. The Class A1-SU notes were a dedicated sustainability tranche, issued under the Bayfront Sustainable Finance Framework, the net proceeds of which will be used to finance or refinance projects and infrastructure debt for green and social assets meeting the eligibility criteria specified in the framework. The UK Foreign Commonwealth and Development Office (FCDO), and AIIB were the anchor investors.

The securitisation of residential transition loans (RTLs, also known as 'fix-and-flip' loans or 'residential bridge' loans) has also become widespread in the US. RTLs are a means by which real estate investors obtain financing for climate-smart construction, modification, repairs and other rehabilitation and renovation projects that increase energy efficiency on a related mortgaged property. A notable example is the asset-backed securitisation (ABS) transaction of US$383 million in March 2022 by Solar Mosaic, a US platform for financing energy-efficient home improvements. Another is the 550-million-euro green residential mortgage-backed securities (RMBS) project that Obvion, the Netherlands' largest mortgage lender, carried out in 2018, thus pioneering green RMBS in Europe.

The learning from global markets is that securitisation of green loans is a lot more common than that of transition loans. A related point is that establishing the underlying loan asset class is a first step, and that securitisation comes later.

Transition Loans in India: Amenable to Securitisation?

Are transition loans in India amenable to securitisation? Can transition loans emerge as an asset class in the coming years? To provide an answer, the key traits an asset class should possess, especially in the Indian context, need to be examined. Even if an asset class is new and undiscovered at present, it could well gain greater traction in the future, as long as it shares essential characteristics with other asset classes that are presently popular. What are the loan categories that account for the bulk of securitisation in India?

(a) **The underlying loans usually form a well-defined homogenous category,** as is the case with truck loans, home loans, personal loans, gold loans, or microfinance institution (MFI) group loans—the most common asset classes to get securitised. With transition loans, despite the growing popularity of the concept, there is no universally accepted definition of transition finance. The concept is not yet fully established, nor is the current volume large enough. Prospective investors thus hesitate to commit capital to securities backed by transition loans.

(b) **The underlying loan pools are usually granular,** composed of relatively small-ticket retail loans. This is the case with practically the entire securitisation market in India. Among the asset types that commonly get securitised, the average loan ticket size tends to be highest in the case of secured business loans or loans against property (~INR 1.5–2 million), while the average size for unsecured group loans by MFIs could be as low as INR 30,000–50,000. A typical securitisation transaction would have a few thousand loans pooled together, and this granularity has a bearing on the way investors/ credit rating agencies evaluate the transaction.

In contrast, transition loans have so far been characterised by large corporate entities borrowing large sums. In May 2022, for instance, DBS Bank provided a transition loan of INR 1,750 million to Shree Renuka Sugars Ltd (a subsidiary of Wilmar International Ltd), one of India's largest sugar and green energy producers, to expand the company's sustainable bio-ethanol business as a part of Wilmar's overall decarbonisation strategy. In September 2022, the Mitsubishi Heavy Industries (MHI) Group issued its inaugural JPY 10 billion (INR 5,450 crore) five-year transition bonds towards investments in projects to de-carbonise existing infrastructure and build a hydrogen solutions' ecosystem.

Large corporate entities typically borrow from capital markets directly. Even when they do borrow from banks and financial institutions, as noted earlier, the securitisation of such large-ticket corporate loans (CLOs) is largely absent in India. Smaller-ticket transition loans, availed by micro, small and medium enterprises (MSMEs), especially the micro-enterprises, could be more amenable to securitisation. Although transition loans to MSMEs are few at present, this asset class may well soon grow, given the increasing pressure on MSMEs—both from the government and the large corporations whose value chains they are part of—to measure and minimise their emissions.

Another hurdle is that the securitisation originators (the loan sellers) are usually NBFCs. NBFCs hardly ever disburse transition loans, which is a segment served by banks, development finance institutions (DFIs) and other large financial institutions.

Investors should also have a clear motive to invest in securitised debt instruments. At present, a key motive for securitisation investors is that the underlying loans qualify as PSL. Likewise, if there was a similar mandate for investors, securitisation of transition loans would find more takers.

Challenges and Opportunities for Securitisation in Transition Finance

This final section summarises the challenges and opportunities for securitisation in transition finance, many of which are similar to those for green finance in general.

Regulatory and Policy Framework

One of the primary challenges facing securitisation in the context of transition finance is the absence of a comprehensive and widely accepted taxonomy. The lack of specific guidelines and standards for what constitutes 'transition finance' creates uncertainty for both issuers and investors. Admittedly, this lack of taxonomy is a challenge not just for securitisation, but for transition finance overall.

To address this, policymakers need to develop a clear and standardised definition of eligible transition assets, disclosure requirements, and reporting standards. Singapore has created a taxonomy for sustainable finance that identifies activities as 'green; 'amber' and 'ineligible', which could be a starting point for India, too.[10] Establishing a robust regulatory framework will provide confidence to investors and promote the growth of securitisation for transition loans.

Asset Quality and Standardisation

For securitisation of green transition finance to take off, transition loans need to be acknowledged as a homogenous asset class. The heterogeneity of projects poses a challenge in creating standardised asset classes suitable for securitisation. It also takes capital market investors time to develop confidence in an asset class, which happens only after asset quality trends are established.

To overcome this challenge, industry stakeholders, including financial institutions, regulators, and project developers, must collaborate to enhance transparency and credibility of project outcomes. They should also facilitate the creation of benchmarking and risk assessment tools for investors.

Credit Enhancement and Risk Mitigation

As mentioned earlier, transition finance availed by large corporations is unlikely to lead to much securitisation. It is more likely that loans availed by MSMEs will be suitable for recycling through the securitisation route. But in this case, credit quality may be a concern for investors. Blended finance structures are ideally suited to address this, be it in the form of a guarantee from or investment in subordinated tranches, at concessional pricing, by development finance institutions or foundations.

Conclusion

Securitisation is not a large market in India. Even for asset classes where securitisation is common, it has remained a marginal option. Even green loan securitisation has not taken off. Against such backdrop, securitisation of transition loans, when the asset class itself is not well established, is not likely to grow soon. However, it could be an avenue once the volume of transition loans for MSMEs grows.

Securitisation requires specialised structuring expertise, complex credit analysis, and a specialised investor base. Securitisation should therefore be seen as complementary to other measures that can be taken to improve the flow of finance.

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III
The Demand for Finance

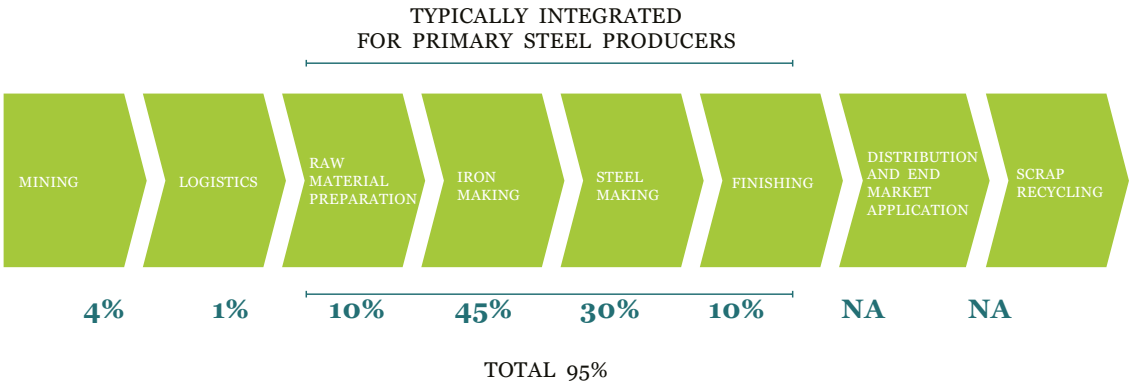
Steel Sector Decarbonisation

Prabodha Acharya and Anuna Banerjee

India is the second largest producer of steel in the world, and the steel sector contributes to approximately 2.5 percent of GDP.[1] In the last five years, total crude steel production in India grew by 25.8 percent, from 111.35 MT in 2019 to 140.17 MT in 2023, compared to a 0.5-percent growth in global production during the same period.[2] This upsurge is not expected to slow down soon. India's total crude steel capacity is projected to grow to 300 MTPA by FY 2031, in line with targets set out in the National Steel Policy 2017. Steel demand in India is also expected to show a strong uptrend, driven by the building and construction industry and the infrastructure segment, with total steel demand projected to grow at 7.2 percent CAGR through FY 2031 to reach ~230 MT.[3]

However, concerns regarding the sustainability of this growth and its implications on the environment need to be addressed. The steel industry is energy intensive and the second largest consumer of energy globally.[4] The steel sector is responsible for approximately 12 percent of India's total emissions, which is significantly higher than the global average of 8 percent.[5] Therefore, India's plan to achieve net-zero emissions by 2070 hinges on the successful decarbonisation of this industry. Consequently, the Ministry of Steel constituted 13 task forces for green steel.[6] The government has also introduced initiatives such as the Steel Scrap Recycling Policy 2019, the Perform, Achieve and Trade (PAT) scheme, and the National Green Hydrogen Mission (NGHM). Under the NGHM, the Ministry of Steel has been allocated 30 percent of the pilot project budget (US$177 million) to decarbonise the steel sector in India.[7]

Figure 1: CO_2 Emissions by Value Chain Actor



Source: Shell and Deloitte (2022)[8]

The Steel Value Chain

The steel value chain begins with the extraction of iron ore through mining, followed by processing the ore to eliminate impurities and produce iron ore concentrate. Steel is produced from the refined ore using two primary methods: the blast furnace-basic oxygen furnace (BF-BOF) route and the direct reduction of iron-electric arc furnace (DRI-EAF) route. Carbon dioxide (CO_2) emissions occur at different stages throughout this value chain, with minor emissions in the mining (4 percent) and logistics (1 percent) stages and substantial emissions (95 percent) during the manufacturing process.[9]

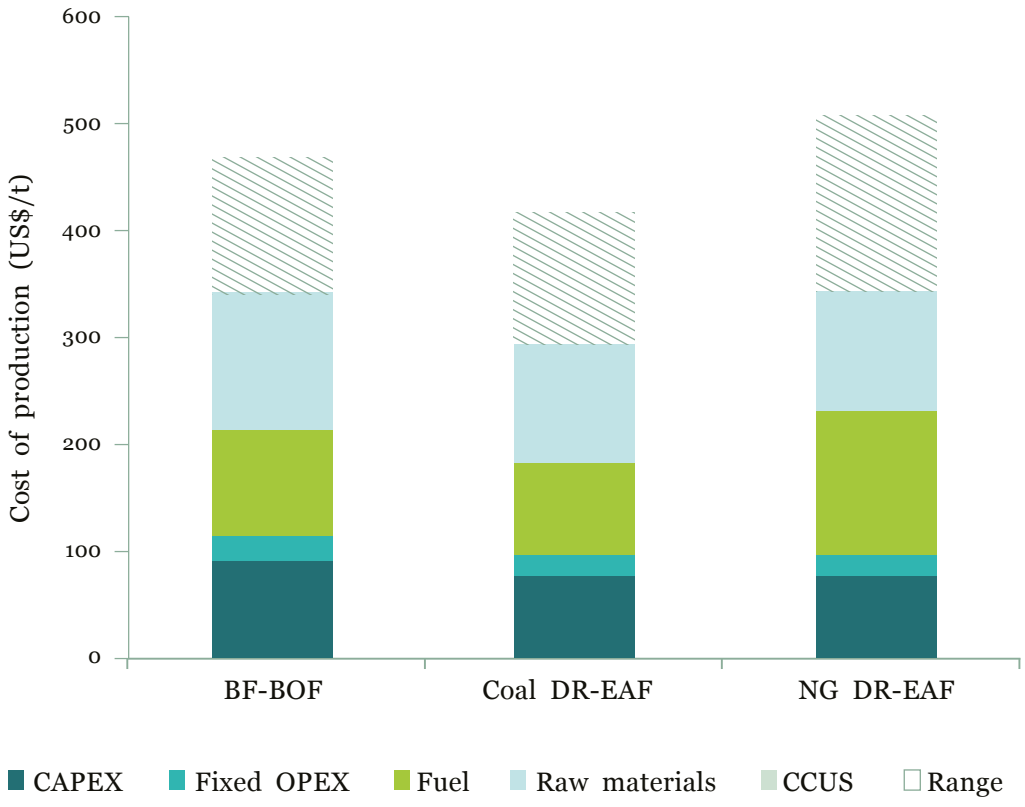
The BF-BOF method uses reduction chemistry to extract iron from the oxygen present in the iron ore. Traditionally, coking coal acts as the reducing agent. Coking coal is produced by heating coal at high temperatures in oxygen-deprived conditions to create coke, an almost exclusively pure carbon product. The coke is burned in the blast furnace to reach temperatures necessary for smelting iron ore (i.e., approx. 1500°C). During this process, carbon reacts with oxygen to produce CO_2 and molten iron. However, this initial product, known as pig iron, lacks malleability and requires further processing to produce steel. This refinement occurs in a BOF, or converter, that is capable of holding up to 400 tonnes of hot metal. Oxygen is introduced into the container, triggering exothermic reactions that oxidise impurities such as carbon and silicon, transforming the iron to steel. The resulting liquid steel is then cast into solid forms such as slabs or ingots and processed through several rolling operations to yield long products like bars, wires, and flat steel strips. Further refining may involve tempering and coating the produced steel to enhance its characteristics and functions.[10]

The EAF method uses electrically charged graphite electrodes that produce heat-generating electric arcs when they make contact with the metal. These arcs reach temperatures as high as 3,500°C to melt the metal. Consequently, the molten metal reaches temperatures of around 1,800°C.[11] The primary feed in this method consists of either directly reduced iron (DRI) or scrap steel. DRI, also known as sponge iron, is created by combining iron ore with a fuel and a reductant to reduce its oxygen content. When iron ore is reduced through the DR route, the resultant iron is solid and resembles a sponge, thus earning it the name ‘sponge iron’. The reducing agent in this

process is either coal, when used in rotary kilns, or natural gas, in vertical shaft technology. Globally, natural gas is the predominant fuel, whereas in India, 82 percent of DRI is manufactured in coal-based rotary kilns, with the rest produced via gas-based routes (e.g., natural gas, syngas from coal gasification, coke oven gas, and gas from the Corex process).

Scrap steel is directly introduced into the EAF. One advantage of employing an EAF furnace with scrap as the primary input is its reduced heat requirement, which renders the process more energy efficient. However, in India, which uses less scrap relative to iron ore and coal, steel production via the DRI method is more carbon intensive.[12] Furthermore, gas-based DRI, which has an average CO_2 emission intensity of 1.6 tCO_2/tcs, is more expensive than coal-based DRI, which has an average CO_2 emission intensity of 3 tCO_2/tcs.[13]

Figure 2: Costs of Steel Production by Route



Source: The Energy and Resources Institute (2022)[14]

Key Levers for Decarbonisation

Coal plays a significant role in the Indian steel industry, with the crude steel production process in India dominated by the entirely coal-based BF-BOF route, which accounts for approximately 46 percent of total production.[15] The approximate emissions intensity of the BF-BOF route in India is 2.46 tCO_2/tcs, significantly higher than the average emission intensity of steelmaking at ~2.36 tCO_2/tcs.[16]

The key levers for decarbonisation of the steel industry can be divided into four categories: energy efficiency technologies (such as heat recovery systems, coke dry quenching, and top pressure recovery turbines), renewable power, alternative fuels (such as biomass, natural gas, and green hydrogen), and carbon management systems (such as Carbon Capture and Storage and Carbon Capture and Utilisation). Of these, carbon capture, utilisation, and storage (CCUS) is expected to play a significant role in the decarbonisation of the Indian steel industry, with the potential to diminish almost 56 percent of the emissions generated by the steel sector.[17]

Energy efficiency technologies, which are readily available in the current emissions landscape, offer an easy method to decrease the emissions intensity of a product without requiring significant alterations in the process or its inputs. However, these technologies can potentially mitigate only about 9 percent of steel sector emissions.[18]

Steelmakers are actively pursuing their decarbonisation objectives by leveraging best available technologies (BATs) for enhancing process and energy efficiency and transitioning from fossil fuels to renewable energy sources to power their operations. For instance, by 2030, JSW Steel[a] aims to procure 100 percent of its electricity from renewable sources, in collaboration with JSW Energy.

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[a] The authors of this article are officials of JSW Group: Prabodha Acharya is Chief Sustainability Officer; and Anuna Banerjee is Deputy Manager, Corporate Sustainability.

Additionally, they are constructing a pumped storage capacity solution to store surplus renewable energy during off-peak periods. Presently, the company operates a 225-MW solar power plant at its Vijayanagar facility and is in the process of expanding its renewable capacity at other sites.

The company has also achieved a 100-percent waste utilisation rate. Plastic waste is recycled and blended with coal fines for charging in the EAF and coke ovens or injected into blast furnaces. The company has also developed an in-house solution to convert blast furnace slag into cement.

