

Financial and Policy Catalysts for Climate Tech Expansion in India: Insights from the ‘Green Innovation and Investment Dialogue’

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Introduction

India is at a pivotal moment in addressing climate change, even as it confronts the severe impacts of global warming. Projections suggest that, by 2040, severe floods could affect an additional 13-34 million people,¹ with approximately 18 million individuals at risk of annual flooding due to rising sea levels.² As weather anomalies intensify, the likelihood of more frequent droughts and increased precipitation during heavy rainfall also increases. With temperatures projected to rise by 1.1-1.4°C by the end of the century, annual heatwaves are expected to affect 200 million people, causing productivity losses equivalent to 34 million jobs.³ According to the National Bureau of Economic Research (NBER), every 1°C rise in global temperature corresponds to a 12-percent reduction in global Gross Domestic Product (GDP).⁴ With scientists warning of a potential 3°C temperature rise by 2100 due to continued fossil fuel use, the NBER forecasts catastrophic economic losses, including a decline of more than 50 percent in output, capital, and consumption by the end of the century.⁵

India's climate crisis affects nearly 200 million people annually,⁶ with cascading impacts on food security, the economy, and social stability. Addressing this challenge beyond immediate threats like floods and heatwaves demands innovative solutions such as climate-resilient urban planning, adaptive agriculture, and transformative financing mechanisms. Achieving the Paris Agreement's 1.5°C target requires a structural overhaul of economies and energy systems, particularly in rapidly developing nations like India. This transformation must go

Attribution: Gopalika Arora and Shradha Pujar, *Financial and Policy Catalysts for Climate Tech Expansion in India: Insights from the 'Green Innovation and Investment Dialogue'*, December 2024, Observer Research Foundation.

beyond replacing fossil fuels with renewable sources to adopt a holistic approach to resource management across energy, water, and land. Technological innovation is crucial to accelerating India's energy transition and decarbonisation, fostering new business models, and scaling clean technologies for a resilient and sustainable future.

The climate tech sector in India has shown remarkable progress, reflecting a strong commitment to integrate economic growth with environmental sustainability. In the past decade, over 2,600 climate tech start-ups were registered in India, with around 800 currently active at the time of writing.⁷ However, only 25 percent (roughly 220 companies) have been able to secure funding, collectively raising approximately US\$3.6 billion.⁸ Over two-thirds of the funded climate tech start-ups (some 150 companies) have only managed to obtain seed funding, with only 2.5 percent (i.e., 20 companies) advancing to raise growth-stage capital, predominantly in electric mobility.⁹

In 2021, the climate tech sector witnessed a boost globally, with funding increasing more than fourfold compared to the previous year. Total investments reached an estimated US\$20 billion in 2021 and grew to US\$22.5 billion in 2022.¹⁰ However, this momentum faced a setback in 2023, with venture capital and private equity investments in climate tech declining by 40 percent.¹¹

The ecosystem is still in its early stages and faces considerable funding gaps and a mismatch between investor expectations and the capital needs of climate tech ventures. Bridging these gaps requires enhanced collaboration between investors, founders, and policymakers to identify regulatory and policy barriers that hinder green capital flow, fostering a more conducive environment for scaling sustainable innovations in India.

In this context, Observer Research Foundation and Theia Ventures hosted a day-long 'Green Innovation and Investment Dialogue' in September 2024, bringing together a diverse group of stakeholders to exchange insights, strategies, and best practices for the development, adoption, and dissemination of new and proven technologies aimed at enhancing climate resilience. In the context of the climate crisis, the dialogue was an imperative step towards transforming challenges into leadership and turning innovative ideas into actionable solutions.

This report builds on the themes that emerged during the dialogue, focusing on critical climate-tech needs in sectors such as agriculture, water management, disaster preparedness, and the circular economy. These sectors play a crucial role in driving a just energy transition, extending energy access to remote areas, fostering development, and improving livelihoods.

