

Blended Finance for India's Climate Goals

August 2026

- **To meet its 2030 climate goals, India needs \$500 billion across 20 low-carbon technologies in power, industry, and mobility**—well above today's investment levels.
- **While mobilizing \$500 billion may seem overwhelming, the route begins with securing a far smaller amount—\$10 billion—in catalytic capital**, financing that is patient, risk-tolerant, focused on development, and accepting of lower returns.
- **Our analysis shows that the 'leverage multiple' (total investment mobilized per dollar of catalytic capital) depends on a technology's maturity and the type of financial support provided.** This ranges from 35x for solar (a mature technology which requires credit enhancement guarantees) to 2x for green hydrogen (a nascent technology which requires more equity support). This implies that power and renewables require \$1.5 billion, green hydrogen needs \$5.9 billion, and electric mobility requires \$2.7 billion in catalytic capital through 2030.
- **Overall, we find that each dollar of catalytic capital mobilizes five dollars of 'blended finance'**—which combines catalytic capital with commercial capital (financing at market rates). This capital improves risk-adjusted returns, allowing commercial private investment to participate in climate projects. As a result, \$10 billion in catalytic capital can mobilize \$50 billion in blended finance.
- **In line with global examples, blended finance typically makes up 10% of total financing.** For India, \$10 billion in catalytic capital can yield \$50 billion in total blended finance, in turn paving the way to meet the \$500 billion required for the country's most critical climate-related needs.

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About CEEW: The Council on Energy, Environment and Water (CEEW)—a homegrown institution with headquarters in New Delhi—is among the world's leading climate think tanks. The Council uses data, integrated analysis, and strategic outreach to support public policy, transform markets, shape technology, and nudge behaviour. It addresses pressing regional and global challenges through an integrated and internationally focused approach. The Council prides itself on the independence of its high-quality research and strives to impact sustainable development at scale. The CEEW Green Finance Centre (CEEW-GFC) acts as a non-partisan observer and catalyst that aims to bridge green financing gaps by addressing financing bottlenecks and enhancing the integration of green considerations in financial decision-making. Its approach is multi-pronged: tracking market trends, publishing research and analysis, developing financial solutions, offering technical assistance, and fostering coherence between policymakers, regulators, financial institutions, and industry.

About Tata Sons: Tata Sons is the principal investment holding company and promoter of the Tata Group companies.

Foreword

India has shown the world that economic development and sustainability can advance together. The country ranks third globally in renewable energy capacity, with over 157 GW of installed solar capacity and 57 GW of wind capacity. Since 2010, solar PV costs have fallen by about 90%, while battery storage costs have declined by 93%. In July 2025, non-fossil sources briefly supplied over half of India's power for the first time—a feat repeated in July 2026. These milestones reflect coordinated progress across policy, technology, and finance.

India's developmental path calls for decarbonization while continuing to industrialize, urbanize, and expand prosperity. These twin imperatives place extraordinary demands on our energy systems, industries, and mobility networks—the three sectors responsible for nearly 70% of national greenhouse gas emissions. Meeting India's 2030 climate commitments will require over half a trillion dollars of investment across these sectors alone.

Conventional finance alone will be insufficient. Traditional capital is often reluctant to back technologies and business models with limited operating histories, evolving cost curves, or uncertain demand. As a result, investment flows remain misaligned with the scale and urgency of the transition. India needs capital willing to absorb early risks, remain patient, and accept lower near-term returns in pursuit of much larger long-term economic, social, and environmental gains.

This is where blended finance becomes critical. By combining catalytic capital—patient, development-focused funding that accepts below-market returns and higher risks—with commercial capital, it can attract private investment at scale and accelerate the transition from innovation to adoption. With the right financial architecture, India's climate transition can become a powerful engine of innovation, competitiveness, energy security, and sustainable livelihoods.