The Cost of Decarbonisation

Globally, the steel industry is estimated to require investments of US$3.5-5.4 trillion in order to transition steel assets to net-zero compatible technologies by 2050. Achieving near-zero emissions in the steel sector in India will require a CAPEX investment of around US$300 billion[19] and increase OPEX costs, estimated at US$8.8 billion. The adoption of carbon mitigation measures in the BF-BOF process is estimated to result in the largest net increase in OPEX, by US$5 billion.[20]

The trade-off between investing in green technologies now and incurring the cost of climate change in the future is a complex challenge for India. Clean technologies are as yet unable to match the scale of steel production required to meet the demands of infrastructure projects. However, pausing infrastructure development until greener technologies mature may hinder progress.

As the potential financial and operational impacts of climate change issues are concerning, it is imperative to strike a balance between infrastructure growth and sustainability. By investing in research, innovation, and collaboration, India can accelerate the development of greener steel production technologies (without jeopardising infrastructure growth), mitigate the long-term financial risks associated with climate change, and create a resilient and prosperous future. Therefore, financing this transition is paramount for the steel industry.

Financing the Transition: Challenges

The steel industry is hindered in its decarbonisation efforts by the absence of commercially viable technologies. As a result, substantial capital investment, particularly from private sources, has not flowed into large-scale decarbonisation initiatives within the sector, which has created a significant barrier to the widespread adoption of sustainable practices and technologies in steel production.

To accelerate the transition to a net-zero future, it is critical to mobilise transition financing for the steel sector. However, the path to securing the capital for these decarbonisation solutions is fraught with challenges, which can be divided into three categories:[21]

- **Absence of an enabling environment:** The lack of a clear definition and framework for transition finance, coupled with the absence of regulatory or policy incentives, is not conducive for decarbonisation. In the absence of a well-defined roadmap, businesses struggle with transitioning to low-carbon technologies and practices.
- **High cost of capital:** Investments in low-carbon solutions are often associated with perceived and real risks arising from the early stage of the technologies, highly competitive markets, and insecurities in policies. In developing countries, immature financial markets, currency fluctuations, information asymmetries, and political risk create higher risk uncertainty.[22] The limited commercial deployment of decarbonisation technologies amplifies the perceived credit risk for issuers, leading to a higher cost of capital. This financial hurdle makes it difficult for businesses to invest in and scale up these technologies.
- **Lack of appropriate financial instruments:** The current financial landscape lacks instruments that are tailored to finance decarbonisation technologies. Traditional financial instruments may not align with the risk and return profiles of these technologies, whereas ‘green’ finance instruments largely focus on near-zero emitting technologies.

Therefore, a collaborative effort is required from policymakers, financial institutions, and industry stakeholders to create an enabling environment, reduce capital costs, and develop appropriate financial instruments that support the transition to a low-carbon future.

The Way Forward

This article makes the following recommendations:

- **Define transition financing:** Establishing a clear definition of transition financing to delineate its scope and purpose will provide clarity to stakeholders and facilitate the development of targeted financing mechanisms.
- **Formulate a decarbonisation pathway:** This includes developing a comprehensive decarbonisation pathway tailored to the Indian steel industry that outlines the steps and milestones required to achieve carbon neutrality, including the adoption of low-carbon technologies and practices.
- **Assess technology eligibility:** The decarbonisation pathway can be used as a reference to assess the technologies that are eligible for financing under the transition finance framework, with technologies that contribute to the decarbonisation goals as outlined in the pathway being prioritised for funding.
- **Engage stakeholders:** Involving industry stakeholders, policymakers, financial institutions, and other relevant parties in formulating the decarbonisation pathway and defining transition financing can ensure their support and effective implementation.

Regulatory and policy incentives such as tax incentives and subsidies could create an enabling environment for decarbonisation investments in the steel sector.

Government-backed guarantees and risk-sharing mechanisms can mitigate the high cost of capital by alleviating the perceived credit risk associated with decarbonisation investments. This could potentially lead to a reduction in the cost of capital for issuers. Therefore, guarantees augment the risk/return calculations of lenders, making project loans more attractive.[23]

These measures provide a safety net for investors, instilling confidence and encouraging greater participation in financing decarbonisation initiatives within the steel sector. Additionally, they can stimulate investment flows by offering assurances against potential losses and fostering a more conducive environment for sustainable investment in low-carbon technologies.

Concessional funding and blended finance structures might also be an effective tool to engage investors and financiers with different risk profiles.[24] Blended finance can bridge the funding gap in the transition to a decarbonised economy and help direct private finance towards green investments and scale impact.[25] Blended finance is a structuring mechanism that uses public and/or philanthropic capital to mitigate risks and increase private investment.[26] It can alleviate technological and market risks by pooling public and private capital and adding concessional capital to the pool.[27] In most blended finance structures, public or philanthropic capital takes a first-loss position or settles for lower returns. This improves the technology's risk–return profile and consequently the project's bankability.[28]

Funding mechanisms and financing facilities specifically aimed at supporting decarbonisation projects in the steel sector could stimulate investments, reduce fragmentation, and promote the efficient allocation of capital. These specialised platforms could be designed to provide incentives such as preferential terms, reduced interest rates, and extended repayment schedules.

The lack of appropriate financial instruments can be addressed through specialised financial products tailored for decarbonisation technologies in the steel sector. These instruments should cater to the unique risk and return profiles of such investments and provide investors with suitable financing options. A potential solution is securitisation, which refers to the process of pooling financial assets that generate regular cash flows and have similar risk and return characteristics, then repackaging them into a new, sellable financial product. The pooled assets are then transferred to a newly created special purpose vehicle (SPV), which sells the repackaged assets to investors. In the context of the steel sector, green securitisation could involve pooling loans or debt that fund the adoption of transition technologies or processes in steel production. The resulting financial product would be marketed to investors who are interested in supporting the decarbonisation of the steel industry.

Another approach could involve encouraging the expansion of existing 'green' finance instruments to a broader range of decarbonisation technologies, beyond near-zero emitting solutions. This may require revising eligibility criteria or creating new categories within existing frameworks to accommodate

diverse decarbonisation projects. This approach can ensure that the financing landscape is more inclusive and supportive of the range of decarbonisation efforts required to achieve meaningful reductions in emissions.

Creating a legally mandated market demand for low-carbon steel products is essential to build the necessary ecosystems to transition towards low-carbon pathways in steel production. Policymakers could also implement mandatory low-carbon steel procurement targets for buyers and intervene through their own procurement processes, stipulating that steel acquired for public infrastructure projects must adhere to a specified emissions intensity limit.

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Cement Sector Decarbonisation

Mahendra Singhi and Anupam Badola

The climate crisis is no longer a distant threat, and its impacts are threatening the very foundation of life on the planet: extreme weather is destroying property, rising tides are swallowing coastlines, coral reefs are disappearing, glaciers are melting, and forests are burning. Therefore, there is need for urgent action through innovative solutions. Decarbonising essential industries holds immense potential for tackling climate change. The cement industry plays a vital role in infrastructure, and its transition to cleaner practices can reduce greenhouse gas (GHG) emissions.

Challenges and Progress

Understanding the cement industry's GHG emissions profile is crucial for developing targeted mitigation strategies. Cement production releases GHGs at various stages, making it a significant contributor to climate change. The primary source of GHG emissions in the industry is calcination, in which limestone is heated to convert it to Calcium Oxide (CaO), a key ingredient in cement; the process also releases carbon dioxide (CO_2), which accounts for roughly 55 percent of industry emissions.[1] Fossil fuel combustion for thermal energy, electricity generation, and mobility contributes the remaining 40-45 percent of GHG emissions. According to McKinsey & Company,[2] 86-90 percent of GHG emissions from the cement sector are concentrated at the pyro-processing stage, in the calcination of limestone and the burning of fossil fuels.

Emerging economies like India face the challenge of achieving sustainable low-carbon industrial growth as it aims for net-zero emissions by 2070. However, this also presents an opportunity for leapfrogging. Over the past three decades, India's cement industry has adopted clean and more efficient practices, gaining global recognition for its environmentally and socially responsible production, optimised energy use, cost reduction, and circular economy principles.[3] This further demonstrates the potential for emerging economies to achieve rapid progress towards sustainability.

India's cement industry has undertaken multiple voluntary actions. In 2013, the industry pioneered a Low Carbon Technology Roadmap with the goal of a 45-percent reduction in CO2 emissions by 2050 from 2010 levels.[4] A progress update was published 2018,[5] and a Net Zero Roadmap is under development.

The cement industry has also actively promoted low-carbon blended cements, which presently accounts for 73 percent of total cement production in India.[6] This shift has contributed to the sector's transition towards sustainable growth and low-carbon products. The sector has also consistently adopted Best Available Technology (BAT) and advanced processes to ensure efficiency and environmental responsibility, with cement companies conducting research and development focused on green technologies and products to maintain

their competitive edge and achieve technological and economic viability. The cement industry in India has an average emissions intensity of 0.66 tonne per tonne of cement.[7] The industry has been implementing a multi-pronged approach to combat its GHG emissions:

- **Circular economy levers:** Using industrial wastes like fly ash and slag as alternatives for traditional clinkers can result in significant CO2 reduction. Other industrial wastes like limestone can also help natural resource conservation during clinker production.
- **Alternative fuels and sustainable biomass:** The industry is switching to alternative green fuels such as Refuse Derived Fuels (RDF) from Municipal Solid Waste (MSW) and exploring the use of sustainable biomass for thermal electricity generation.[8]
- **Energy efficiency and renewable electricity:** Upgrading to energy-efficient technologies and adopting renewable energy sources like solar and wind power can help reduce dependence on fossil fuels. Indian cement plants have commissioned Waste Heat Recovery (WHR) power generation and RE plants to generate fossil-free electricity8.
- **Electric and other low-carbon solutions for mobility:** Compressed Biogas (CBG), Compressed Natural Gas (CNG) trucks, electric trucks, and road-to-rail model shift in the industry that are aimed at reducing GHG emissions from mobility.

The Potential of New and Transformative Technologies

These strategies alone can only achieve a 15-20 percent reduction in GHG emissions from current levels. India's infrastructure growth will continue to demand building materials like cement, which would necessitate increasing production while reducing absolute GHG emissions to meet the sector's net-zero goal. Addressing the remaining 70-75 percent of emissions, primarily from calcination, requires a shift towards transformative technologies and processes. This is also crucial to make the net-zero transition a possibility within the given timeframe, which would further necessitate deploying capital-intensive technologies that can reduce GHG emissions, such as Carbon Capture Utilisation and Storage (CCUS).

CCUS can achieve significant emission reductions by capturing CO_2 emissions from the production process and safely storing them underground or using them to produce functional materials. However, this technology is in its early stages of development and requires substantial investments in infrastructure and research to address technical and economic hurdles. As a first step in this nascent lever, Dalmia Cement[a] partnered with Asian Development Bank (ADB) to develop a first feasibility study of 0.5 million tonne CO_2 capture and utilisation in its Ariyalur plant in Tamil Nadu.[9]

Furthermore, electrification of heat combined with fossil-free electricity powered by renewable and modular nuclear power plants holds immense potential to partially or fully eliminate energy-related GHG emissions. While this technology is nascent, its potential to revolutionise the industry necessitates investments in research and development for commercial viability. Cement players like Ultratech, Dalmia, and JSW Cement are exploring heat electrification technologies for their decarbonisation potential,[10] combined with fossil-free electricity from solar or waste heat recovery power generation. The green hydrogen landscape may also benefit the cement industry, with collaborators providing clean fuel without creating additional capital expenditure and challenges to partially or fully replace fossil fuels.

Challenges to Financing Decarbonisation and Key Recommendations

The economic benefits of advanced low- or zero-carbon technologies might not be immediately evident. While these technologies enable GHG reduction, the initial investment outlay creates a hurdle. Additionally, securing long-term financing with affordable interest rates is challenging for projects with extended payback periods. Traditional financial institutions usually do not finance a project with a long payback period. The perceived risks associated with new technologies and their uncertain returns due to being commercially unavailable at a large scale limits their immediate adoption and hinders their ability to attract significant investment.

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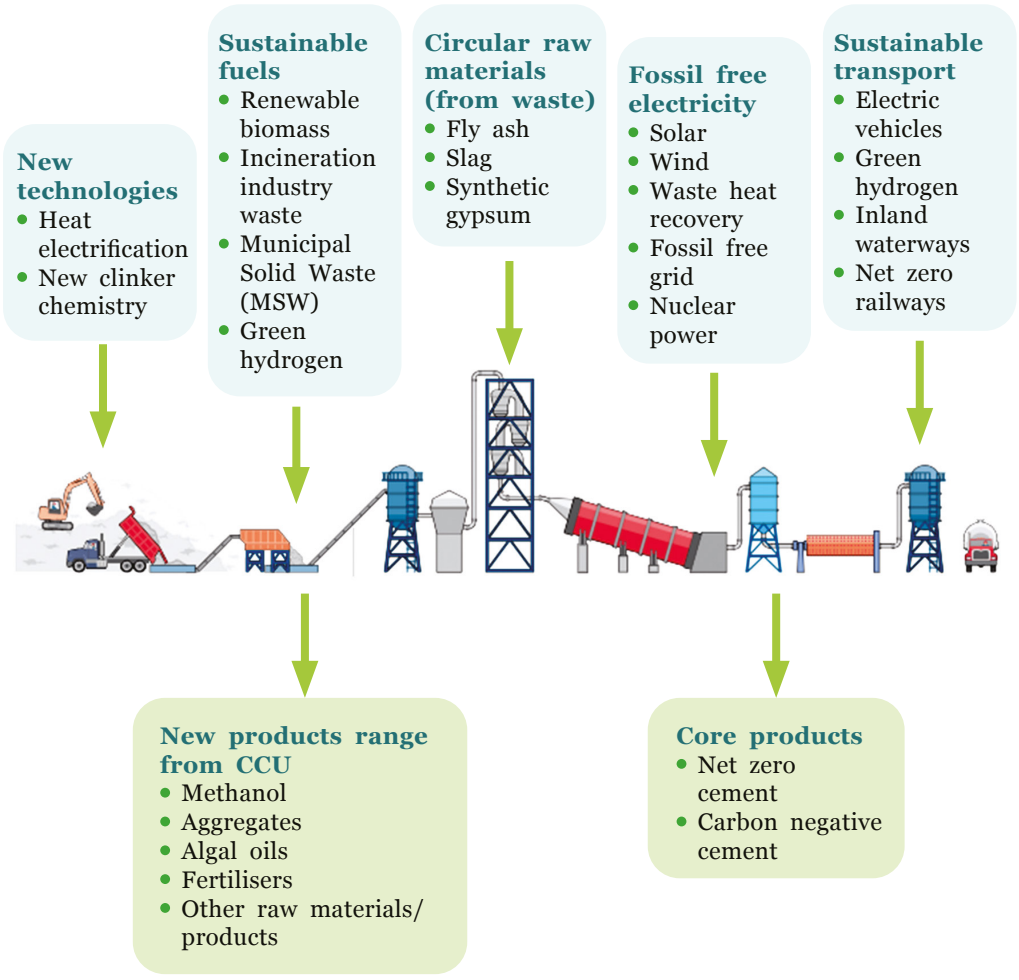
[a] The authors of this article are officials of Dalmia Cement.

Decarbonisation technologies are constantly evolving, with new solutions and improvements to existing technology. This demands continuous adaptation and investment, which adds to the complexity for companies and investors. With new and more efficient technologies emerging rapidly, the first-mover advantage might turn into an early movers' peril. The absence of clear and consistent policy frameworks for decarbonisation also contributes to the uncertainty for investors and industry players.

These factors make it difficult to plan long-term investments and assess potential risks and returns, thus discouraging participation and hindering progress.

Figure 1: Illustrative Low/Zero-Carbon Cement Plants of the Future



The various stakeholders within the industry, including investors, may lack a comprehensive understanding of the urgency and feasibility of decarbonisation, which can create further resistance towards adopting new technologies and practices. The transition towards a low-carbon cement sector requires a workforce equipped with the skills and knowledge to operate and maintain advanced technologies. Additionally, the limited availability of data on the financial benefits and performance of such technologies makes it difficult for companies to assess their viability and investment potential.

These issues can be addressed by setting up demonstration projects in deep decarbonisation technologies. By showcasing benefits such as carbon capture, heat electrification, and sustainable biomass, it is possible to de-risk these technologies, attract larger investments, and fuel transition through practical testing in order to pave the way for wider commercialisation. Data-driven insights from these projects would also assist in the formulation of effective policy frameworks and building the workforce and expertise needed to implement these technologies at scale. Investing in demonstration projects is not just about the here and now; it is about building a sustainable Indian cement industry towards a low-carbon future, one project at a time.

Bridging the gap between deep decarbonisation technologies and widespread adoption requires financial support from public and private sources. While business capital plays a crucial role, the high upfront costs and inherent risks associated with these projects demand additional support. Government intervention can be a powerful catalyst to this end. Through public-private partnerships (PPPs), governments can co-invest in demonstration projects, sharing the financial burden and mitigating the risks for private enterprises. Additionally, targeted grants and subsidies can incentivise participation and accelerate technology development.