The Big Old Money Problem

India's climate ambitions include aiming to meet its Nationally Determined Contributions (NDCs) under the Paris Agreement by 2030. Substantial financial investments are required to achieve these goals. Meeting India's 2030 renewable energy targets needs an annual investment of US\$385 billion. This need will grow to reach an estimated US\$7.2–12.1 trillion by 2050 to meet net-zero targets.¹² Mobilising both domestic and international funding is critical to closing this gap. The Reserve Bank of India has emphasised that green finance should account for at least 2.5 percent of the country's annual GDP until 2030 to achieve these targets.¹³ Current funding for climate action in India stands at a comparatively low US\$44 billion per year.¹⁴ This funding gap underscores the lack of adequate capital, potentially impeding India's climate commitments and sustainable development goals.

In response, the Union Budget 2024-25 emphasises the need for a framework to streamline and boost the flow of capital¹⁵ for climate initiatives. Most current climate finance from private and public sources is limited to specific sectors such as renewable energy and electric mobility, catering mainly to last-stage climate-tech companies.¹⁶ There is a significant gap in accessible climate financing options for early-stage climate-tech start-ups looking to scale their solutions and drive substantial growth. Public finance alone is unlikely to meet India's mitigation and adaptation targets, underscoring the critical role of private capital in driving climate projects. Recent studies have revealed a global private-funding gap of US\$2 trillion for climate tech,¹⁷

highlighting the need for substantial financial resources to fuel the next wave of climate technologies and address the growing decarbonisation demands in the face of the climate crisis.

Establishing a Robust De-Risking Framework to Unlock Private-Sector Financing

Unclear regulatory frameworks and a lack of support for innovative financial solutions hinder investment inflows in the climate tech ecosystem. However, the challenge extends beyond traditional investment barriers. Large customers such as hospitals, Fast Moving Consumer Goods (FMCG) companies, and manufacturers are hesitant to adopt climate solutions due to the perceived cost premiums and operational uncertainties. To address this, there is a need for a comprehensive ecosystem approach that develops a robust evaluation framework by assessing technical feasibility, financial viability, scalability, and environmental impact and explicitly valuing manufacturing capabilities, hard assets, Research and Development (R&D) potential, and technological innovation capacity. The companies in the energy space should be valued for Intellectual Property (IP) created at the hardware level to help scale electric mobility charging infrastructure. This strategy can also be used to create targeted government subsidy mechanisms to offset the “green premium” for Business to Business (B2B) customers. It further provides transparent risk-assessment tools that enable large enterprises to understand the long-term economic and environmental benefits of climate solutions.

By designing strategic financial de-risking interventions, including government-backed adoption incentives and standardised impact measurement, it is possible to transform institutional perceptions. The goal is to demonstrate that climate solutions are not just environmentally responsible but economically compelling investments with measurable returns. This approach aims to reduce upfront adoption costs for large customers, provide clear and quantifiable impact metrics, build investor confidence through comprehensive risk assessment, and create a supportive policy environment for climate-tech innovation.

Facilitating Access to Affordable Venture Debt

Affordable venture debt offers a strategic opportunity to catalyse the growth of climate-tech companies, especially in capital-intensive sectors like renewable energy, electric mobility, and battery recycling. By providing non-dilutive financing, venture debt empowers start-ups to scale rapidly while preserving equity for future rounds, thereby aligning long-term sustainability with financial resilience. This funding model not only helps companies bridge critical growth phases but also de-risks investments, making it more attractive for institutional investors to engage in climate tech. To truly unlock its potential, the imperative is to streamline access to affordable venture debt, ensuring that early-stage climate innovators have the financial tools they need to tackle scaling challenges.

Building a Strong Grant Capital Infrastructure for Climate Innovation

Grant capital infrastructure is a critical piece of the puzzle. While India has witnessed a rise in venture capital and private equity funding for climate tech, many early-stage climate innovators lack access to non-dilutive grant capital, which is essential for R&D, initial proof of concept, and supply-chain development. For example, companies in the waste-to-value sector from crop residue lack infrastructure for the removal of contamination from the waste. While there are solutions for developing this infrastructure, the lack of grant capital available to fund these solutions creates a challenge for entrepreneurs to source this waste from India. Building a robust grant capital infrastructure would provide much-needed support for climate projects in the nascent stages, helping to de-risk technologies before they are ready for private investment. More grants targeting innovative climate technologies would allow leaders to focus on long-term sustainability without the immediate pressure of financial returns.