N Chandrasekaran

Chairman, Tata Sons

Contents

Preface	I
Acronyms	II
Part I	
Blended Finance for India's Climate Goals	1
The low-carbon financing opportunity: where traditional finance falls short	3
Bridging the risk gap through blended finance	4
Blended finance as India's untapped climate engine	11
Part II	
Quantifying the climate financing opportunity	13
Determining the scale of blended finance required	15
Quantifying what every dollar of catalytic capital unlocks	16
Quantifying the value of catalytic capital needed	21
Unlocking the next wave of climate capital in India	23
Annexures	
Annexure 1: Technology-wise targets till 2030	26
Annexure 2: Cost benchmarks for each technology	27
Annexure 3: Methodology for estimating leverage multiples	28
References	31

Preface

India's climate transition is a stress test for the financial system. Can it evolve fast enough to match the scale and urgency of what lies ahead? Low-carbon technologies are at varying stages of maturity, each with its own pathway to commercial viability—and therefore, its own financing needs. The conventional financial architecture cannot, on its own, respond to all of them. It was not designed for a transition of this complexity.

This report—a joint effort between Tata Sons and CEEW—makes the case for blended finance as the bridge. We analyzed 20 critical decarbonisation technologies across power, industry, and mobility—the three sectors responsible for nearly 70% of India's greenhouse gas emissions. Our estimate: a half-trillion-dollar financing opportunity by 2030. The arithmetic that follows is both sobering and hopeful. We find that blended finance interventions need only address a fraction of this portfolio—10%, or \$50 billion. And to mobilize that \$50 billion, catalytic capital of just \$10 billion could suffice, unlocking the rest in an unsupported manner. But the natural question is as important as the arithmetic: where should this catalytic capital be deployed, and where will it come from?

On deployment, our Financial Readiness Levels offer a way to think about where such capital can be most useful—by identifying whether a technology's binding constraint lies in access to finance, its affordability, or the availability of finance at scale. On sourcing, multilateral and development finance institutions have historically played this role. They will remain indispensable. But a transition of this scale demands a deeper and more effective pool of catalytic capital.

What is needed is an institutional architecture to deploy this catalytic capital with precision. A National Green Finance Institution could play this role: aggregating public, philanthropic, and development capital; designing appropriate blended-finance structures; and building a pipeline of investable low-carbon projects. It could be the connective link between India's climate ambitions and the financial system.

This report is an effort to trigger a conversation and to contribute to the literature at the intersection of blended finance and climate action, particularly in the Indian context. The future is already being written. The question is whether we have the financial imagination to match it.

Arunabha Ghosh

Former CEO, CEEW

Acronyms

ADB	Asian Development Bank
AfDB	African Development Bank
AREF	Africa Renewable Energy Fund
BESS	Battery Energy Storage System
BFCP	Blended Finance for Climate Program
CEA	Central Electricity Authority
CEEW	Council on Energy, Environment and Water
CEEW-GFC	CEEW Green Finance Centre
COP	Conference of the Parties
CPI	Climate Policy Initiative
CSR	Corporate Social Responsibility
DFI	Development Finance Institution
DISCOM	Electricity Distribution Company
E-2w	Electric Two-Wheeler
E-3w	Electric Three-Wheeler
E-4w	Electric Four-Wheeler
ECL	Expected Credit Loss
ESG	Environmental, Social and Governance
EV	Electric Vehicle
FCDO	Foreign, Commonwealth and Development Office (United Kingdom)
FRL	Financial Readiness Level
GC-RSPV	Grid Connected Rooftop Solar Photovoltaic
GCF	Green Climate Fund
GGEF	Green Growth Equity Fund
GHG	Greenhouse Gas
GH2	Green Hydrogen
GIFT IFSC	Gujarat International Finance Tec-City International Financial Services Centre
GUVNL	Gujarat Urja Vikas Nigam Limited
IDB Invest	Inter-American Development Bank Invest
IFC	International Finance Corporation
IFRC	Impact Finance Research Consortium
InvIT	Infrastructure Investment Trust
JETP	Just Energy Transition Partnership

LBNL	Lawrence Berkeley National Laboratory
LCOH	Levelized Cost of Hydrogen
LCOS	Levelized Cost of Storage
MDB	Multilateral Development Bank
MFI	Microfinance Institution
MNRE	Ministry of New and Renewable Energy
MoRTH	Ministry of Road Transport and Highways
NBFC	Non-Banking Financial Company
NGFI	National Green Finance Institution
NGHM	National Green Hydrogen Mission
NITI	National Institution for Transforming India
NPA	Non-Performing Asset
OECD	Organisation for Economic Co-operation and Development
PCG	Partial Credit Guarantee
PSF	Payment Security Fund
PURE	Productive Use of Renewable Energy
RE	Renewable Energy
REIT	Real Estate Investment Trust
RBI	Reserve Bank of India
SDG	Sustainable Development Goal
SEBI	Securities and Exchange Board of India
SECI	Solar Energy Corporation of India
TCCL	Tata Cleantech Capital Limited
VGf	Viability Gap Funding

Blended Finance for India's Climate Goals

Three sectors—power, industry¹, and mobility—account for 70% of India's greenhouse gas (GHG) emissions.