Philanthropic capital can also play a vital role. Foundations focused on sustainability can channel resources towards demonstration projects. Impact investing funds, seeking both financial returns and positive social outcomes, can also be valuable partners.

Dedicated funding platforms can be established to facilitate collaboration and maximise impact. These platforms can bring together stakeholders, streamline project selection and approval processes, and ensure the efficient allocation of resources. Furthermore, regulatory reforms that incentivise investment in clean technologies, such as tax breaks and accelerated depreciation allowances, can attract private capital.

By leveraging a multi-pronged approach that combines government support, philanthropic contributions, and business capital, India can unlock the potential of demonstration projects and pave the way for a greener, more sustainable future for its cement sector. This collaborative effort not only benefits the environment but also creates long-term economic opportunities for the nation.

Carbon markets, where companies can trade permits to emit GHGs, can also be used to finance deep decarbonisation projects. Cement companies that implement low-carbon technologies and practices can generate additional revenue by selling emission reduction credits in carbon markets. These credits, created by exceeding predefined emission targets or adopting innovative solutions, can be purchased by companies seeking to offset their own emissions, creating a financial incentive for decarbonisation in international markets.

Global carbon markets, like the one provisioned under the Paris Agreement, enable international cooperation in emission reduction efforts.[11] This would also allow Indian cement companies to participate in international markets, potentially attracting foreign investments and sharing knowledge and expertise with other countries tackling similar challenges.

Besides carbon markets, other financing instruments can support deep decarbonisation projects in the cement sector:

- **Green bonds:** These fixed-income securities allow investors to directly fund environmentally sustainable projects, including decarbonisation initiatives. By investing in green bonds linked to specific cement projects, individuals and institutions can contribute directly to the transition.

- **Green insurance:** Innovative insurance products can provide risk mitigation for investors in deep decarbonisation projects. These products can cover potential cost overruns, technology failures, or carbon capture leakage, making these projects more attractive to risk-averse investors.
- **Crowdfunding and green peer-to-peer lending:** These platforms can democratise access to finance by allowing smaller investors to directly contribute to deep decarbonisation projects. This can be particularly beneficial for supporting innovative start-ups and early-stage technologies.
- **Performance-based contracts:** These contracts reward project developers based on the achieved level of emission reductions. This aligns with the interests of investors and developers, ensuring that projects deliver measurable environmental benefits.
- **Green guarantees:** Governments or multilateral organisations can offer guarantees to reduce the risk for private lenders financing deep decarbonisation projects. This can incentivise financial institutions to provide loans at more favourable terms, increasing the availability of capital.
- **Impact investing funds:** These funds specifically target investments that generate both positive financial returns and positive social or environmental impact. They can play a crucial role in financing projects that might not offer immediate or high financial returns.
- **Blended finance:** This approach combines public and private resources to finance projects that deliver both development and environmental benefits. Blended finance can bridge the funding gap by using public funds to de-risk projects and attract private sector investments.

By exploring and implementing a diversified mix of these financing instruments, India can create a robust and sustainable financial ecosystem that supports deep decarbonisation in the cement sector. This will not only accelerate the transition to a low-carbon future but also create new opportunities for economic growth and innovation.

The financing solutions must be tailored to the specific needs and risk profiles of different projects and stakeholders. A multi-pronged approach that leverages various instruments can unlock the necessary resources and pave the way for a greener future in the Indian cement industry.

While carbon pricing and financial instruments play a crucial role in driving decarbonisation, other policy and regulatory levers could impact market development without relying on financing tools. Some key alternatives follow:

- **Stringent building codes:** Implementing stricter building codes that mandate the use of low-carbon cement in new construction projects can increase the demand for these materials. This would also create a predictable market for producers and incentivise investments in scaling up production capacity.
- **Performance-based standards:** Establishing performance-based standards for embodied carbon in buildings can incentivise the innovation and adoption of low-carbon materials beyond just cement. This would allow for flexibility in choosing solutions and ensure overall emissions reduction.
- **Transparent labelling:** Implementing a transparent labelling system that displays the embodied carbon footprint of different construction materials can empower consumers and builders to make informed choices to favour low-carbon options.
- **Public awareness campaigns:** Raising public awareness about the environmental impact of traditional cement and the benefits of low-carbon alternatives can influence consumer behaviour and drive the demand for sustainable materials.
- **Green public procurement:** Similar to carbon pricing, prioritising low-carbon cement in government infrastructure projects can create a strong market signal and accelerate adoption, setting a benchmark for private-sector players.
- **Industry-government collaboration:** Establishing collaborative platforms between government agencies and industry stakeholders can facilitate knowledge sharing, joint research initiatives, and the development of effective policy frameworks.
- **International cooperation:** Sharing best practices and collaborating with other countries for research and development can accelerate the innovation and adoption of low-carbon technologies in the cement industry globally.

By implementing a combination of these policy levers, governments can create a supportive ecosystem for the market development of low-carbon cement without relying solely on financial instruments. This multi-pronged approach can stimulate demand, incentivise innovation, and create a level playing field for sustainable construction practices, paving the way for a greener future for the cement industry and meeting the net-zero target of the Indian economy. The global focus on achieving net-zero emissions has spurred innovative business models across industries. The Indian cement industry is well positioned to experience similar advancements in areas like construction and demolition waste management, collaborative services for carbon capture and utilisation (CCU), novel activated supplementary cementitious materials (SCMs) to reduce clinker content, and digitalisation solutions to integrate and optimise the entire value chain for decarbonisation.

However, navigating the challenges and unlocking the full potential of next-level decarbonisation in the cement industry cannot be achieved by industry alone. All relevant stakeholders—governments, research institutions, technology providers, and consumers—play an essential role.

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The opinions and views expressed by the authors in this article are personal and not those of the organisation.

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Transport Sector Decarbonisation

Mahua Acharya

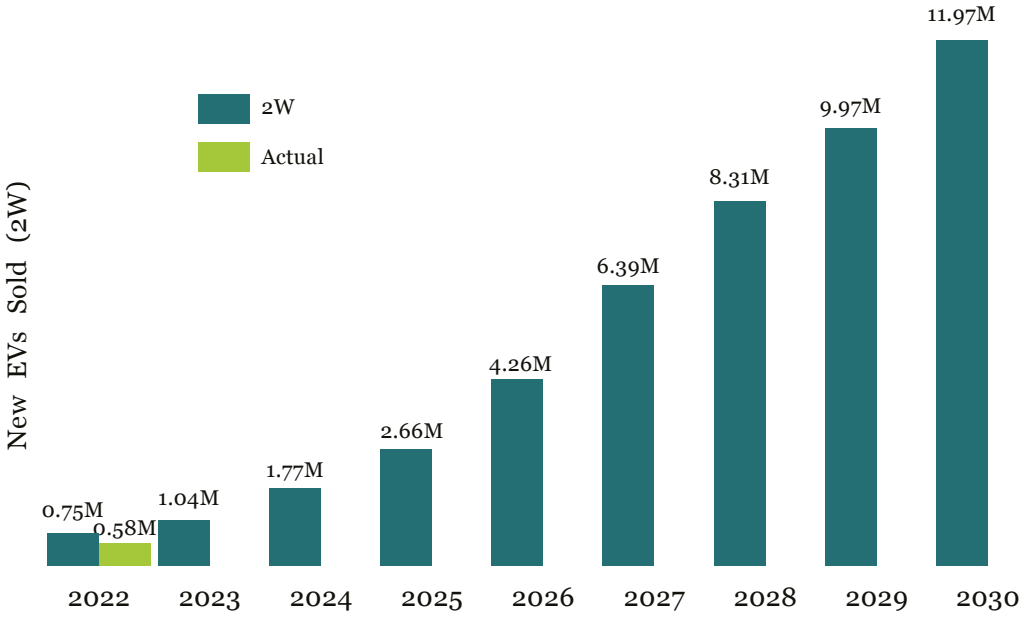
Transportation accounts for ten percent of India's total carbon emissions, with the highest emissions from road transport, especially trucks and buses.[1] By 2050, emissions from global freight transport are expected to surpass those from passenger vehicles.[2] Trucking is the dominant mode of carrying freight and accounts for almost 60 percent of emissions in this category in India.[3]

Transportation also includes railroads and air traffic. Decarbonising transport in India needs to be achieved without compromising economic growth. However, as long as large-scale technologies remain unavailable and unaffordable

in the sector, the question around methods of financing remains moot. So far, financing activities in the sector have focused on venture capital initiatives for new technologies.

The electric vehicles (EV) market in India is poised for significant growth in the coming decade, with the economics of the vehicles proving itself against fossil fuels and new models entering the market.[4] While growth estimates around electric mobility vary by entity, depending on their assumptions and the reading of the market, estimations point to a 15-percent increase year-on-year.[5] The two-wheeler market is experiencing a sustained turnaround, and the bus market can be viewed as having reached a catalytic point away from diesel. NITI Aayog estimates that, by FY 2026, EV penetration is expected to rise from the current 2 percent to 13–15 percent for domestic sales in electric two-wheelers (e-2Ws) and from 5 percent to 26–28 percent for electric three-wheelers (e-3Ws). Electric passenger vehicle (e-PV) sales are expected to rise slower, from 0.6 percent to 3–5 percent, while electric buses (e-buses) are expected to move from 3.7 percent to 4–6 percent. The sales of e-2W have reached new highs (see Figure 1), which will lead to increased lending comfort as well as differentiated financial products.[6]

Figure 1: 2W new EV sales to reach 12M in 2030



Source: Blume Ventures (2023)[7]

While more aggressive estimates have been discussed, they depend on large-scale financing and underlying infrastructure.[8] For these targets to be achieved, the sector needs to grow eight to ten times in the new few years and reach between US$40 billion and US$206 billion.[9] This raises the question of who provides the funding and how.

Finance and Financing

In India, the focus is on methods to finance at scale. Done right, this could spur technology revolution and sectoral transformation.

There are three ways to approach financing in a market: policies and regulations by the government, applicable business models, and financial instruments for the chosen business model.

The Government of India has introduced multiple incentive-based schemes to promote electric mobility, including the Faster Adoption and Manufacturing of Electric Vehicles (FAME) India Scheme,[10] the Production Linked Incentive scheme,[11] the Phased Manufacturing Program,[12] PM-eBus Sewa,[13] a payment security mechanism to enable the financing of 50,000 electric buses,[14] and announcements to enable the transition of nearly one million diesel buses on Indian roads.[15] (See Table 1)

Table 1: Incentive-Based Schemes of the Government of India to Promote EVs

Policy	Implementation Date	Highlights
FAME I	April 2015	(i) Subsidies for all vehicles (lead and lithium) (ii) Allocation of INR 7.95 billion
States launching EV specific policies with supply and demand side incentives	2018–2021	(i) 19 states launch EV policies (ii) SOPs include demand incentives for commercial as well as personal mobility (iii) SOPs for setting up charging stations (iv) SOPs for establishing manufacturing hubs in form of subsidies, stamp duty exemption, and low power tariff

FAME II	April 2019	(i) Outlay raised to INR 100 billion (ii) Lead acid EVs not included in this scheme (iii) Incentive for e-2Ws increased from INR 10,000/ kilowatt-hour kilometers (km) to INR 15,000/ kilowatt-hour km in June 2021 (iv) Validity extended till 31 March 2024
Import duties on EV components	March 2019	(i) Custom duty hiked from 15.0% to 25.0% in April 2020 for e-buses, e-trucks, and e-2Ws imported in semi-knocked down form and e-PVs from 15.0% to 30.0% (ii) Custom duty on completely built unit imports of commercial EVs to 40.0% from 25.0% in April 2020 (iii) Custom duty on lithium cells increased from 5.0% to 10.0% from April 2021
Warranty conditions for eligibility	May 2019	(i) Two years or 20,000 km for e-2Ws (ii) Three years or 36,000 km mandated for e-3Ws
Information technology tax deduction for supplementing EV financing	July 2019	Tax deduction on interest of up to INR 150,000 for purchasing an EV
Drop in GST from 12% to 5%	August 2019	(i) GST reduced from 12.0% to 5.0% for all EVs (ii) GST rate for charging and charging stations reduced from 18.0% to 5.0% (iii) Hiring of electric buses by state transport undertakings exempted from GST
Changes in power distribution contracts	October 2019	(i) Private charging at residences and offices permitted (ii) Delicensing of public charging station activity (iii) Public charging stations permitted to redistribute power and source power from other sources
BS VI implementation for ICE vehicles	April 2020	Implementation of BS VI emission norms, part implemented in 2020. Part B scheduled to be implemented in 2023 to help bring total cost of ownership parity with EVs for some segments.

Delinking of batteries in registration process	August 2020	Ministry of Road Transport and Highways allows e-2Ws and e-3Ws to be sold with delinking of batteries, thus bringing down acquisition costs
ACC and Auto Component PLI scheme	June 2021	(i) Government of India notified INR 181 billion ACC scheme for setting up manufacturing facilities for batteries. Government is expected to announce bidders by June 2022. [Note 1] (ii) Government of India notified INR 260 billion PLI scheme to augment auto original equipment manufacturers and component players to increase scale and productivity.
Road tax	August 2021	Ministry of Road Transport and Highways notified that EVs will be exempt from paying road tax for issuance/renewal of registration
Scrappage policy	August 2021	This policy will most benefit electrification in the medium and heavy commercial vehicles segment, where major purchases, especially from state transport undertakings, will be electric.
Battery swapping policy	April 2022	(i) This policy supports battery swapping for e-2Ws and e-3Ws, with end-to-end compatibility in the battery swapping ecosystem for ACC batteries. (ii) The in-built requirement of a battery management system with unique identification numbers for an Internet of Things monitoring system will allow performance of the battery to be tracked.
PM eBus SEWA	August, 2023	The aim is to augment bus operations by deployment of 10,000 electric buses on PPP model

Source: NITI Aayog[16]

A number of states also have EV policies, some of them with additional subsidies and others that adopt new business models. For example, some states waive road taxes, while others provide preferential parking.[17] The Delhi EV policy allows for the leasing of batteries for EVs[18]—a measure that was implemented to reduce the purchase price for consumers, since the battery alone accounts for almost 40 percent of the cost of an EV.[19]

Most regulations emphasise and even mandate domestic manufacturing. States have SOPs for establishing manufacturing hubs in the form of subsidies, stamp duty exemption, and low power tariffs. Tax levels have been reduced and customs duties decreased. Mandates are also governed by regulations; for example, Delhi mandates all aggregators to transition to electric if they wish to keep operating their business in India.[20]

Drivers of Decarbonisation

The biggest driver of decarbonisation is the need to reduce diesel bills. India paid US$132 billion in fuel bills in FY 2023-24, which is slightly lower than the previous year, although the issue around dependency on overseas suppliers remains the same.[21] Therefore, sustained decarbonisation efforts through greater electrification and the use of alternative fuels is imperative.

Air pollution is another driver. Indian cities are amongst the world's most polluted. To the extent that India can promote a clean transportation system in an affordable manner, the focus on electric and other greener modes of travel must be promoted.

Business Models for Decarbonisation

The emergence of EVs has enabled new business and services offerings. This is partially in response to the higher costs of EVs compared to their internal combustion engine (ICE) counterparts; for example, an electric bus costs three times as much as a diesel bus.[22] This has led to a lot of innovative

structuring, such as vehicle leasing,[a] charging as a service, retrofitting,[b] enabling deliveries on electric, and digital sourcing.[c] Offering batteries as a service can lower the acquisition cost of EVs by 40 percent.[23] A lack of service and repair centres, coupled with unpredictable products, is also pushing companies to set up maintenance and repair centres.

One of the largest disruptions has been in electric buses, where mobility is offered as a service to state transport companies rather than having them purchase electric buses. This has reduced the cost of running diesel buses by 27 percent, without any subsidies.[24] However, with tens of thousands of electric buses contracted through long-tenured offtake contracts between state transport companies and private operators, the financial risk for the private operators is significant due to high upfront costs, limited financing options, and long tenured contracts.[25] A payment security mechanism was deemed critical to enable this sector to transition to electric, at least until India is able to restructure and reform its state transport corporations. The announcement of such an instrument in December 2024 brought much-needed relief to industry players and financiers, although the mechanism is yet to be made operational.[26]

Of the 1.5 million buses on Indian roads, approximately 10 percent lie with state transport undertakings.[27] Buses are typically financed through vehicle finance, but this option is not available for EVs. An affordable lease can potentially disrupt this segment. However, such a lease does not exist in India, in large part due to the perceived risks for the operator company and a risk that the batteries will not hold up to the promised years of performance.

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a Vehicle leasing is feasible for e-commerce operators who deal in “asset light” models.

b EV retrofitting is an emerging business model where existing ICE vehicles are retrofitted with EV powertrains. EV retrofits are a way to accelerate EV adoption, as they potentially lower the cost of acquisition for existing ICE vehicle owners.

c Digital sourcing, underwriting, and sanctioning can streamline EV loans by helping overcome the operational and logistical challenges of vehicle financing.