Reducing Risks with Blended Finance Mechanisms

Many investors often seek quick returns, typically within a few years, creating a disconnect with the extended timelines required for climate-tech ventures to mature. Climate-tech companies, especially those in sectors like renewable energy, require longer gestation periods due to their capital-intensive nature and the time required to prove scalability and commercial viability. This mismatch is exacerbated by a lack of investor understanding of the high upfront costs and long-term horizons of early-stage climate innovations. Consequently, some investors exit too early, stifling the growth and scaling potential of sustainable solutions.

Blended finance emerges as a promising strategy to bridge this financing gap by leveraging both public and private capital, effectively de-risking investments, and unlocking essential funding for climate tech. However, for blended finance to thrive, key reforms are required, such as streamlining tax policies and establishing clear frameworks for green finance. The success of blended finance models in other emerging markets, such as Kenya's Renewable Energy Fund, which combines donor contributions with private investment to support solar projects, highlights the potential of blended finance as a tool for catalysing climate innovation and scaling impactful solutions.

Highlighting the Role of Development Financial Institutions and Banks

Development Financial Institutions (DFIs) and banks are well positioned to support climate tech investments and can play a critical role in de-risking investments through co-financing arrangements and partial credit guarantees. These institutions can provide the long-term, low-interest capital needed for large-scale climate projects, with their involvement providing private investors greater confidence in the stability and viability of these projects. An obstacle for climate tech start-ups is the lack of “bankable” projects—i.e., those structured to offer reliable

risk-adjusted return to attract commercial capital. For example, companies in carbon-dioxide removal require huge inventory for the development of carbon-negative products.

The availability of private credit funding from DFIs or development banks to fund the inventory of start-ups at a lower interest rate will help start-ups use equity funding in R&D projects and remove the burden of working capital management to gain initial traction in their business. These resources can help project developers and entrepreneurs build capacity, structure projects, and secure the necessary financing, thus creating a pipeline of viable projects, unlocking more significant investment opportunities for private capital, and accelerating the deployment of climate technologies.

Enabling a Supportive Public Sector

Effectively overcoming the barriers to climate-tech investments requires a deep understanding of the specific risks, capacity limitations, and financial gaps that hinder the flow of capital into this sector. Public finance institutions play a crucial role in addressing these challenges by offering targeted support and sharing associated risks. Governments can provide critical funding for the research, development, and demonstration (RD&D) of new technologies, taking on high-risk aspects that the private sector might shy away from. Additionally, they can support the early commercialisation phase by offering financial incentives and reducing investment risks. Establishing a comprehensive climate technology innovation framework, integrating climate-tech considerations into broader economic planning, and providing necessary price-support mechanisms are essential steps. These efforts can help create a robust ecosystem that accelerates the transition to sustainable, low-carbon solutions.

A Robust Infrastructure to Support Innovation in Manufacturing

India's small and medium enterprises (SMEs) are a cornerstone of the nation's industrial base, accounting for 45 percent of the country's manufacturing output and 40 percent of total exports.¹⁸ However, their ability to scale and compete globally is constrained by outdated infrastructure and limited access to advanced and innovative technologies. More than 70 percent of SMEs rely on manual processes, limiting productivity and hindering the adoption of Industry 4.0 technologies such as automation, artificial intelligence (AI), and predictive analytics, which are critical tools for enhancing efficiency, lowering operational costs, and advancing decarbonisation efforts.¹⁹

Despite notable investments in the sector, challenges such as limited access to affordable capital, inadequate infrastructure, and a lack of technical expertise continue to impede progress. The slow pace of policy implementation and insufficient awareness about the benefits of digital transformation and sustainable practices exacerbate these barriers. Driving digital transformation in this segment has the potential to boost productivity by 20-30 percent.²⁰

One of the most pressing issues faced by SMEs is the lack of access to affordable capital. The International Finance Corporation (IFC) estimates that the financing gap for Indian SMEs is approximately US\$230 billion.²¹ This shortfall limits their capacity to invest in modernising equipment, adopting digital solutions, or engaging in critical R&D. Targeted financial interventions, such as preferential lending schemes and grants for technology adoption, could

play a transformative role in bridging this gap. Moreover, enhancing access to R&D resources is crucial, particularly since only 5 percent of Indian SMEs currently invest in R&D compared to the global average. India's overall R&D expenditure is just 0.7 percent of GDP²²—well below global leaders such as South Korea (4.8 percent) and Germany (3.1 percent).²³ Therefore, there is an urgent need for policy initiatives to incentivise investment in innovation by both the public and private sector.