Decarbonizing them will require \$500 billion in climate investments by 2030, but capital flows remain constrained due to persistent barriers. Unlocking this may require just \$10 billion in catalytic capital to de-risk investments and crowd in much larger pools of commercial capital through blended finance solutions.

To achieve its 2030 climate goals, India will need to mobilize \$500 billion in climate-related investments across multiple technologies in its top three emitting sectors—power, industry, and mobility

PART I

India is at a crossroads on its journey to a net-zero future. So far, the country has installed over 283 GW of non-fossil power capacity, nearly 60% of the 500 GW target it has set for 2030. Electric vehicles (EVs) are gaining ground, yet overall market penetration remains at 8.3% in 2025-26²—well short of the 2030 vision of 30%. Sectors like green hydrogen, which could decarbonize hard-to-abate industries, have seen some development in the form of tenders and commitments, but currently have limited commercial viability.

The obstacle lies not in the availability of frontier technologies, which exist, but in their perceived financial attractiveness. Green industries need financing, but are often considered to be high-risk or nascent in terms of techno-economic maturity. As a result, the pace, flow, and cost of capital—especially debt capital—towards these technologies are not adequate to meet demand. To achieve its 2030 climate goals, India will need to mobilize \$500 billion of investments across multiple technologies in its top three emitting sectors—power, industry, and mobility—which account for 70% of India's GHG emissions.

The scale of investment India needs for decarbonization cannot be met by traditional finance alone. It will need a more innovative approach: 'blended finance', which combines capital from different sources, with distinct mandates and expectations. This report, a joint paper between Tata Sons and the Council on Energy, Environment and Water (CEEW), proposes leveraging blended

¹ Hard-to-abate sectors including steel, cement, aluminium, oil refineries, and limestone

² Press Information Bureau, Government of India

Our findings suggest that with a leverage multiple of 5x on an aggregate level, just \$10 billion in catalytic capital could mobilize \$50 billion in blended finance, setting the stage for traditional finance to cover the rest

finance as a solution to accelerate the flow of finance in these sectors at a transformative pace and scale.

This report is the first to quantify how blending capital could help India meet its decarbonization targets. The report investigates three key questions: (1) *How big is the financing opportunity in power, industry, and mobility?*; (2) *How can blended finance address financing challenges in these sectors?*; and (3) *How much catalytic capital would be required for this?*

We arrive at the \$500 billion figure by multiplying the additional capacity needed by 2030 in 20 key low-carbon technologies across power, industry, and mobility with their costs.

We assume that blended finance can cover 10% of the financing needs across each of the 20 technologies, adding up to \$50 billion in total. The 10% assumption draws on conversations with over a dozen sectoral and climate finance experts, as well as major country-level examples where blended finance accounted for 7-12% of total investment. By supporting early projects and demonstrating commercial viability, blended finance can help reduce risks, lower financing costs, and build confidence among commercial investors. In doing so, it can crowd in commercial capital to finance the remaining \$450 billion required to support India's climate transition.

Mobilizing this \$50 billion in blended finance will, in turn, require \$10 billion in catalytic capital—financing that is patient, risk-tolerant, focused on development, and accepting of lower returns—giving it a leverage multiple of 5x on an aggregate level. The amount of catalytic capital required is calculated by dividing the blended finance requirements of each of the 20 technologies by their specific leverage multiple.

While international sources will be imperative to meet the large demand for catalytic capital, India should also explore complementary avenues—particularly its growing pool of domestic philanthropic capital—to support climate-focused blended finance.

Clean technology projects face structural challenges such as a lack of cost competitiveness, limited technology performance track records, credit risks, and headroom constraints faced by lenders

Moreover, the smooth flow of different kinds of capital will need an enabling ecosystem that facilitates these transactions. A National Green Finance Institution—proposed by NITI Aayog in a recent paper—could serve as a one-stop platform for aggregating catalytic capital from governments, philanthropies, and development partners, and channelling it through blended finance structures.