Vehicle leasing is an emerging model for e-commerce operators that deal in "asset light" models as well as for electric buses that are privately run and ply long-distance routes. Vehicle leasing companies act as intermediaries between original equipment manufacturers (OEM) and users, while securing asset risk. E-commerce companies are keen on asset utilisation, as such arrangements help them maintain accountability for the quality of a product. Whereas bottom-of-pyramid customers do not receive financing easily, such models can improve EV adoption. Vehicle leasing is also substantial in the 2W segment, where fence-sitters can operate an EV without asset risk.

Dampeners

Financing is linked with the viability of a business and the likelihood of investments being scaled up to generate value to investors. In India, this translates to multiple challenges, which hinder large-scale finance from entering the market. These include the following:

- **Charging infrastructure:** One of the biggest barriers to rapid adoption is the time, complexity, and complications around charging infrastructure. The utilisation rate of public chargers is around 5 percent, which means that the only other model that can become sustainable is charging for a fleet.[28] For rapid adoption in the market, charging stations need to be omnipresent and competitively priced. However, there are multiple public and private counterparts in this sector, including ministries, departments, and local bodies. Incentives are not aligned, timelines are mismatched, and access to subsidies is complicated. It is easier to finance the software that manages a charging station than the charging station itself. Therefore, the sector requires an unprecedented level of detail, strict enforcement of accountability among agencies, and enabling markets in new ways. Access to land and power infrastructure are also difficult to achieve.
- **Institutional capacity:** India's state transport companies have weak financial health, are habitually loss making, and are not structured to handle contracts that acquire services. Capacity is low, incentives and

KPIs are not aligned to new types of electric bus contracts that they handle, and digitisation is almost nil. These institutions need to be reformed across areas—from owning buses and depots to managing service contracts.

- **Bankability and scale:** Projects are not structured appropriately or other contractual features render them unbankable. This makes it challenging for investors to commit large-scale capital, even if they were to bear additional risk in the early years. Bankability affects all sectors of the market, particularly three-wheelers and buses operated by private operators that do not face State Transport Undertakings (STUs). The EV sector is new, and a line of sight for deploying large-scale capital is absent. Achieving scale is possible through traditional means such as consolidation, but that usually happens when the market has matured. For now, scale is not available through single transactions.
- **Resale value and credibility of products:** The absence of a resale market for EVs is a serious impediment to rapid adoption. Furthermore, start-up brands dominate the EV space, whereas traditional players have adopted a cautious stance towards the segment owing to a lack of economic viability across select application segments or the lack of availability of mature EV technology.

Sectors at the Cusp of Commercialisation

The net-zero commitments of companies go hand-in-hand with their inability to make reductions in emissions from activities that they do not control but which indirectly affect their value chains. So far, these corporate inventories are not regulated. While some companies have made announcements to shift from ICE to electric trucks,[29] this changeover is yet to be implemented. Additionally, at the time of writing, India has only two heavy-duty electric trucks in the market. Sectoral transformation will require more than two models and a few corporate announcements. The economics have to work for finance to come in at scale.

The starting point of change is companies demanding green transport as part of their net-zero commitments and their willingness to engage proactively to support the delivery of such a transition, including paying a premium for a short period of time, if required. At present, this is yet to happen and the market only has a few pilot cases in operation. Incentives, both policy and financial, could assist.

Enablers

Without focused attention to financing this sector and uncertainty in large and institutional capital, a potentially pivotal decarbonisation opportunity may be lost. Therefore, India requires more development capital and various instruments capable of handling specific kinds of risk.

- **More development capital:** For under-developed projects, there is a need for research and data analyses, standardisation of contracts, and the removal of regulatory risks, however small. The early days of the renewable energy industry in India saw several development companies engaged in deploying small amounts of capital in order to build large portfolios that, when de-risked, attracted large-scale capital. More development capital is required to de-risk this segment.
- **Market for resale:** The absence of a market for the resale of EVs is a serious impediment to rapid adoption. However, with additional sales, prominent use cases of the secondary and tertiary life of batteries become viable. Given the volumes of EVs that have already been sold and are continuing to enter the market, India has the potential to become a global hub for battery recycling. This market can be enabled through regulations—including those on safety— and a serious incentive for using repurposed batteries.
- **Aggregation and achievement of scale:** The aggregation of demand, in particular for electric buses, has demonstrated benefits of scale and affordable pricing and signalled the continuity of business and achievement of scale in the market. Similar efforts are required in other areas. However, in order for this to take place, grant monies may be required to fund independent commercial organisations rather than NGOs or single companies.

- **Role of carbon finance:** Carbon finance can reinforce investments. However, accessing this line of finance is cumbersome and the rewards from the international voluntary market are small. India could consider a domestic scheme for the transport sector itself, where companies could trade their excesses and purchase allowances for their shortages. Article 6 of the Paris Agreement provides a small window for compressed biogas. Designed right, this segment of the market has very high rewards in the form of a sovereign backed contract.
- **Other business models:** Decarbonisation of transport needs to be contextualised in the existing infrastructure in cities, which has its own challenges. As with anything new, business models will need to evolve and change until the most suitable option can be identified. At the same time, concerted, consistent, and persistent effort by the government is required to enable the development of infrastructure for an industry that is still emerging and in need of private-sector involvement.
- **Blended finance solutions:** With different and emerging business models, strengthening institutions and achieving bankability are priorities, and India will need more large-scale blended finance solutions to accommodate these developments. This includes commercial pools of capital that can easily access risk mitigation instruments such as payment security, floor price guarantees, offtake guarantees, price guarantees, and buyback schemes for old batteries. These instruments are considered to be within the remit of multilateral development banks. However, private agencies can offer such instruments for a fee and usually within timelines that the multilaterals cannot match. The market for these instruments is massive, and greater efforts need to be directed towards their creation.

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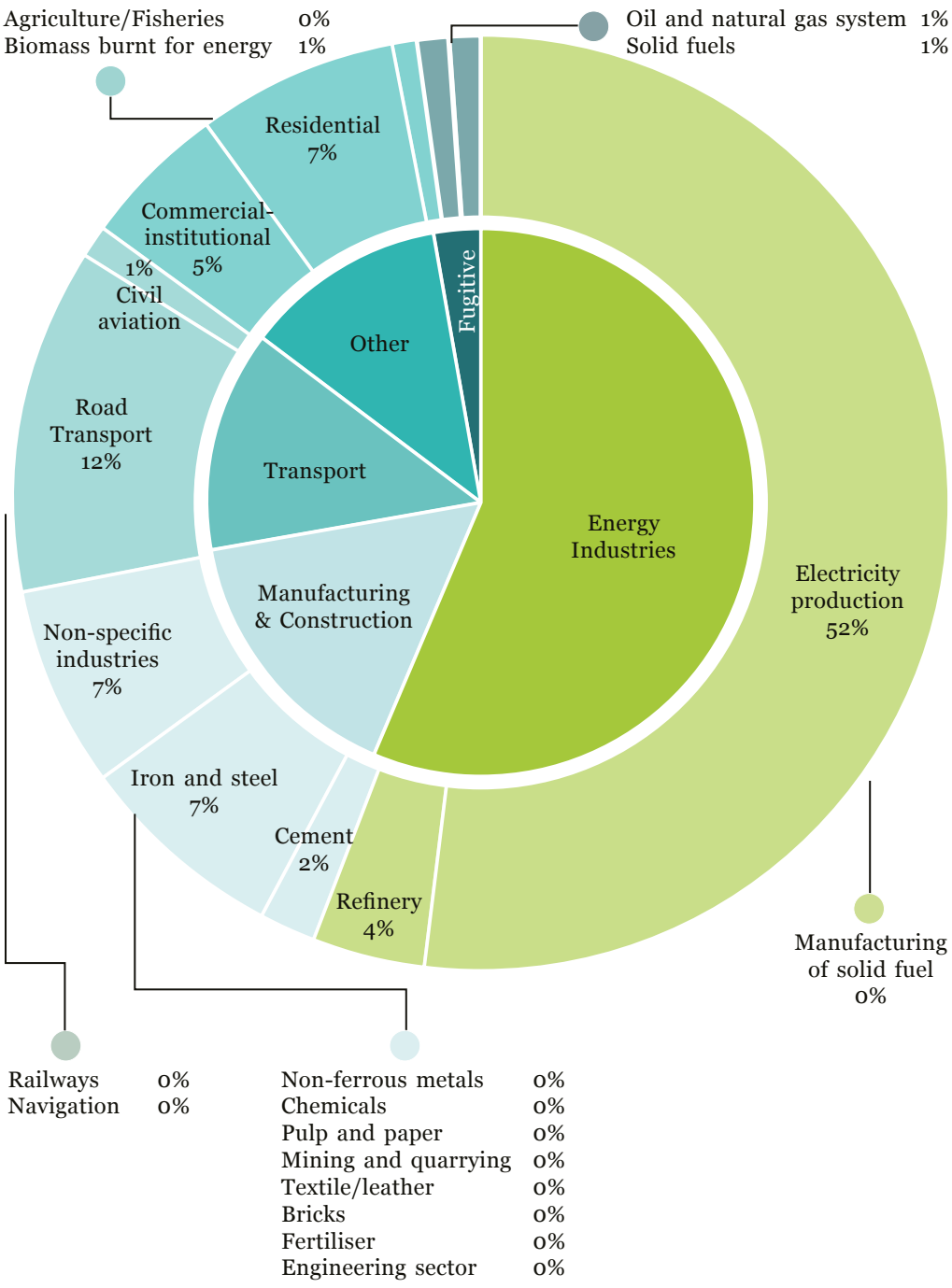
Power Sector Decarbonisation

Saarthak Khurana

Emissions from energy consumption contribute 76 percent (2.4 gigatons) of India's annual economy-wide greenhouse gas emissions (3.1 gigatons).[1] Of this, electricity generation alone contributes 40 percent (1.2 gigatons).[2] In order to meet the country's 2070 net-zero emissions target,[3] the low-carbon transition of the country's electricity sector is vital. With the planned electrification of other high-emitting energy sector activities, such as transport and industry, the criticality of the electricity sector transition increases.[4]

Figure 1: India Economy-Wide Emissions



Source: NITI Aayog ICED[5]

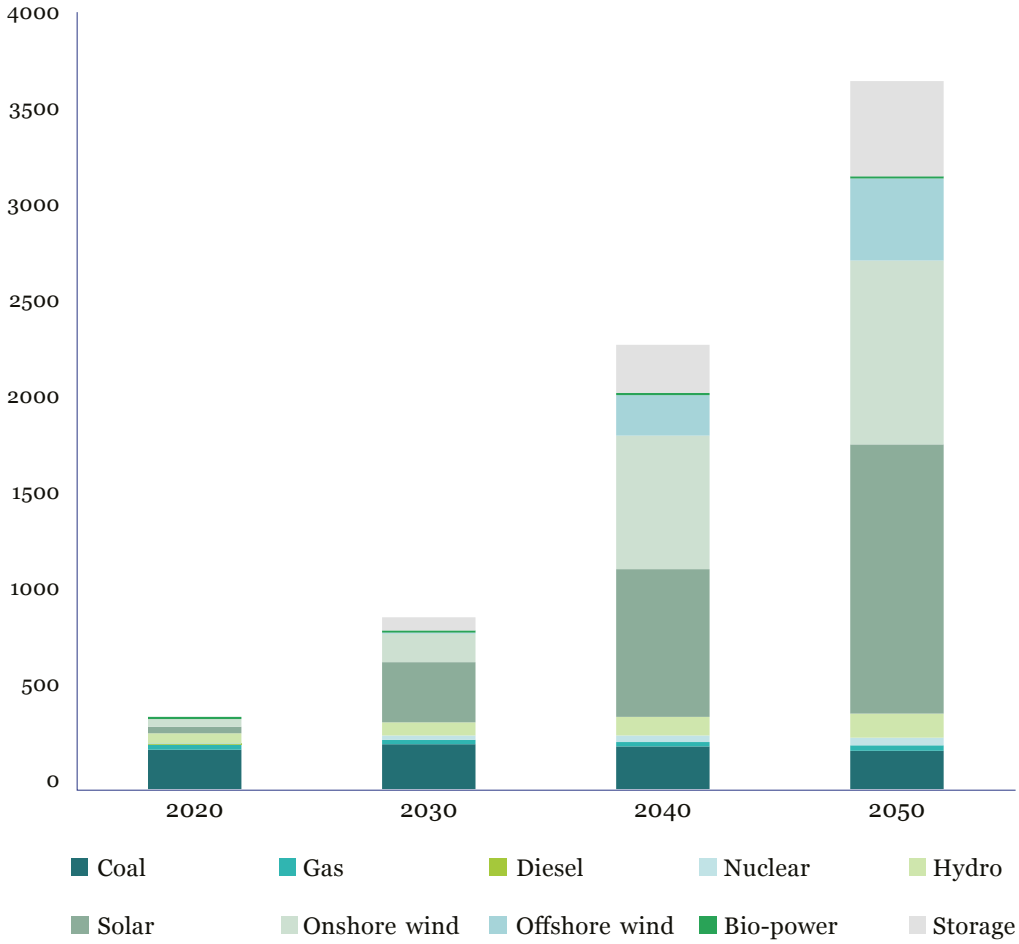
The country has set a target of achieving 500 GW of non-fossil fuel based power-generation capacity by 2030.[6] However, this goal needs to be balanced with ensuring the adequate availability of electricity to support the growing economy and enabling grid stability. Following the 2031-32 electricity demand projections by the Central Electricity Authority (CEA), the Government of India announced the planned addition of 80 GW of thermal power generation capacity.[7] Considering a gestation period of four to six years for new thermal power generation assets, the proposed capacity can be expected to be functional by 2030. This is in line with CEA projections, which highlight the need for this capacity to meet the base load requirements of the country in 2032.[8]

The existing and planned thermal capacity addition would be crucial to meeting the base load generation requirements of the country in the near term. However, considering the long asset life of thermal generation assets (~40 years), their role in India's energy mix would need to evolve over the long term, with non-fossil-fuel-based capacity growing beyond current targets and dominating installed capacity as well as electricity generation.

The Evolution of Thermal Generation Capacity

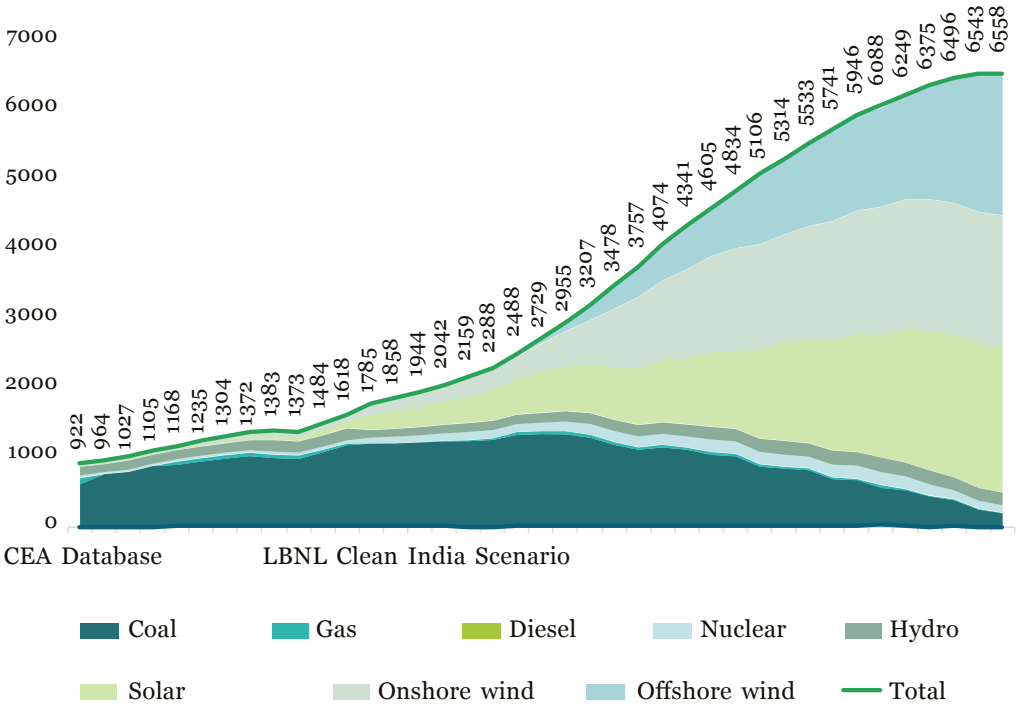
With the growth of low-cost non-fossil-fuel-based generation in India's energy mix, the share of higher-priced thermal generation is likely to decline over time. This is also highlighted in Lawrence Berkeley National Laboratory's *Pathways to Atmanirbhar Bharat* report,[9] which underlines that while installed thermal capacity in the country would be nearly 200 GW in 2050, its share in generation would decrease drastically, with a majority of electricity generation coming from non-fossil-fuel-based generation sources.