Additionally, the lack of robust IP protection and enforcement mechanisms hampers innovation and technology transfer within the manufacturing sector. India ranked 40th out of 53 countries in the International IP Index 2021,²⁴ which deters global companies from introducing cutting-edge technologies and advanced manufacturing processes into the country.²⁵ This further limits technological advancements and restricts India's ability to ascend the global value chain in advanced manufacturing. Strengthening IP laws and their enforcement should be prioritised to create a conducive environment for innovation and technology transfer.

High logistics costs further compound the sector's challenges. India spends 13-14 percent of its GDP on logistics, where the global average is 8-9 percent.²⁶ This discrepancy arises from inefficiencies across transportation networks, port delays, and inadequate supply-chain infrastructure, which increase production costs and erode competitiveness in international markets. For example, the cost of transporting goods domestically can be up to 50 percent higher than in developed economies like the United States. Reducing logistics costs even marginally—by even 1 percent—could generate savings of up to US\$5 billion annually, benefiting manufacturers across the board and improving margins.²⁷

To address these structural constraints and develop infrastructure for the manufacturing sector, mechanisms such as a multifaceted policy framework, collaboration between industry and academia, and industry-specific skill-development centres are required. Other programmes such as public-private partnerships and targeted incentives like tax breaks or subsidies for investments in automation, AI, and other Industry 4.0 technologies would accelerate the

adoption of digital solutions, allowing advanced manufacturing practices to play a pivotal role in the development of infrastructure to support innovation and the adoption of advanced technologies in the manufacturing sector.

Policy reforms such as a unified lending interface, similar to digital platforms used in other sectors, could enhance transparency and ease of access to finance. Simplifying regulations will create a more conducive environment for foreign direct investment (FDI) and position India's manufacturing sector as a global hub for industrial innovation.

By adopting these policy interventions, India can not only modernise its manufacturing base but also unlock substantial productivity gains, enhance global competitiveness, and drive long-term economic growth.

The Urgent Need for Climate Leaders and Changemakers

India's transition to a greener economy presents a unique set of challenges that require visionary leadership. However, there is a shortage of climate leaders capable of navigating the complex intersections of policy, technology, and finance. It is not enough to rely solely on government initiatives or global pledges; India needs leaders who can integrate climate solutions into scalable, sustainable business models that address both local and global needs.

Developing climate leaders must address specific systemic deficiencies. For instance, the policy landscape around climate regulations and green finance remains fragmented, making it difficult for innovators to secure consistent support. Leaders who can advocate for streamlined policy frameworks are essential in shaping the regulatory environment to attract more investment into climate technologies.

Moreover, India's entrepreneurial ecosystem for climate solutions, although expanding, is still nascent. There is a clear need for leadership that can bridge the gap between innovation and commercialisation. Green entrepreneurs focusing on technologies like energy efficiency, electric mobility, waste-to-value systems, and climate biotechnology must lead initiatives that are not just technologically viable but also economically sustainable. Globally, examples like Elon Musk's leadership in electric mobility and Pat Brown's work with Impossible Foods illustrate how effective climate leaders can drive market transformation.

India can look to these models while simultaneously addressing talent gaps and creating opportunities for young people to enter the climate space, leveraging the country's demographic dividend. Initiatives aimed at fostering talent and entrepreneurial spirit among the youth can be crucial in shaping the next generation of climate leaders.

The role of financial experts becomes crucial as they can help secure necessary finance through innovative mechanisms like blended finance, aligning public, and private investment to reduce the risks associated with climate projects. Leaders in finance must be adept at structuring novel financial mechanisms, such as green bonds and impact investment funds, that make climate ventures more appealing to mainstream investors.