The low-carbon financing opportunity: Where traditional finance falls short

In India, nearly 83% of the \$50 billion in annual climate-related capital flows³ comes from traditional domestic sources, compared to approximately 60% for other developing economies. Commercial banks and non-banking financial companies (NBFCs) account for 38% of these flows, government budgetary allocations for 16%, residential, commercial and institutional investors contribute 15%, and public sector undertakings provide 12%. Corporations, development finance institutions (DFIs), and private equity firms account for the rest⁴. International finance flowing into India's green projects—through dollar-denominated loans, offshore bonds, or equity from institutional investors—faces significant currency depreciation risk. High hedging costs often erode the advantage of low-cost foreign capital, reinforcing the reliance on domestic sources.

Yet, annual climate finance flows pale in comparison to the hundreds of billions of dollars required across power, industry, and mobility. By 2030, India could see a \$500 billion financing opportunity across these three sectors, indicating a more than doubling of annual financial flows. Traditional finance alone cannot meet this steep rise. This stems from structural challenges such as the lack of cost competitiveness of nascent technologies, limited technology performance track records, less-than-satisfactory

³ Includes capital flows to power and renewables, hydropower projects, biofuels, EVs, mass rapid transit systems, dedicated freight corridors, energy efficient appliances, transmission and distribution, and green energy corridors

⁴ Climate Policy Initiative, Landscape of Green Finance in India 2024

Financial Readiness Levels (FRLs) capture how easily a technology can secure financing. Higher FRLs indicate stronger lender confidence and a lower need for financial support

creditworthiness of borrowers or off-takers, and headroom constraints faced by lenders. Consequently, low-carbon technologies face financing challenges that broadly fall into one or more of these three categories:

- **Access**, where finance—debt finance in particular—is rarely flowing or not flowing at all—for instance, in green hydrogen.
- **Affordability**, where finance is flowing but the terms may be prohibitively uncompetitive—for instance, in EVs and battery energy storage systems (BESS).
- **Abundance**, where finance is flowing at pace and at competitive terms, but sources may face scale constraints—for instance, in utility-scale renewable energy.

Based on these three buckets, we suggest a measure—Financial Readiness Levels (FRLs)—which captures how easily a technology can secure financing, particularly debt. A higher FRL signals a greater willingness of lenders to extend finance and reduced need for financial support. On the other hand, a lower FRL reflects limited willingness to lend and, therefore, greater need for financial support. For instance, proven technologies like grid-scale solar (FRL 3) already have a track record, necessitating minimal intervention for individual transactions, whereas emerging technologies like green hydrogen (FRL 1) need early-stage support to establish proof of concept.

This is why India needs new types of capital—capital willing to take on risk, stay patient, and accept lower returns initially to unlock larger rewards in the future.

Bridging the risk gap through blended finance

This is where ‘blended finance’ comes in. While different definitions exist, according to the Organisation for Economic Co-operation and Development (OECD), blended finance is the strategic use of development finance for the mobilization of additional finance

Blended finance's effectiveness is measured in terms of the 'leverage multiple'—the ratio of total blended finance mobilized per unit of catalytic capital deployed

towards sustainable development in developing countries⁵. At its core, blended finance brings together capital from distinct sources and with distinct mandates and expectations. For instance, it leverages catalytic development finance from philanthropies, governments, and DFIs to absorb risk, offer low-interest loans, improve returns, or cover early-stage costs. This improves investment appeal for commercial investors, channelling private capital into sectors that are critical for low-carbon transition but often perceived as too risky or unproven.

Different sources of finance often have varying priorities. Development finance, in particular, is inherently catalytic, and its impact can take shape in five dimensions (the 5Ps)⁶:

- **Price:** accepting returns below market rates;
- **Purpose:** supporting investments with non-traditional mandates;
- **Position:** taking a subordinate role in the capital structure to provide credit enhancement;
- **Patience:** allowing for longer and sometimes uncertain timelines before exit; and
- **Pledge:** covering potential losses in the event of default to strengthen credit.