Figure 2: Installed Capacity (GW)



Source: All India Electricity Statistics - General Review 2023, CEA, 2023 ; Pathways to Atmanirbhar Bharat, Berkley Lab, 2023[11]

Figure 3: Electricity Generation (BU)



Source: All India Electricity Statistics - General Review 2023, CEA, 2023 ; Pathways to Atmanirbhar Bharat, LBNL, 2023[13]

Despite the expected decline in generation from thermal-based capacity, these assets are likely to serve a critical role in the evolution of the country's energy system in the long term. As the share of renewables in the electricity supply mix grows, conventional generation capacity could play the following critical roles in supporting the grid and electricity system:

Intraday flexibility and peaking power: With the growth of renewables in India's energy mix, the increasing need for instantaneous and intraday flexibility requirements has been met through ramping in thermal plants. According to the CEA in its report on *Flexiblisation of Coal-Fired Power Plants,* the maximum thermal ramp touched 250 MW/minute in 2018-22.[14] With the growth in renewable energy, this ramping requirement is expected to rise over threefold by 2030.[15] Meeting such ramping requirements would require mechanical modifications and advanced control solutions such as the integration of a Condensate Throttling System (CTS). Such retrofits on suitable assets in India's vast thermal fleet can augment the RE integration capacity of the grid. However, such implementation at scale would require the adequate availability of suitably priced finance to avoid significantly raising the costs of RE support solutions.

Box 1. Intraday Flexibility and Peaking Power[16]

A pilot implementation for enhancing flexibility has been undertaken by NTPC at its thermal plant at Dadri. The NTPC Energy Technology Research Alliance (NETRA) integrated the CTS Solution and Unit Control modules in the existing control system of Dadri U#6. This integration helped enhance and improve the unit's primary frequency response (PFR) and ramp rate.

Seasonal flexibility: Renewable generation sources face the challenge of variability. This variability can be classified under three broad categories: instantaneous variability, intraday variability, and seasonal variability. While energy storage solutions such as battery and pumped hydro can be utilised for balancing instantaneous and intraday variability, they are technically unsuitable for providing seasonal flexibility. Additionally, the cost of developing these energy storage solutions poses a hindrance to their large-scale adoption, thereby limiting the amount of renewable generation that can be integrated into the grid.

Box 2: Seasonal Flexibility[17]

Periodic mothballing and re-igniting of the thermal assets has been demonstrated by Germany. With the rise in RE generation, Germany had mothballed several of its thermal generation assets as a part of the reserve capacity.

But considering the rise in electricity demand during the winter season, the assets were brought back online to meet the seasonal peak demand and mitigate gas shortages.

The vast thermal fleet can be used to provide seasonal flexibility during periods of high-RE generation through economic compensation for regular mothballing. The existence of legacy thermal capacity has an impact on how examined systems with high RE behave, as there is no need to invest in additional seasonal backup or reserve capacity, considering that investments in long-duration energy storage are much less profitable. Undertaking the mothballing exercise, however, requires requisite investment to avoid physical deterioration during the shut-down phase as well as regulatory economic frameworks to allow for the fixed costs to be paid or deferred suitably.

Grid inertia, reactive power, and fault current: The stability of a power system is defined by its ability to restore the operating balance after being subjected to a disturbance, whereby system inertia helps keep the frequency within an acceptable range until the system rebalances. Thermal generators, with their large, physical rotational inertia, help maintain system stability. However, with a decline in the share of thermal generation, the inertia of the system is expected to decline; the lower the inertia of the system, the more sensitive it is to frequency deviations. Thermal generators, with their large generators, can supply both real and reactive power as needed. Reactive power is essential for managing the power factor and avoiding damage to equipment. Additionally, with a doubling of the amount of power being consumed in an area, the reactive power that is consumed quadruples. Therefore, the role of embedded thermal generators is particularly important, as reactive power does not travel as far as real power. These generators help utilities and grid operators maintain the service voltage within required limits. Grid-synchronised generators at thermal power plants also provide fault current (i.e., very large amount of reactive power) in case of physical fault such as a short circuit. This fault current lessens the voltage disturbance while the grid disconnects the short circuit for recovery.

With a decline in the share of thermal power in the electricity system, the essential requirements of grid inertia, reactive power, and fault current would need to be fulfilled from an alternative source. Synchronous condensers can be a valuable source for these purposes. Synchronous condensers are motors/generators that draw energy from the grid to maintain a spinning mass. These have been historically employed only to support local system support requirements, but they can be scaled up to meet broader grid-level requirements.[18,19] Generators at thermal plants, instead of being retired, can be converted into synchronous condensers. Although these generators were not originally built to act as synchronous condensers, requisite retrofits could help convert them to the desired role. With a large and physically distributed thermal fleet, this could be a valuable asset in supporting the integration of greater shares of RE into the grid.[20]

These assets would be needed to provide the requisite flexibility to ensure grid stability and support to non-fossil fuel based capacities, thereby enabling their significant scale-up. Additionally, with the shift in the role of thermal assets

from being base-load providers to flexibility- and grid-stability providers, the reduction in absolute generation from these assets would translate to lower greenhouse gas emissions.

The Need for Transition Finance

In order to serve the roles of supporting the grid and electricity system, thermal assets would need to have significantly low minimum technical requirements for operation, rapid ramping speeds, low start-up duration, and conversion to synchronous condensers. The current fleet of thermal assets does not offer these flexibility options and would thus require extensive retrofits and modernisation. Therefore, finance becomes vital for enabling investments towards the retrofits and modernisation of the thermal assets. The growth of climate finance over the past decade has directed the flow of capital towards the development of assets that generate minimal or no greenhouse gas emissions. However, it does not drive investments in technologies and assets that can help reduce emissions from industries and assets in traditionally high-emitting sectors. Transition finance can help bridge the investment gap for such technologies and solutions and help reduce emissions from high-emitting sectors.

In the case of thermal generation assets, transition finance can help drive investment for the technological upgrade of these assets, which would allow them to operate more flexibly, enabling them to move away from high-emitting large-volume base-load electricity generation and shift to lower-emission, higher-value options—such as blending with non-fossil-based generation—to mitigate variability challenges, offering back-up capacity, providing peaking power, and ensuring grid stability.

The Way Forward

Electricity demand in India is expected to accelerate with economic growth and development. To meet the growing demand in the short term, the country will need to utilise all available resource options, including thermal generation assets. However, considering the long balance life of India's thermal assets and their value in supporting the transition to a low-carbon energy system, a mechanism to leverage the strength of these assets while reducing overall

sectoral emissions will need to be developed. However, the evolution and repurposing of these assets to fit newer roles such as the ones highlighted above will require significant investments.

The traditional structures of commercial finance do not accurately value the critical role that these assets can play in supporting sectoral transition. Transition finance can play a catalytic role in obtaining concessional capital to repurpose these assets. This can help transform assets created for energy security in the near term into drivers of long-term energy transition by enabling the accelerated scale-up of non-fossil-fuel-based electricity generation. In order to achieve this objective, concerted efforts from domestic and international stakeholders would be vital. To support transition finance for emission reduction, it would be essential to address domestic limitations in the policy, regulatory, financial, or institutional frameworks within the existing enabling environment.

On a global scale, it is critical to acknowledge that developing economies have different needs in the near term. Such an understanding, with the requisite guardrails, can ensure not just near-term energy security but also evolve into the necessary support mechanism for a long-term low-carbon transition. This acknowledgement can help in the development of an aligned understanding of transition finance frameworks and reduce apprehensions of international financial institutions towards investing in this domain. While it is a welcome development to see the increasing flow of international capital towards non-fossil-fuel-based generation under the climate finance banner, a similar flow in transition finance would be necessary to ensure the acceleration of energy transition in India.

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Financing the Decarbonisation of Agriculture

Harsh K Bhanwala and Sanjoy Ghosh

Over the past 50 years, India has transformed from being reliant on food aid to becoming a food exporter. India's economy has historically been largely agricultural, employing nearly 50 percent of the labour force and contributing 20 percent to the country's GDP.[1]

While climate change has negatively affected agriculture worldwide, India is especially vulnerable due to its large agricultural population, its dependency on natural resources, and insufficient adaptation strategies. Over the past century, India's average temperature has risen by 0.64°C, which has caused wheat and

paddy yields to decline.[2] Even as climate change impacts agriculture, the sector accounts for a significant 14 percent of total greenhouse gas (GHG) emissions.[3]

Agricultural activities emit GHGs in several ways, with animal husbandry and crop production being the primary sources of emissions in India. According to data from 2016, enteric fermentation accounts for more than 54 percent of GHG emissions; agricultural soils, 19 percent; rice cultivation, 17.5 percent; manure management, 6.7 percent; and field burning of agricultural residues, 2.1 percent.[4] Furthermore, India ranks second only to China in terms of nitrogen-based fertiliser over-application, with over 110kg/ha/year, more than double the European Union yearly average of 52kg/ha.[5]

India's agriculture sector also accounts for 17 percent of the total electricity consumed in the country.[6] Diesel pumps comprise nearly 80 lakh of the approximately 3 crore agricultural pumps deployed in India. The annual diesel consumption of these users amounts to 5.52 billion litres, accompanied by 15.4 million tonnes of equivalent CO_2 emissions.[7] The electrification of farms in India is thus responsible for considerable amounts of GHG emissions.

Therefore, it is imperative to design and implement efficient mitigation strategies and suitable adaptation technologies in order to decrease the GHG emissions of the agricultural sector if the country is to achieve a net-zero outcome by 2070.

Current Decarbonisation Efforts

Agriculture in India is viewed primarily as a site for adaptation, with mitigation co-benefits. Various scientific and technological innovations are currently receiving attention, including: nano urea, slow release/coated fertilisers, reduced usage of chemical fertilisers, the rice intensification system, alternate wet and dry method, and smart irrigation. These initiatives aim to promote the judicious utilisation of agricultural inputs in order to facilitate input cost savings for producers, with the added benefit of contributing to environmental and climate improvement.

The government has set the replacement of current irrigation pumps with solar pumps at the top of its list of priorities. By 2026, 35 lakh conventional pumps are to be replaced with solar pumps, according to the PM-KUSUM programme.[8] The plan further calls for the installation of 10 GW of solar power plants on farms.

To encourage farmers to practice chemical-free farming and expand the scope of natural farming, the government has established the National Mission on Natural Farming (NMNF)[9] as a separate and independent plan beginning in 2023-24. The government has also announced the 'PM Programme for Restoration, Awareness, Nourishment and Amelioration of Mother Earth' (PM-PRANAM)[10] scheme in the Budget of FY 2023-24 with the objective of incentivising the use of alternative fertilisers and the balanced use of chemical fertilisers.

Moreover, the Ministry of Agriculture and Farmers Welfare launched the Framework for Voluntary Carbon Market in Agriculture Sector in January 2024[11] to enable small and medium-sized farmers to benefit from carbon credits.[12] The introduction of a carbon market for farmers will not only be a source of additional income, but will also speed up the adoption of environment-friendly farming techniques.

Domestic budgets fund the majority of India's climate measures, which are a combination of governmental action and market instruments. The National Action Plan on Climate Change (NAPCC), launched in 2008, include eight missions aimed at addressing climate change and providing the requisite policy and monetary support. The National Mission on Sustainable Agriculture (NMSA) is one of the crucial focus areas for the NAPCC. Also, in August 2015, the Government of India announced the National Adaptation Fund for Climate Change. Of the nine GCF projects under implementation in India, two are in the agricultural sector, with a total investment of US$296.6 million, of which US$77.8 million is the GCF Grant component.[13]

However, decarbonising agriculture in India presents a myriad challenges. Traditional farming methods ingrained in the sector contribute massive amounts of carbon emissions, hindering progress towards environmental sustainability. A lack of awareness and understanding of sustainable alternatives compounds the difficulties.

Access to technologies that could effectively mitigate emissions remains limited within the agricultural sector. Unlike other industries, agriculture operates with a lower degree of centralisation, necessitating the involvement of a substantial portion of India's population in emission reduction efforts. Additionally, the agriculture sector must balance multiple objectives, including addressing climate change, ensuring food security, preserving biodiversity, and safeguarding the well-being of farming communities and farmers. These diverse goals necessitate comprehensive and multifaceted strategies to achieve meaningful progress towards decarbonisation.

Financing Decarbonisation of India's Agriculture Sector

The sources of finance for decarbonisation in agriculture include government funds, budgetary allocations from state governments, contributions from corporate social responsibility (CSR) initiatives, private sector investments, and limited community-driven funding. Additionally, various banking channels provide direct lending for a range of sustainable agricultural practices. Yet, farmers continue to face formidable obstacles to obtaining funding, such as insufficient collateral, exorbitant borrowing rates, and low financial literacy. These hurdles impede the adoption of sustainable farming methods, thus sustaining the current state of carbon-intensive agriculture.

Therefore, the role of finance becomes crucial in facilitating the shift towards sustainable agriculture. Financial institutions can promote productivity gains, encourage innovation, and alleviate climate-related risks by allocating investments towards environmentally sustainable agricultural methods. These investments yield benefits that go beyond environmental stewardship; they promote the development of resilient agricultural ecosystems and ensure the protection of livelihoods.

Green and Climate Finance

There is a wide range of estimates of the financial costs required to reform agriculture and food systems to help achieve the Sustainable Development Goals (SDGs) and the targets set forth in the Paris Agreement. Between 2022 and 2030, these will range from an additional global expenditure increase of US$15 billion to US$350 billion annually.[14] In comparison, the financial

flows in 2017–18 for arresting the effects of climate change and adapting to them in the AFOLU sector (agriculture, forestry, land use, and management of natural resources), reached only US$20 billion annually, or less than 4 percent of the total climate finance deployed during that period.

Of the total climate finance tracked during 2019-20, climate finance to AFOLU made up only 2.5 percent, indicating the severe underfunding of these sectors; renewable energy generation received 51 percent and low-carbon transport, nearly 26 percent of the total.[15] In the same year, agrifood systems received a meagre 4.3 percent of total global climate finance tracked at the project level, with an annual average of US$28.5 billion.[16]

The vast majority of monitored climate finance for the AFOLU sectors comes from public sources, with a smaller portion contributed by private philanthropies.[17] Private investment in AFOLU faces barriers, including significant real and perceived risks and a lack of considerations of potential impact. Additionally, the limited understanding of agriculture's double materiality—as both contributor to and victim of climate change—has shifted climate finance focus to other sectors. The small-scale nature of farming further hinders agriculture's ability to showcase its potential for generating positive climate outcomes on a large scale.

Climate finance has the potential to bridge the agricultural financing gap by directing additional funds with positive climate impacts directly to smallholder farmers. It can stimulate the development and implementation of innovative systems to leverage more finance, especially from private sources. Climate financing can address fundamental challenges in the agriculture finance landscape, such as inadequate enabling environments, limited capacity to manage agricultural risks, and high transaction costs. By unlocking additional public and private investments, climate finance can enhance relationships between financial institutions and smallholder farmers, and build the capacities of both lenders and borrowers. Additionally, climate finance can be a significant catalyst for transforming food systems, providing the resources and incentives needed for a sustainable transition. This alignment of financial flows with climate and sustainability goals enables integrated and meaningful ways of addressing issues of food security, climate change, and environmental degradation.

Agriculture Credit and Market Instruments

Adequate and timely availability of formal credit at affordable interest rates is critical to improving agricultural productivity in ways that are sustainable for the farmer. Institutional credit flow to agriculture and allied sectors has grown by a CAGR of 14.8 percent during FY2019–FY2023. While crop loans grew at a CAGR of 15.8 percent, term loans grew at an impressive 13.2 percent during the same period.[18]

The agriculture sector in India is supported by an intricate network of financial instruments. The primary elements of India's agricultural credit policies are mainly supply-driven through targeted ground-level credit, directed lending through regulatory prescription under Priority Sector Lending guidelines, and interest subvention schemes. These policies, along with other policy interventions, have yielded commendable results in the field of agricultural credit.

Innovative financial solutions, supported by all the relevant stakeholders including central and state governments, Reserve Bank of India, NABARD,[a] and commercial banks, have been instrumental in ensuring steady growth in institutional credit to the agriculture sector. Also able to contribute to ensuring adequate and sufficient finance for the agriculture sector in India are Kisan Credit Card, SHG-Bank Linkage Model, Joint Liability Groups (JLG) scheme, and various other schemes of NABARD such as the Rural Infrastructure Development Fund (RIDF), Micro Irrigation Fund (MIF), and Warehouse Infrastructure Fund (WIF). They also address the diverse needs of farmers and promote sustainable agricultural practices. The response to the Agriculture Infrastructure Fund, launched in 2020 with a focus on creation of infrastructure specially at post-harvest stage of the agriculture value chain, has been satisfactory, encouraging efficiency in the use of energy.

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However, the agricultural sector continues to face significant challenges, including insufficient capital formation and regional disparities. Small and marginal farmers, tenant farmers, landless labourers, and sharecroppers often rely on non-institutional credit sources with high interest rates. Farmers also frequently do not receive fair prices for their produce, leading to distress. Farm loan waivers, while providing temporary relief, can undermine the credit culture and weaken state finances.