Education and leadership training are integral to this process. Climate leadership training programmes such as the Climate Leadership Corps by the Climate Reality Project or the Change Leadership for Sustainability initiative by the Stanford Doerr School of Sustainability offer models for how leadership can be cultivated through tailored programs. These programmes must be tailored to equip the new generation with both technical knowledge and strategic management skills. Platforms for cross-sectoral collaboration will help foster the exchange of best practices, enabling a unified effort across various industries. Additionally, leaders must be trained to leverage data-driven decision-making and advanced technologies like digital twins to forecast climate risks and develop scalable mitigation strategies.

Ultimately, the path to building climate leaders in India is not just about filling roles but about cultivating multidisciplinary leadership capable of managing the intricacies of climate action. Without this, India risks lagging in its green transition, missing out on both the environmental and economic benefits of leading in global climate solutions.

Importance of Multilevel Collaboration among Stakeholders

Addressing the challenges of climate change requires a collective approach that involves stakeholders across multiple levels, including governments, private investors, international organisations, and local communities. India's transition to a sustainable economy cannot be achieved without strong networks of collaboration that align goals and pool resources. These collaborative efforts are essential to bridge gaps in financing, scale innovations, and ensure that climate action reaches the communities most in need. For example, ArcelorMittal's recent partnership with IIT Madras marks a promising step towards reducing carbon emissions in the steel industry. By combining the technical expertise of the academic institution with the industrial experience of a global steel producer, this collaboration aims to drive innovative solutions for decarbonisation.

Another key aspect of multilevel collaboration is the alignment between national policies and international capital flows. India has faced challenges in attracting international capital for climate tech initiatives, partly due to policy gaps and regulatory uncertainties. Simplifying regulatory frameworks and creating incentives for foreign investors would be crucial role from directing much-needed funding to Indian climate projects. Coalitions like the International Solar Alliance (ISA) serve as examples of successful international collaboration; by uniting over 120 countries, the ISA has accelerated the deployment of solar energy projects globally.

Collaboration is equally important at the grassroots level, where local innovators, MSMEs, and community-based organisations require support to materialise their ideas. MSME start-ups in India are often too small to drive change on their own, yet they play a vital role in developing localised solutions for climate adaptation. While these solutions have the potential to solve climate-change issues, the lack of the right policies create a challenge for adoption. This necessitates a consortium of MSMEs and start-ups that can provide policy advocacy to government organisations. Additionally, partnering these start-ups with larger industries and associations can help them access technical expertise, market insights, and distribution networks. This kind of support is crucial for translating local innovations into scalable solutions.

Platforms for data exchange and knowledge-sharing are also critical for effective collaboration. Tools like Climate Action 100+²⁸ and knowledge-exchange platforms like Climate-KIC²⁹ offer valuable models for how stakeholders can collaborate to share best practices and insights. Such platforms can enable Indian climate tech innovators to learn from global experiences, adopt successful practices, and refine their own solutions to local challenges.

Effective multi-level collaboration is about creating a cohesive ecosystem where diverse actors work together towards achieving common climate goals. By aligning policies, facilitating investment flows, and fostering knowledge-sharing, India can unlock the full potential of its climate-tech ecosystem.

Financing Technologies for Adaptation


Despite rapid advancements in India's climate-tech start-up ecosystem, there is a noticeable imbalance in funding allocation, with a stronger focus on climate mitigation technologies and much less capital directed towards adaptation sectors. According to the *State of Climate Finance in India* report, the country requires an estimated US\$300 billion for sustainable food systems by 2030, US\$200 billion for water and solid waste management, and US\$60 billion for demand-side energy efficiency.³⁰ This capital need highlights the untapped investment potential within the adaptation sector, suggesting that investors need to broaden their focus to include these critical areas.

Currently, most adaptation technologies in India are funded by the public sector, often at the local level or linked to infrastructure projects. The diversity of adaptation technologies, spanning multiple sectors and regions, complicates financing efforts, as it becomes difficult to standardise and monetise their benefits. This complexity can further deter investment, as the business case for adaptation technologies is less straightforward than for mitigation projects.