The key measure of a blended finance transaction's effectiveness is the 'leverage multiple'. In this report, we define blended finance mobilized as the sum of two components: the value of catalytic capital deployed and the commercial capital it attracts. The leverage multiple is then calculated as the ratio of total blended finance mobilized to the value of catalytic capital deployed.

Typically, the catalytic capital used for blended finance can take the following forms:

⁵ OECD DAC Blended Finance Guidance 2025

⁶ Impact Finance Research Consortium (IFRC), a collaboration among the Wharton School, Harvard Business School, and the University of Chicago Booth School of Business

Grants (sometimes accompanied by technical assistance),

typically funded by governments or philanthropies, which usually take on the risk of funding feasibility studies or pilot projects with no expectation of a return. For instance, the Zero Gap Fund⁷, a philanthropic climate investment fund, leveraged \$30 million in grants from the Rockefeller and MacArthur Foundations to mobilize over \$1 billion in commercial capital.

Similarly, the Asian Development Bank (ADB)'s Climate Innovation and Development Fund⁸, seeded with \$25 million in grants from Goldman Sachs Gives and Bloomberg Philanthropies, has catalyzed over \$500 million in commercial and government investments—a 20x leverage multiple.

Concessional debt, priced below market terms, can help lower financing costs and improve viability. For instance, the World Bank's Grid Connected Rooftop Solar Photovoltaic (GC-RSPV) program⁹ has provided \$515 million in concessional debt to developers and consumers. The program provided loans at rates of 8% to 8.5%, with tenors of up to 15 years, which improved projects' net returns by 4-8 percentage points (pp).

Concessional equity entails capped returns for the development financiers, thereby improving returns and investment attractiveness for commercial investors. For instance, the Global Environment Facility (GEF)¹⁰ provided \$4.5 million to the Africa Renewable Energy Fund (AREF) (managed by the African Development Bank (AfDB)) with returns capped at 4%, enabling 2-3% higher returns for commercial investors.

Patient capital accepts lower or delayed returns over a horizon of 10–15 years, giving emerging technologies time to mature. The

⁷ Rockefeller Foundation, Zero Gap Fund—State of the Portfolio Report 2024

⁸ Goldman Sachs Climate Innovation and Development Fund, World Bank

⁹ JMK Research, Financing Trends in the Commercial and Industrial Renewable Energy Market, World Bank

¹⁰ Global Environment Facility

Between 2019 and 2024, almost 70% of global blended finance flows were targeted at climate-related investments

Ouarzazate solar complex in Morocco¹¹—one of the world’s largest concentrated solar power plants—received \$435 million in patient capital from Climate Investment Funds, which is administered by a consortium of multilateral development banks (MDBs). This helped de-risk its nearly decade-long evaluation and construction timeline and estimated payback period of 14 years, besides unlocking \$2 billion in concessional investments.

Guarantees, specifically first-loss guarantees, provide comfort to lenders by assuring repayment in case of default or delays by the borrower. For instance, the Scaling Solar program in Zambia¹² used guarantees and first-loss capital from the World Bank Group to attract \$100 million in private investment for two solar plants, driving down solar tariffs to 6 cents per kWh—among the lowest in Africa.

Results-based funding and impact bonds, where public or philanthropic capital pays only if predetermined outcomes are achieved, making investing in climate innovation less risky for private investors. The Amazon Fund¹³, for instance, has mobilized over \$1.9 billion since 2008, disbursing funds only when Brazil achieves verified reductions in deforestation. So far, this model has supported over 100 conservation projects.

Globally, blended finance has proven its worth, increasing from 111 transactions worth \$32 billion¹⁴ in 2009 to almost 1,500 transactions worth \$266 billion by 2024¹⁵ across infrastructure, financial services, and energy. During this period, climate-related transactions accounted for over \$158 billion, or about 60%, of total blended finance flows. In recent years, the trend has accelerated. Between 2019 and 2024, almost 70% of total blended finance flows were targeted at climate-related investments¹⁶, with the share crossing an unprecedented 80% in 2023.