Responsive Financial Systems and Instruments

Responsive financial systems and instruments tailored for farmers involve creating flexible and accessible mechanisms that address the unique needs and challenges faced by agricultural communities.

Notable examples of such financial systems and instruments include the following:

- **Microfinance institutions** play a crucial role in responsive financial systems by offering small-scale loans to farmers who may not have access to traditional banking services. Tailoring microfinance and microcredit products to the needs of smallholder farmers enable them to access smaller, more manageable loans for climate-resilient technologies and practices. Short-term working capital can help smallholder farmers, particularly women, in adopting climate-resilient agricultural practices to increase their yields and incomes while reducing their vulnerability to climate change as well as adopting decarbonising practices.
- **Credit cooperatives** enable farmers to pool resources and access credit collectively. These entities are often community-based, fostering a sense of ownership and cooperation.
- **Digital financial services,** such as mobile banking and digital payment platforms, facilitate seamless financial transactions for farmers, reducing the need for physical infrastructure.
- **Crop insurance programmes** through integrated credit-linked crop insurance schemes provide a safety net for farmers, protecting them from financial losses due to adverse weather conditions or other unforeseen events. Implementing insurance products with payouts

linked to specific weather conditions helps protect farmers against losses caused by adverse weather events, encouraging them to adopt resilient practices.

- **Warehouse receipt systems** allow farmers to use stored crops as collateral for obtaining credit, promoting better market access and reducing post-harvest losses.
- **Value chain financing** aligned with the entire agricultural value chain—from production to marketing—ensures a holistic approach that benefits all stakeholders.
- **Government subsidies and grants** directed towards agriculture help reduce the financial burden on farmers, enabling them to invest in climate-resilient technologies and practices.
- **Agri-fintech solutions** such as innovative financial technology solutions designed for agriculture, including mobile apps and online platforms that simplify financial transactions, provide market information, and offer advisory services.
- **Flexible loan repayment structures** including customised loan repayment schedules aligned with the agricultural cycle, considering the income patterns of farmers and the seasonality of their activities. Integration of technical support and capacity-building programs alongside credit facilities to empower farmers with the knowledge and skills needed for sustainable and resilient farming practices.
- **Partnerships with agricultural input providers** allow farmers to access credit for purchasing seeds, fertilisers, and other essential inputs, enhancing agricultural productivity.
- **Blended finance** has gained popularity as donors seek to attract private capital for development objectives. This approach is most effective when public funds can mitigate perceived market risks that are higher than actual risks, demonstrating commercial viability. To encourage investment in low-carbon agriculture, various models of impact finance need to be developed and replicated, aiming to secure funding from capital markets in the future.
- **Farmers collectives,** like farmer producer organisations (FPOs), can act as catalysts for creating responsive financial systems by promoting financial inclusion, negotiating favourable terms for their members, and facilitating the adoption of climate-resilient practices among smallholder farmers in India. Their role in bridging the gap

between farmers and financial institutions is instrumental in building a sustainable and resilient agrifood system.

- **Guarantees,** which are an important but underused tool for mobilising private climate finance, can play an important role. A recent OECD evaluation found that guarantees leveraged 26 percent of all mobilised private finance between 2018-2020 and were among the preferred risk mitigation tools of private investors.[19] Studies by Climate Policy Initiative suggest that larger and more effective credit guarantee facilities have the potential to mobilise 6-25 times more financing than loans. This is because guarantees help improve the credit ratings of assets and enable borrowers to access a far bigger pool of capital at a lower cost, thus acting as a catalyst in unlocking finances.

The Way Forward

Decarbonisation strategies and climate-resilient technologies are already being utilised and developed but require increased funding for scaling up, reorientation, and integration with conventional systems. The funding needs, especially in the Natural Resource Management (NRM) sector, far exceed the available resources. Grant-based programs by governments alone cannot meet the demands of individual projects.

Policy

- Increased Climate Finance: Future climate action demands are projected to rise, necessitating a significant increase in climate finance. Policy should focus on mobilising both local and foreign sources of funding, utilising innovative tools like blended financing to stimulate growth without overburdening budgetary resources.
- Private Sector Engagement: Policy initiatives should encourage the mobilisation of private sector capital for climate transformation. Recognising the private sector's potential for economic growth through climate transition, policymakers must implement adequate regulations and procedures to attract investments in climate technologies.
- Affordable Climate Finance Solutions: India's climate finance policy seeks to close the gap between accessible funds and its actual requirements, facilitate increased private investment, and diminish

excessive reliance on debt. Notable financial instruments encompass equities, debt, bonds, grants, philanthropic capital, and blended finance. Prioritising affordable climate finance solutions through international partnerships, including with Multilateral Development Banks (MDBs), is crucial. Private sector entities and state governments should utilise the bond market and philanthropic funds in order to reduce the expenses associated with transitioning and decarbonising this sector.

Regulation

- Diversification of Financial Instruments: Regulation for promoting the diversification of financial instruments, including equities, debt, bonds, grants, and philanthropic capital is a key imperative. This diversification aims to reduce reliance on debt and encourage private sector entities and state governments to utilise the bond market and philanthropic funds for transitioning expenses.
- Support for Research and Development: Regulations need to prioritise the allocation of funds towards climate-focused research, development, and innovation. Start-ups play a vital role in driving this change, and regulatory frameworks should support India's venture capital ecosystem to foster innovation in climate technologies.
- Innovative Funding Approaches: Regulations that encourage innovative funding approaches to address decarbonisation challenges would provide a big fillip. Microfinance programs, impact investments in sustainable agriculture, and carbon financing schemes offer viable options for greening Indian agriculture, and regulatory support can enhance their effectiveness.

Markets

- Finance-Driven Decarbonisation: Markets play a crucial role in finance-driven decarbonisation efforts. Policymakers may consider creating a conducive environment for investment in sustainable agriculture by rewarding such investments and boosting financial literacy among farmers. Collaboration among government, financial institutions, and civil society is essential to achieving India's green agricultural revolution.
- Village-Level Solarisation: Markets can facilitate village-level solarisation initiatives by creating opportunities for increased farmers' incomes, job

creation, and financial transactions through banks and Microfinance Institutions (MFIs). Solar power generation in rural areas can promote water conservation, increase production, and income, while initiatives like the PM Surya Ghar: Muft Bijli Yojana can help achieve sustainable development goals.

- Circular Economy and Waste Management: Markets need to promote circular economy principles and sustainable waste management practices to reduce carbon emissions from the waste industry. By focusing on waste reduction, recycling, and circular activities, markets can contribute significantly to achieving net-zero objectives and advancing towards a more sustainable future.
- Regenerative Agriculture: Regenerative agricultural practices are a promising approach to agricultural sustainability, soil health, biodiversity, and decarbonisation. They focus on restoring and improving soil health, reducing GHG emissions, and mitigating climate change. These practices include no-till farming, cover crops, crop rotation, agroforestry, and biochar application. Organisations and community involvement are crucial in facilitating the transition towards environmentally responsible farming. Scaling up these cost-effective practices can offset a significant portion of GHG emissions, contributing to a more sustainable and resilient agricultural system.

Finance plays a crucial role in decarbonising agriculture as India aims for a sustainable future. Beyond mitigating climate change impacts, India has the opportunity to empower rural communities with economic prosperity through innovative financial mechanisms and policies.

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The views expressed in this article are personal and not of their organisations.

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Financing the Transition of MSMEs

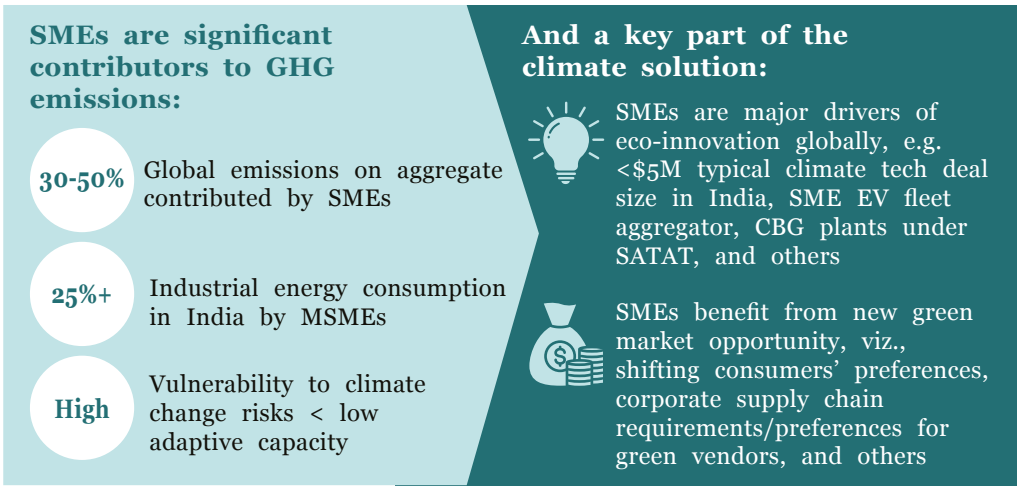
Sivasubramanian Ramann, Ravindra Kumar Singh, and Rajiv Kumar

India, one of the fastest growing economies in the world, is increasingly recognising the importance of transition and green finance. Although the market for transition finance is currently nascent, it is expected to grow in the coming years. A number of sectors in India, especially energy/power generation, mobility, and the circular economy, are already experiencing or are expected to see a high transition over the next decade or so. The transition is pitted against legacy assets that continue to have an active residual life of over 30 years, thereby negating the commercial or business case for the switchover. This highlights the need for innovative financing solutions that can address the business case and commercial barriers.

Despite its relatively weak technological know-how and financing capabilities, India has committed to achieving net-zero by 2070 and 50 percent installed power capacity from non-fossil-fuel-based resources by 2030. Although it is a critical economy for the global energy transition, India's national decarbonisation pathway will differ from that of the developed world, aiming to pioneer a new model of rapid economic development alongside a low-carbon future.

Nearly half (about US$50 trillion) of the total global investment in the net-zero transition will need to be directed towards small- and medium-sized enterprises.[1] In India, Micro, Small, and Medium Enterprises (MSMEs) contribute over 30 percent of GDP, account for 50 percent of exports, and provide over 100 million jobs.[2] They are well positioned, therefore, to deliver climate action from the ground up. However, MSMEs also face heightened vulnerability to climate change risks due to limited adaptive capacity.

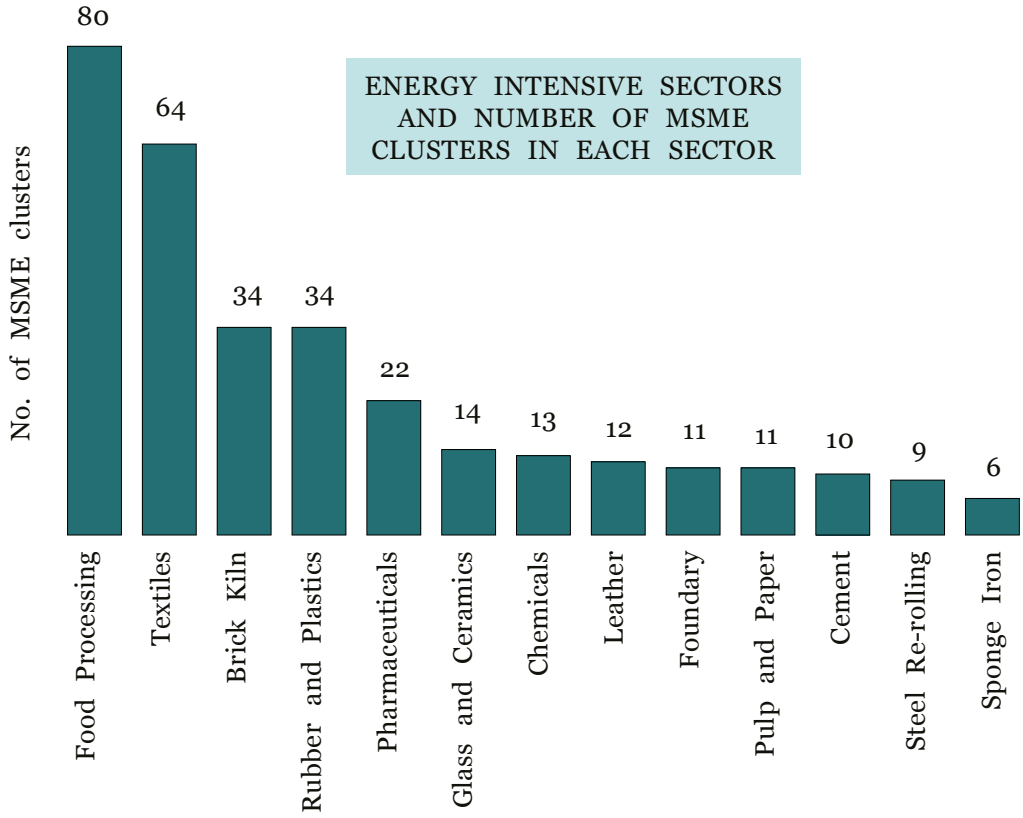
Figure 1: Role of MSMEs in Mitigating and Adapting to Climate Change



Source: OECD[3]

While MSMEs will be critical to India's decarbonisation pathway, most do not have formal transition plans like large organisations. The MSME sector is currently characterised by a resource-intensive technology profile. The industrial sector consumes 56 percent of India's total energy demand and the MSME sector consumes 25 percent of the energy demand of the industrial sector. India's MSME sector generates around 110 million tonnes of CO2 equivalent annually.[4] Some of the energy-intensive MSME sectors include food processing, textiles, brick kiln, rubber and plastics, pharmaceuticals, glass and ceramics, leather, foundry, pulp and paper, cement, steel re-rolling, and sponge iron.[5]

Figure 2: Energy-Intensive MSME Sectors and Corresponding MSME Clusters



Source: Jain et al.[6]

Transition levers will include switching to natural or biogas and renewable energy sources, promoting the use of electric or other zero-emissions vehicles, and improving the energy efficiency of production equipment.

Access to finance is a critical barrier to sustainable investment by MSMEs, especially in the energy-intensive and hard-to-abate sectors. Barriers in the MSME sector to adopting green and climate resilient technologies are highlighted in the Third National Communication and Initial Adaptation Communication submitted by the Government of India to the United Nations Framework Convention on Climate Change (UNFCCC). The report states that MSMEs, being semi-formal in nature, lack access to credit from financial institutions as well as the technical know-how and capacity to adopt energy-efficient technologies.[7] Therefore, a transition finance framework can act as a critical step in enhancing credit availability for green investment.

A Demand-Side Perspective

Transition finance is characterised by sector-specific needs, key implementation challenges, and innovation.

Sector-specific needs

Hard-to-abate industries such as steel, cement, and energy, which are traditionally high carbon emitters, are at the forefront of seeking transition capital. This further extends to MSMEs in their value chain and the dependent sectors. Transportation is another hard-to-abate sector, especially in terms of emissions from aviation, shipping, and heavy-duty road transport. These industries need financing, technical expertise and policy support to manage a transition, with blended finance ideal to aiding this transition.

Challenges and expectations

Industries, especially MSMEs, emphasise the challenges in balancing operational costs and investments in sustainability. They expect financial solutions that offer competitive terms and recognise the long-term benefits of sustainable practices.

Role of innovation

Industries seek support in funding research and development activities that could lead to more efficient and sustainable practices.

Accelerating Green and Transition Finance in Indian MSMEs

The concerned authorities must consider implementing the following measures to accelerate green and transition finance in India's MSME sector.

Policy Framework

- **Risk-sharing mechanisms:** Developing mechanisms where public funds, philanthropies, and impact investors share some of the financial risks associated with transition finance, especially in MSMEs, via credit guarantees or co-investment.
- **Expand priority sector lending:** Potentially expanding the priority sector lending norms to create sustainable sector lending, thereby mandating banks to allocate a portion of their portfolio to transition finance in MSMEs.
- **Green bond guidelines:** Streamlining guidelines for green bonds to ensure that the funds raised are used for genuine sustainable projects that accelerate the transition towards a low-carbon economy, fostering investor confidence.
- **Tax incentives:** Rolling out tax deductions or credits for investments in transition financing projects. For instance, a tax break for MSMEs that successfully reduce their carbon emissions beyond a specific threshold. Similarly, financial institutions providing transition finance could benefit from reduced tax liabilities, making such financing more attractive.

Regulatory Framework

- **Clear definitions and transition finance taxonomy:** Establishing clear definitions for what constitutes hard-to-abate sectors in MSMEs requiring transition finance can provide a solid foundation for focused regulatory measures. For example, the identified hard-to-abate sectors

in MSMEs are bricks and refractories, which require transition finance.[8] It is imperative to expand the research further to study other MSME sectors that might be categorised as hard-to-abate sectors requiring transition finance.