Alternative financial models could be leveraged to address this funding gap. For example, microfinance may provide a viable financing solution for adaptation technologies that yield immediate development impacts. In agriculture, established financial tools, such as crop insurance and the securitisation of distributed renewable assets, could extend beyond conventional venture equity to support climate-resilience initiatives. Streamlining access to government grants would also help early-stage start-ups find essential resources more easily.

Conclusion

India's climate transition presents both a tremendous opportunity and a daunting challenge. The complexity of integrating sustainable practices across multiple sectors, from energy to manufacturing, requires the collective efforts of visionary leaders, robust financial frameworks, and collaborative partnerships. By addressing key barriers such as inadequate infrastructure, a lack of skilled climate leaders, and insufficient access to funding, India can create a resilient, innovation-driven ecosystem that not only tackles domestic climate challenges but also sets a global example. The implementation of blended finance, regulatory reforms, and capacity-building initiatives will be pivotal in attracting private capital and de-risking investments in climate technologies.

Furthermore, empowering entrepreneurs, innovators, and policy advocates will enable India to foster sustainable solutions that drive economic and environmental progress. The road ahead demands collective action. With visionary leadership and robust investments, India can overcome its climate challenges and set a global standard on climate tech. 

Appendix

Participants

Green Innovation and Investment Dialogue

September 2024

1. Adrian Schmidt, Co-Founder, Sarla Aviation
2. Anirudh Gupta, Co-Founder, Climes
3. Arjun Gupta, Co-Founder, Smart Joules
4. Arpit Dhupar, Founder, Dharaksha
5. Arun Vinayak, Co-Founder & CEO, Exponent Energy
6. Arya Kumar, Professor and Dean, BITS Pilani
7. Ashwini Swain, Fellow, Sustainable Futures Collaborative
8. Debajit Palit, Professor-Energy, NTPC Business School
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10. Gauraang Biyani, Chief of Staff, Varaha
11. Gopalika Arora, Associate Fellow, Observer Research Foundation
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13. Himanshu Sharma, Associate Vice President, Theia Ventures
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15. Mahi Singh, Founder, Cancric
16. Mannat Jaspal, Associate Fellow, Observer Research Foundation
17. Mansi Jain, Founder, Digital Paani

18. Megha Nath, Program Manager - Energy and Environment, Institute for Sustainable Communities
19. Mihir Sharma, Director, Centre for Economy and Growth, Observer Research Foundation
20. Neha Jain, Founder, ZeroCircle
21. Piyush Agarwal, Investment Analyst Fellow, Theia Ventures
22. Prarthana Bohra, Vice President, Sustainability, Momentum India
23. Priya Shah, General Partner, Theia Ventures
24. Rahul Mishra, Co-Founder, Probus Smart Things
25. Rajat Gupta, Director, McKinsey
26. Rajat Singh, Co-founder, Earth Sync
27. Ritu Lal, Client Partner, Infrastructure & Energy Practice, Amrop India
28. Saarthak Khurana, Senior Manager, Climate Policy Initiative
29. Sarang Lakhaneer, Executive Director, Vishwaraj Water
30. Saurabh Marda, Co-Founder & CEO, Freyr Energy Services Ltd
31. Shradha Pujar, Chief of Staff, Theia Ventures
32. Shreyans Kokra, Founder & CEO, Canvaloop Fibre
33. Shubham Vishwakarma, Co-Founder & CEO, Metastable Materials
34. Shuva Raha, Fellow and Lead – International Cooperation, Council on Energy, Environment and Water
35. Sivaram Krishnamoorthy, Deputy Director, SED Fund
36. Sookrit Malik, CEO, Energeia
37. Subhash Chandra, CEO, National Authority (CAMPA), Ministry of Environment, Forest and Climate Change
38. Sukanta Sahoo, Deputy General Manager, National Bank for Agriculture and Rural Development
39. Suranjali Tandon, Assistant Professor, National Institute of Public Finance and Policy
40. Vibhuti Garg, Director, South Asia, Institute for Energy Economics and Financial Analysis

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The authors thank Himanshu Sharma and Piyush Agarwal for their valuable insights, as well as all the participants of the Green Innovation and Investment Dialogue for their contributions and discussions, which greatly enriched the report.

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