¹¹ Climate Investment Funds, African Development Bank

¹² World Bank’s Scaling Solar in Zambia

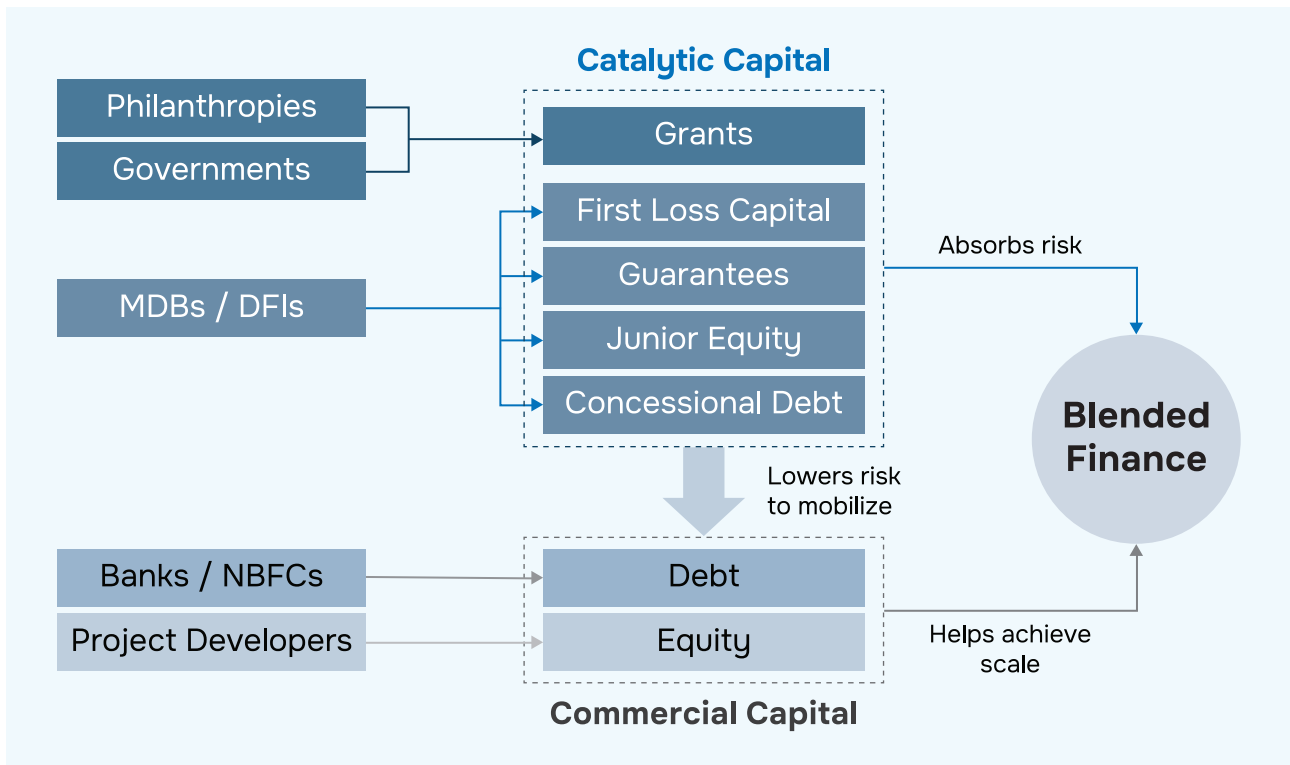
¹³ Climate Funds Update

¹⁴ Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science

¹⁵ Convergence’s State of Blended Finance 2025

¹⁶ Convergence’s State of Blended Finance 2024 and State of Blended Finance 2025

Figure 1: Blended finance combines catalytic and commercial capital to de-risk investment



Source: Coalition for Private Investment in Conservation, CEEW-GFC, Tata Sons Research

Blended finance can be deployed at the project level, sector level, at the national level (through country platforms), or as blended funds (see Box 1).

Among these models, anchor investments in blended funds have proven particularly effective at mobilizing private finance at scale because they provide a cushion against early losses. This risk-sharing structure helps unlock much larger pools of private capital for development and climate-related investments in emerging and underserved markets. This allows limited public resources to create a much greater impact than they could achieve on their own.