- **Standardised reporting:** In addition to business responsibility and sustainability reporting for top 1000 listed companies, the mandate on standardised reporting for MSMEs seeking transition finance can be strengthened to ensure transparency and allow financiers to make informed decisions.
- **Green rating system:** Potential collaboration among rating agencies to introduce a green rating system, evaluating the sustainability and environmental impact of projects and businesses in MSMEs.
- **Facilitate securitisation:** Streamlining regulations to facilitate the securitisation of green assets, enabling financial institutions to offload these assets from their balance sheets and free up capital for further lending.

Fostering Public-Private Partnerships

- **Collaborative platforms:** Leading institutions can initiate the establishment of platforms where the government, private sector, and even academia can collaborate on sustainable projects, pooling resources, expertise, and capital, which could lead to knowledge creation, capacity building, sensitisation, and an awareness of market participants.
- **Incentive structures:** Development financing institutions, climate philanthropies, and international climate funds could collaborate and introduce incentive structures to roll-out blended financing opportunities to promote transition financing in hard-to-abate MSMEs at a sub-national level.
- **Shared infrastructure:** In sectors like green hydrogen; compressed biogas; carbon capture, use and storage; and distributed renewable energy—certain policy enablers can be introduced to foster collaboration and co-creation of the necessary infrastructure.

Capacity Building and Awareness

- Capacity building: Capacity aimed at equipping professionals with the skills needed in the transition finance domain should include the assessment of greenhouse gas (GHG) impact, carbon emissions, risk assessment, sustainable technology evaluation, and more for both demand and supply side.
- Awareness campaigns: The Indian Banks Association (IBA) and other industry organisations should run nationwide campaigns partnering with relevant government entities to build favourable public opinion, which in turn can influence corporate behaviour.

The SIDBI Experience

To achieve India's net-zero commitments, development finance institution Small Industries Development Bank of India (SIDBI)[a] supports MSMEs in their transition journey. For over 15 years, SIDBI has furthered energy efficiency in a cluster-centric mode, deploying US$1.7 billion towards such efforts, which resulted in GHG emission reductions of 2.0 million tCO2 annually.

SIDBI is committed to help MSMEs adopt low-emissions pathways and energy efficiency measures in their business processes. As such, it has developed dedicated thematic missions:

- **Mission 2.5k Solar:** Enabling each enterprise, especially energy-intensive MSMEs, to go green by installing solar rooftops.
- **Mission EV4ECO** (EV Operations and Lending for Vibrant Ecosystem): Supporting India's electric vehicle market in alignment with the government's 'EV30@30 Mission'.
- **Mission Waste 2 Environment Taste:** Supporting technology interventions to convert waste into wealth (circular economy).

[a] The authors are officials of SIDBI.

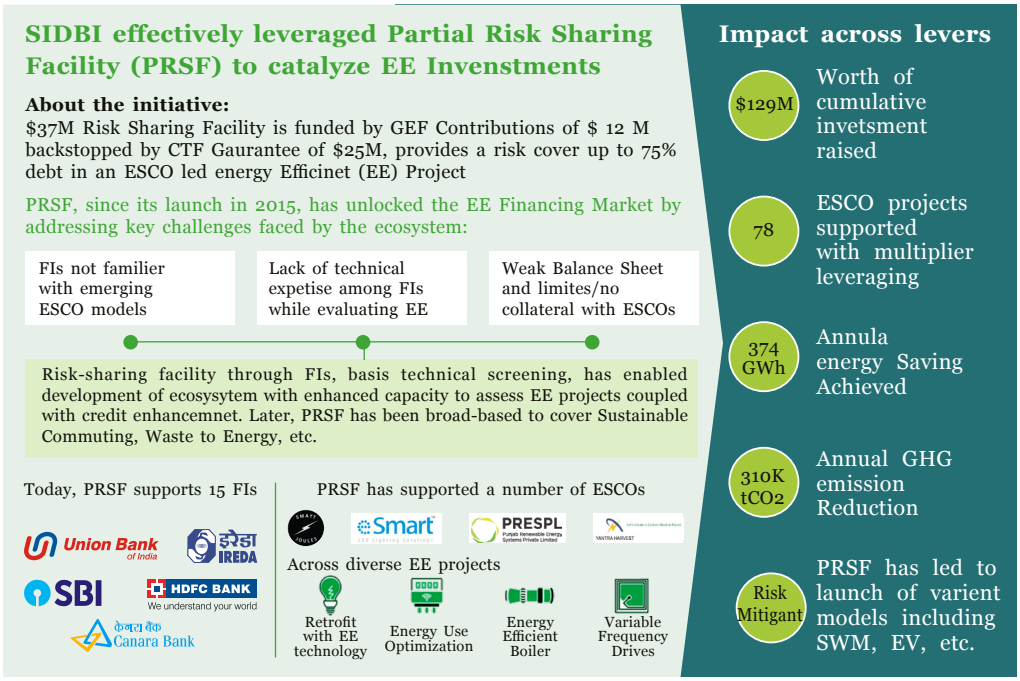
- **Mission Energy Efficiency:** Mobilising energy efficiency investment in the MSME sector to further GHG reductions.
- **Nurture-t-Nature:** Nurturing nature through a technology basket, promoting innovative technologies.

SIDBI caters to these missions through two main green schemes: the End-to-End Energy Efficiency (4E) Scheme and the Green Finance Scheme (GFS), supported by the TIFAC – SIDBI Technology Innovation Fund (SRIJAN) scheme. Under the 4E Scheme and GFS, the objective is to provide financial assistance to MSMEs, especially energy-intensive ones that are engaged in reducing GHG emissions, by investing in energy-efficient or energy-transition technologies as well as renewable projects. For instance, solar rooftop financing catered to the market needs through a cluster-centric incentive-embedded approach, wherein financing was provided at below the cost of funds. Through the SRIJAN scheme, launched in 2010, 40 innovative technologies were supported, with some even penetrating the global market.[9]

SIDBI has also piloted and validated a few replicable risk sharing facilities (RSF) models, which enable financiers such as banks and non-banking financial corporations to support perceived high-risk green projects. These include:

- **Partial Risk Sharing Facility for Energy Efficiency (PRSF):** A US$37-million guarantee facility corpus, leveraged to US$120 million. The programme was initiated in 2015 to support the government's efforts to transform India's energy efficiency market by promoting increased levels of investments through energy service companies (ESCOs). ESCOs act as project developers for a comprehensive range of energy conservation measures (ECMs) and assume the technical and performance risks associated with a project. The World Bank has supported PRSF work as a complement to collateral security, which enables banks to support energy efficiency projects being implemented through ESCOs.

Figure 3: Impact of SIDBI's Partial Risk Sharing Facility for Energy Efficiency Investments



Source: Clean Energy Finance and Investment Roadmap[10]

- **RSF for Municipal Solid Waste Management Projects:** As part of the Mitigation Action Facility-funded 'Waste Solution for a Circular Economy India' project implemented by GIZ India, SIDBI is operating a RSF worth €4.2 million to provide partial loan guarantees to entrepreneurs in the municipal solid waste management sector.
- **RSF for Electric Vehicle (EV-RSF):** EV-RSF, a US$6-million joint initiative by SIDBI and the Shell Foundation, intends to mitigate the credit risk exposure of partner financial institutions, thereby unlocking commercial financing for electric two- and three-wheelers, and associated EV ecosystem investments. This would help improve the access to affordable commercial finance to support the adoption of EVs in India.

SIDBI has several other initiatives that support MSMEs in their green transition. Examples include Green Climate Fund of Funds, Project GRiT, Energy Efficient Enterprise and E-Rupi for Excellence (E4E), Promoting

Adoption of Clean Energy (PACE), Sustainability Perception Index (SPeX), and State-level partnerships.

Conclusion

As a bridge between current practices and a sustainable future, green and transition finance is becoming a focal point of global economic discourse. Recognising its pivotal role in achieving the Sustainable Development Goals, countries worldwide are aligning their financial systems to support this transition. India, with its burgeoning economy and vast developmental ambitions, is now at a crucial juncture. India's green and transition finance market is nascent but holds significant promise. There is significant interest from capital suppliers, including banks, capital markets, and insurance providers, who are eager to tap into the potential of sustainable investments.

Industries, particularly carbon-intensive ones, are actively seeking transition capital to align with global sustainability standards and embark on green pathways. As such, the role of policymakers and regulators becomes paramount. They hold the key to crafting policies that incentivise sustainable investments, shaping a regulatory landscape that fosters transparency and trust, and promoting public-private collaborations that pool resources and expertise.

The journey towards a robust green and transition finance ecosystem in India is an economic and moral imperative. It requires a collaborative effort, with every stakeholder—from the government to industries to financial institutions—playing their part.

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IV

A Roadmap for Green and Transition Finance in India

Mannat Jaspal and Neha Khanna

There is a substantial gap between the investment required for India to achieve Net Zero by 2070 and the actual finance flows so far. For the real sector, while some technologies exist, their viability and commercialisation is yet to become a reality. To achieve the country's net-zero goals, carbon capture and carbon removal technologies are crucial. It is estimated that 67 percent of industrial emissions would need to be mitigated through carbon management techniques such as Carbon Capture, Utilisation, and Storage (CCUS) as well as carbon offsetting measures.[1] CCUS, however, is still nascent, and carbon removal technologies are even farther behind. This

means that India's immediate focus will need to be on emission reduction and transition efforts, effectively promoting the growth of both green and transition sectors.

To be sure, there are low-hanging fruits that can drive the green and transition journey, at least for the short to medium term: power decarbonisation, energy efficiency and material efficiency, fuel switching, and material circularity. For this to happen, transition and transformation in the financial sector is also required. The financial sector will have to provide support and be supported in its efforts to buttress India's net-zero future.

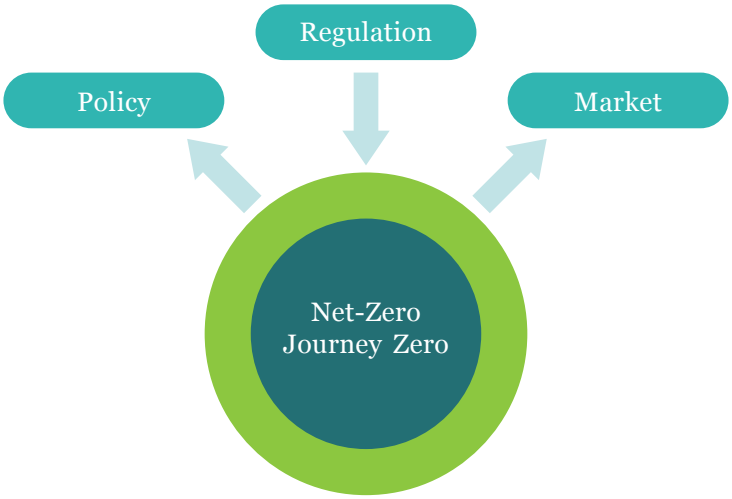
Achieving this transformation requires creating an enabling environment through a combination of policy prescriptions, regulatory actions, and market movements.

Policy Prescriptions: Identifying and implementing policy levers that policymakers can use to advance green and transition finance. This involves crafting policies that incentivise investments in sustainable projects and support the growth of green and transition sectors, activities, and processes.

Regulatory Actions: Addressing regulations from the perspectives of both real and financial sectors. This includes steps that regulators such as the Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), and Central Electricity Regulatory Commission (CERC), can take to foster a supportive regulatory environment for green and transition investments and ensure compliance with set targets.

Market Movements: Encouraging actions by individual firms, industry bodies, and sectoral organisations to drive the market towards green and transition projects. This includes adopting best practices, committing to green initiatives, and collaborating across industries to promote innovation and a collective transition to a low-carbon economy.

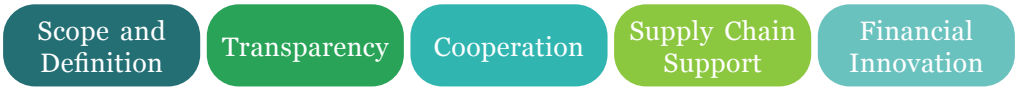
Figure 1: Drivers to Net-Zero



Source: Authors' own

To understand the challenges, scope, and trajectory of the economy—from both real sector and financial sector perspectives—the authors invited individuals belonging to key industries to share their views. Based on these responses, along with the authors' own insights and experiences, recommendations were formulated and grouped into five pillars, as identified in Figure 2.

Figure 2: Pillars of Key Recommendations



Source: Authors' own

The recommendations have been classified under the five pillars (Figure 2) and are aligned with the three primary drivers (Figure 1). Additionally, potential actors responsible for implementing these recommendations have been identified, along with specific timelines for implementation. These timelines are defined according to short-term goals (one to three years), medium-term (three to five years), and long-term (five to 10 years)—this would ensure a structured and phased approach to achieving the desired

outcomes. Such a comprehensive framework aims to provide clarity on the roles and responsibilities of various stakeholders and to set realistic milestones for progress.

Before delving into the recommendations, it is important to highlight the authors' view that carbon markets will be pivotal in India's journey toward achieving Net Zero. We have included our perspectives in a dedicated section to share with a broader audience. This discussion is particularly timely given the budgetary announcement in late July to utilise carbon markets in the transition of hard-to-abate sectors. By leveraging carbon markets, India can drive significant emission reductions, support sustainable development, and enhance the competitiveness of these challenging sectors. This approach aligns with India's broader climate goals and reinforces its commitment to innovative solutions for a sustainable future.

Carbon Markets

In December 2023, The Government of India notified a Carbon Credit Trading Scheme (CCTS) for implementation of carbon trading mechanisms.[2] The government must leverage a combination of Indian Carbon Market (ICM), Voluntary Carbon Market (VCM), and Article 6 of the Paris Agreement, to maximise their reach and effectiveness.

a) Indian Carbon Market (ICM)

The Indian Carbon Market (ICM) is crucial to foster a competitive environment, incentivising designated entities to adopt affordable and innovative low-carbon solutions by encouraging technology and financial investments for projects that generate carbon credits.[3] The evolution of the ICM from the existing 'Perform, Achieve and Trade' (PAT) scheme marks a shift in focus from energy efficiency to rigorous emission reductions. In the 2023-24 budget, the Finance Minister highlighted the need for a clear roadmap to shift 'hard-to-abate' industries from energy efficiency targets to more rigorous emission reduction targets, with the ICM playing a central role in this regulatory evolution.[4]

Dynamic target setting in the ICM will be vital to help adjust goals based on supply and demand fluctuations, preventing oversupply issues seen with the PAT scheme. Ensuring stable carbon prices is crucial for investment certainty and market confidence. Incremental ambition will drive industries to seek higher returns and expand trading opportunities. The budget's emphasis on credit support, capacity building, and skills development particularly for Micro, Small, and Medium Enterprises (MSMEs), alongside leveraging Digital Public Infrastructure, reflects a positive step for successful ICM implementation.

b) Voluntary Carbon Market (VCM)

The Indian government has introduced a framework to advance the Voluntary Carbon Market (VCM) within the agricultural sector.[5] This initiative aims to promote eco-friendly farming practices, incentivise small and marginal farmers to earn carbon credits, and increase their income. It also seeks to provide other agro-ecological benefits, such as improved soil, water, and biodiversity. By fostering a more sustainable and bottom-up approach, this framework will support the development of much needed innovative agricultural solutions. Promoting climate-smart agriculture and boosting farm productivity appeared as key focus areas for the government according to the Budget pronouncements.[6]

c) Article 6 of the Paris Agreement

Article 6 of the Paris Agreement establishes both market and non-market mechanisms for voluntary international cooperation to help countries meet their Nationally Determined Contributions (NDCs) and cut greenhouse gas emissions. This article includes three key components:

- **Article 6.2** provides guidelines for bilateral agreements on internationally transferred mitigation outcomes (ITMOs), allowing countries to transfer emission reductions between themselves to meet their NDC targets.[7] The Bangkok E-Bus Programme is a model example of the Swiss-Thai Carbon Credit Deal under Article 6.2 of the Paris Agreement.[8] India should, however, be strategic in their sector selection to avoid compromising their own NDCs. For example,

Ghana aims to refrain from issuing ITMOs for initiatives like switching light bulbs or planting trees on smallholder plantations, as these are relatively cheaper for the country to manage by itself.[9] Under Article 6.2 mechanism, India has notified a list of activities to be considered for trading of carbon credits under bilateral or cooperative approaches as a means to facilitate the adoption or transfer of technologies and mobilisation of international finance in India.[10] These activities are the following:

I. GHG Mitigation Activities

1. Renewable energy with storage (only stored component)
2. Solar thermal power
3. Off-shore wind
4. Green Hydrogen
5. Compressed bio-gas
6. Emerging mobility solutions like fuel cells
7. High-end technology for energy efficiency
8. Sustainable Aviation Fuel
9. Best available technologies for process improvement in hard-to-abate sectors
10. Tidal energy, Ocean Thermal Energy, Ocean Salt Gradient Energy, Ocean Wave Energy, and Ocean Current Energy
11. High-Voltage Direct Current Transmission in conjunction with renewable energy projects

II. Alternate Materials:

1. Green Ammonia

III. Removal Activities:

1. Carbon Capture Utilisation and Storage

- **Article 6.4** introduces a new international carbon crediting mechanism, designed to enable countries to achieve their NDCs through emission reductions from projects and programs. This mechanism will replace the Kyoto Protocol's Clean Development Mechanism (CDM) and is expected to be operational by 2025.[11]

- **Article 6.8** focuses on non-market international cooperation including capacity building and technical assistance, which may cover areas such as social inclusivity, financial policies, circular economy, blue carbon, just transition of the workforce, and adaptation benefits. This article addresses interactions between governments and the private sector, potentially involving scenarios such as one country financing efficiency improvements in another's energy or transportation sectors, or purchasing carbon offsets from forest projects in another country.[12]

The government should leverage these components to seek necessary finance and technical assistance to support decarbonisation efforts at home.

RECOMMENDATIONS

A. Scope and Definition

This pillar arises from the need to standardise definitions and decarbonisation pathways, ensuring a level playing field and providing clarity to institutions. This standardisation will enable institutions to take faster and more targeted action.

Category	Recommendation	Details	Stakeholders	Timeframe
Policy	**Taxonomy**	Policymakers must develop a clear and standardised definition (dynamic) for eligible green and transition assets, activities, and processes including technology specifications where applicable. Ensuring interoperability and harmonisation with international taxonomies, such as the EU Taxonomy, will be crucial to attract global capital.	MOF	Short term
Policy, Market	**Target Setting**	It provides an impetus for all players to take action. **a. National Level** Align and update national targets with international Paris Agreement commitments. **b. State Level** Set GHG emission reduction targets at the state level contextual to regional resource endowments. State governments should be encouraged to develop localised strategies and policies that align with national goals. This localised approach will address regional differences and enable more effective implementation and monitoring of emission reduction efforts. **c. Sector level** Establish tailored GHG emission reduction targets for specific industrial sectors such as steel, aluminium, cement, and thermal power. Entities within these sectors must be mandated to meet these targets, with progress monitored through a timeline divided into several time blocks up to 2030, ensuring continuous progress and accountability.	Various ministries, Industry bodies, companies	Short term

Market	**Decarbonisation Pathways/ Transition Plan**	Entities should create company-wide transition plans aligned with government and industry targets to achieve net-zero. Establish robust corporate governance and develop KPIs, including emission reduction targets, technology efficiency metrics and technology roadmaps, social KPIs, overall emissions tracking; and utilise sustainable financing Sustainability-Linked Bonds/ Loans (KPI-linked) or Green Bonds.	Industry	Short to medium term

B. Transparency

This pillar focuses on the interventions which would help in greater data availability, leading to higher transparency and addressing integrity concerns.

Category	Recommendation	Details	Stakeholders	Timeframe
Regulation, Market	**Disclosure Guidelines**	**Corporates** Strengthen the mandate for standardised reporting, especially for MSMEs in addition to the BRSR requirements for ESG disclosures for the top 1,000 listed companies. Expand scope to include net-zero targets. **Financial Entities** The RBI aims to promote climate risk disclosure among banks, and the Insurance and Pension regulators should be encouraged to do the same for their entities to boost demand for green and transition finance.	SEBI; IFRDA AND PFRDA, RBI, IFSCA	Short term
Regulation, Policy	**Standards and Labelling**	Implement stricter building codes and promote stronger performance-based standards to foster adoption of low-carbon materials. Develop a transparent labelling system and make green labelling mandatory for products and ensure the accreditation of products aligns with specific environmental and emission standards.	Real sector regulators and policy makers	Short to medium term
Regulation, Industry	**Auditing**	Audit firms should be equipped to assess and track progress on net zero targets. Third-party verification will ensure transparency and accountability, reducing the chances of greenwashing.	SEBI, Industry	Short to medium term

Regulation, Industry	**Green Rating System**	Encourage collaboration among rating agencies to establish a carbon/green rating system, assessing the sustainability and environmental impact of projects and businesses. This will also foster innovation in financial instruments and ensure consistency in approaches to manage emission reduction. Cues may be taken from the 2023 SEBI circular on ESG ratings which refers to a Parivartan/transition score.	SEBI, CRAs	Short term

C. Cooperation

Climate change is a global challenge that requires enhanced cooperation at both the design and action stages by stakeholders at domestic and international levels. The interventions under this pillar emphasise actions such as forming sector alliances, leveraging the role of multilateral development banks, and fostering government-industry collaboration, among others.

Category	Recommendation	Details	Stakeholders	Timeframe
Market	Sector Alliances – Domestic and International	Develop and participate in sector alliances both domestically and globally to enable economies of scale and enhance technological and capital efficiencies. The G20 should establish industry transition roadmaps and foster alliances for all hard-to-abate sectors. Provide clear policy signals and align domestic policies with international commitments and global sustainability initiatives. Collaborate on low carbon technology co-development; and leverage G20 and other multilateral and bilateral partnerships to access global capital, technologies and resources.	Industry bodies, International coalitions	Short term
Market	Advisory and Thought Leadership	Banks, development finance institutions (DFIs), and other financial intermediaries can offer advisory services to clients and MSMEs in their supply chain on developing transition roadmaps and integrating ESG factors into their business decision-making. Bigger companies should provide support to MSMEs in the form of mentorship and/or investments.	Industry	Short term

Policy, Market	Shared Infrastructure	Foster collaboration in sectors like green hydrogen, compressed biogas, and carbon capture. Introduce policy enablers for co-creating necessary infrastructure such as pipelines and storage facilities, among others. Establish collaborative platforms for knowledge sharing, joint research initiatives, effective policy framework development and tech co-development. Pool resources, expertise, and capital for knowledge creation and capacity building.	Industry association, policymakers	Medium to long term
Policy, Market	Role of multilateral agencies	**Concessional Capital** Development Finance Institutions (DFIs) can extend concessional capital through credit lines to local financial institutions (FIs), which blend it with their own funds to offer lower-than-market-rate loans to end-users. MDBs can support by providing concessional finance, grants, credit insurance, guarantees. **Technical Assistance** Provide capacity building support and technical assistance across stages: project preparation, proposal documentation, funding applications, and implementation and reporting. Combination of TA and concessional capital may be more effective in driving change given the rapidly evolving nature of this problem.	MDB, DFI, FIs, Policy Makers	Short to medium term

D. Supply Chain Support

While bigger industries may contribute significantly to emissions, the value chains are crucial in the decarbonisation journey. The proposed interventions aim to support these value chains, ensuring they receive the necessary assistance to transition effectively.

Category	Recommendation	Details	Stakeholders	Timeframe
Market, Regulation, Policy	Innovative business models	Incentivise innovation in business models to introduce fresh strategies and frameworks to address market challenges and opportunities. For example, in the electricity sector, the UK energy regulator Ofgem has permitted the testing of innovative demand-side business concepts outside existing regulatory frameworks. This initiative aims to identify and address regulatory barriers that hinder adoption and implementation.	Market, Government / Policy Makers, Real sector regulators	Across timelines
Policy, Market	Green Domestic Manufacturing	Support local manufacturing of key energy inputs to remain competitive in global markets. **Green Public Procurement** Green procurement goals for public infrastructure projects will send a robust market signal and incentivise private sector adoption. This can be done by either direct procurement at a premium or via contract-for-differences (CfDs). **Fiscal Incentives** Capital subsidies, Op-ex subsidies, grants or one time rebates, Investment / Production tax credits tax credits, targeted subsidies and accelerated depreciation allowances, long-term agreement on fixed price for key energy inputs. MSMEs should be prioritised. For example, Manufacturing electrolysers for green hydrogen in India is essential for competitiveness, supported by Production Linked Incentives (PLI) and Viability Gap Funding (VGF).	Policymakers, Industry	Short to medium term
Market	Tokenisation/ Collectivisation	MSMEs can leverage digital technologies to form clusters for capital raising purposes.	MSME units	Short term

E. Financial Innovation

Innovation by the financial sector, supported by policy and regulatory decisions, would be needed to achieve India's target of Net Zero by 2070. This pillar looks at the interventions that would be required across various stakeholders in the financial sector.

Category	Recommendation	Details	Stakeholders	Timeframe
Policy, Market	Government-Backed Guarantees and Incentives	Implementing credit guarantees, co-investment programs, and risk-sharing mechanisms can mitigate high capital costs and perceived credit risks for clean technology projects. This enhances attractiveness for lenders by improving risk/return profiles and potentially reducing capital costs for project issuers. For instance, Viability gap funding for demonstration products.	Policymakers, AIFIs, RBI	Short to medium term
Policy	Dedicated Funding Mechanisms	**Financing Facility** Establish a financing facility to support decarbonisation projects in challenging sectors, offering preferential terms, reduced interest rates, and extended repayment schedules. These platforms should mitigate regulatory risks, streamline project approval, and allocate resources efficiently. Green and transition concessional credit lines overseen by the Department of Economic Affairs (DEA) and the Department of Financial Services (DFS) will be pivotal. Promoting blended financing opportunities at sub-national levels and tailoring strategies for MSMEs is also crucial. Utilize Public-Private Partnerships (PPPs) to jointly invest in demonstration projects, sharing financial responsibilities and reducing risks. **Research, Development and Demonstration (RD&D) Facility** Establish a dedicated fund to drive RD&D in green and transition technologies funded by government allocations, industry contributions, international grants, philanthropic capital and CSR funds. Facilitate R&D partnerships and joint ventures between companies domestically and across borders working on the same technology solutions.	MoF	Short to long term

Regulation, Market	Beyond Banking	**Deeper and broader bond market** The government should collaborate closely with the Reserve Bank of India (RBI) and the Securities and Exchange Board of India (SEBI) to strengthen the domestic bond market. Industry stakeholders, including financial institutions, regulators, and project developers, should collaborate to develop benchmarking and risk assessment tools for investors, fostering bond market growth. Utilising international markets like the London Stock Exchange can provide models for development. **Securitisation** Revitalising securitisation would also enable financial institutions to remove assets from their balance sheets, freeing up capital for further lending. Pooling loans or debts to fund challenging-to-decarbonise technologies is essential.	RBI, SEBI, IRDAI, PFRDA, IFSCA, Financial Sector	Short to medium term
Regulation	Domestic Currency Hedging Market	Implement measures to deepen the domestic currency hedging market to reduce hedging costs. Considering the long gestation period and back-ended pay-outs of green projects, this is a crucial prerequisite for increasing foreign green investments.	RBI	Short to medium term
Policy	Effective Implementation of Carbon Credit Trading Scheme (CCTS)	The Indian Carbon Market is underway, providing a regulated domestic platform for carbon credit trading. This market is crucial for transparent price discovery and efficient trading of carbon credits among designated industrial units. To ensure effective implementation, a robust system for tracking, monitoring, and evaluating GHG emissions should be established, based on science-based targets. The system must ensure long-term visibility of incremental emissions caps, as they align with sectoral and national targets. Increase engagement with international Offset mechanisms and voluntary carbon markets.	MoEFCC, MoP	Short to long Term
Regulation	Domestic Institutional investments	Relax investment regulations for pension funds, insurance funds, and the Employees' Provident Fund Organization (EPFO) to encourage participation in transition and green sectors.	PFRDA, IRDAI	Short to medium term

Regulation	Micro-finance Programs	Support microfinance programs and impact investments particularly crucial for sustainable agriculture, and carbon financing schemes through regulatory measures to enhance their effectiveness in greening Indian agriculture.	Multiple	Short to medium term
Market, Policy and Regulation	Innovation in Financial Instruments	**Blended Finance** Blended finance structures are highly effective. These can include guarantees, first-loss tranches or investments in subordinated tranches at concessional pricing provided by development finance institutions or foundations or government and support adoption of new product offerings. This will attract investors with varying risk profiles. **Crowdfunding and Peer-to-Peer Lending** Democratise access to finance by allowing smaller investors to support decarbonisation projects. Crowdfunding and peer-to-peer lending is particularly beneficial for innovative start-ups and early-stage technologies. **Performance-based contracts** Reward emission reductions with performance-based contracts, aligning investor and developer interests. **Contract for Difference/ Carbon Contract For Difference** A project-based Contract for Difference (CfD) financially offsets the incremental production costs of low-carbon technology compared to conventional methods, established through a bilateral agreement with a government or its entity. **Green Insurance** Innovative insurance products to mitigate risks for investors in decarbonisation projects. Cover potential cost overruns, technology failures, and carbon capture leakage.	Multiple/ cross-sectoral	Across timelines

Policy and Regulation	Increasing mobilisation of International capital	**External Commercial Borrowings (ECB)** Relax ECB regulations to facilitate greater investment. Current regulations are stringent and lead to maturity mismatch. **Role of IFSCA** IFSC can play a pivotal role in increasing mobilisation of international capital to India. IFSCA, as the regulator, is already taking steps to create regulations and guidelines to increase transition, and sustainable finance flows through IFSCs.	MoF, IFSCA, RBI	Short to medium term

Foundational Recommendations

Capacity building, Diversity, Equity, and Inclusion (DEI) considerations, and greater coherence between stakeholders including government, industry, regulators and academia will form the base for the above pillars.

1. Capacity Building and Awareness

Effective capacity building is critical for both the financial and real sectors to meet climate goals. This includes organising workshops, seminars, and training programs tailored to specific needs:

a) Financial Sector: Capacity building should focus on climate finance, green finance, climate-related financial risks, Environmental, Social, and Governance (ESG) criteria, and other relevant topics. Financial institutions need to develop the skills and knowledge required to assess and manage the risks and opportunities associated with green and transition projects, activities, processes, and finance.

b) Real Sector, Especially MSMEs: For the real sector, particularly MSMEs, capacity building should emphasise technology adoption, regulatory compliance, disclosures, accounting principles, and risk evaluation. Enhancing the capacity of MSMEs is vital for integrating them into the broader decarbonisation efforts and ensuring their competitiveness in a low-carbon economy.

2. Diversity, Equity, and Inclusion: Climate change and decarbonisation efforts will impact different segments of society in various ways. It is crucial to integrate diversity, equity and inclusion considerations into the design of climate and energy transition pathways and strategies to ensure solutions in the short run do not become problems in the long run.

a) Inclusive Policy Design: Ensuring that policies and interventions consider the needs and vulnerabilities of all segments of society, particularly marginalised and vulnerable groups.

b) Equitable Access to Resources: Providing equitable access to financial resources, technology, and capacity-building opportunities to all stakeholders, including women, indigenous communities, and low-income groups.

c) Long-Term Sustainability: Designing solutions that are sustainable in the long run, preventing short-term benefits from leading to long-term challenges. This approach helps in building resilient communities and economies that can withstand the impacts of climate change and adapting to an evolving transition landscape.

3. Prime Minister's Net Zero Council (PMNZC): Given the complexity of decarbonisation involving multiple ministries and energy sources, establishing the Prime Minister's Net Zero Council (PMNZC) is crucial. Modelled after the Prime Minister's Economic Advisory Council (PMEAC), the PMNZC should be housed in the Prime Minister's Office (PMO) and include representatives from ministries like Power, Finance, New and Renewable Energy, Environment, Skill Development, External Affairs, Commerce, and Heavy Industries, as well as private sector bodies, multilateral institutions, and civil society. The Council will coordinate inter-ministerial efforts, maintain and track emissions related data, manage diverse energy sources, oversee financial mechanisms and pipeline infrastructure, drive skilling and workforce development, facilitate public communication, and ensure robust policy and regulatory frameworks to effectively guide India's transition to net zero. This approach will ensure that all the relevant actors operate in a coordinated and integrated manner, rather than in isolation. The medium- to long-term objective of the council should be to enact legislation in order to ensure the continuity of decarbonisation efforts, thereby legitimising the net-zero target and providing a robust foundation for its implementation.

India's journey to achieve Net Zero by 2070 is long and multifaceted, requiring numerous strategic pivots over the coming decades. In just the past two years, there have been significant policy, regulatory, and market-driven developments, such as SEBI's Business Responsibility and Sustainability Reporting (BRSR), the government's push for Green Hydrogen, and the rise in issuances of green bonds. Despite these advancements, much work remains. India has already taken a leading role in driving crucial climate action and energy transition narratives, particularly during its G20 presidency in 2023. This volume synthesises insights from industry leaders in both the real and financial sectors, combined with our analysis, to identify solutions supporting India's Net Zero journey. A key takeaway is the critical need for cooperation at all levels and among various stakeholder groups. Although India has historically contributed little to the global climate crisis, it is uniquely positioned to lead the way in achieving sustainable development.

Looking ahead, India must continue to foster collaboration across sectors and leverage its position to drive global climate action. By aligning policy measures, regulatory frameworks, and market mechanisms, India can accelerate the transition to a low-carbon economy. This includes enhancing the role of financial institutions, promoting innovative technologies, and scaling sustainable business practices across industries. Additionally, addressing social inclusivity and ensuring a just transition for all communities will be vital. Through concerted efforts and strategic initiatives, India can pave the way for a sustainable future and set a benchmark for other nations to emulate.

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Endnotes

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