Box 1: Different models of blended finance

- **Project-level** blended finance, where governments or MDBs use tailored instruments to address specific financing and commercial challenges faced by individual climate or infrastructure projects. For instance, in Kenya, the \$775 million Lake Turkana Wind Power project¹⁷ received over \$225 million in debt from the European Development Bank and \$38 million in grants from the European Union (EU) and the Dutch government, besides over \$22 million in guarantees from the AfDB, to protect investors—who might have otherwise been hesitant to invest—from political risks and currency fluctuations.
- **Sector-level** approaches offer incentives or guarantees that encourage broader investment in specific sectors, such as solar or sustainable agriculture. In India, the ADB has partnered with Indian banks to offer \$500 million in concessional credit lines for rooftop solar projects¹⁸. These funds, offered below market rates, helped reduce borrowing costs for developers or residential consumers, making rooftop solar projects viable. This facility mobilized an additional \$500 million in commercial investments, enabling the installation of over 1 GW of rooftop solar capacity.
- **Country platforms** bring together governments, donors, and investors to coordinate funding around national climate goals. These platforms help streamline investment pipelines and reduce duplication. For instance, Indonesia's SDG One platform¹⁹ has mobilized \$3.3 billion from 37 partners to support sustainable infrastructure for clean energy, water, and sustainable transportation.
- **Anchor investments in blended funds** are typically provided by governments, philanthropic organizations, and development banks to finance portfolios of projects or platforms that deliver social, environmental, or development outcomes. These investors provide the initial capital and absorb a greater share of the risk, improving the fund's risk-return profile and attracting commercial investors. The Global Energy Alliance for People and Planet²⁰, for example, has awarded \$503 million in catalytic funding, unlocking \$7.9 billion in total investments and powering 137 projects in over 30 countries.

¹⁷ European Investment Bank

¹⁸ Ministry of Finance, Government of India, Asian Development Bank

¹⁹ OECD, Indonesia's SDG One platform

²⁰ Rockefeller Foundation

Greater standardization across project preparation, due diligence processes, impact reporting, risk assessment, and contractual structures can make deals easier to structure, compare, and scale

In Africa and Southeast Asia, blended finance has made investing in renewable energy, agriculture, and sustainable infrastructure attractive. For instance, Mission 300²¹, an ambitious project anchored by the World Bank, aims to connect 300 million people in Sub-Saharan Africa to electricity by 2030 by deploying solar mini-grids, distributed solar, and clean cooking technologies. Backed by \$48 billion in funding from the World Bank and the AfDB, the initiative is expected to unlock \$140 billion in commercial capital between 2024 and 2030, according to the World Bank. Since its launch, the initiative has connected 43 million people in Africa to electricity.

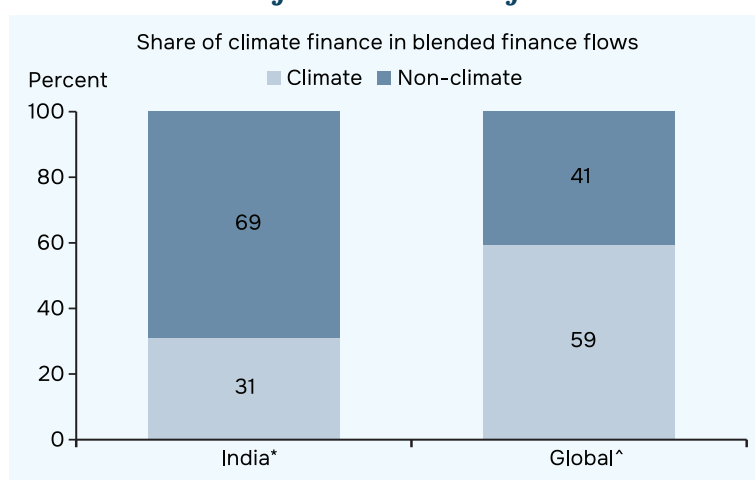
Yet, mobilizing private capital at scale requires more than innovative financing instruments—it requires an enabling ecosystem. A major challenge today is the fragmented nature of blended finance, where projects often rely on bespoke risk assessments, disclosure standards, and guarantee structures. This raises transaction costs and slows investment. Greater standardization across project preparation and documentation, due diligence processes, impact reporting frameworks, risk assessment methodologies, and contractual structures for guarantees and credit-enhancement instruments can make deals easier to structure, compare, and scale. Equally important is policy certainty. Investors are more likely to commit long-term capital when regulations are stable, contracts are enforceable, and governments provide clear and consistent policy signals. Initiatives such as the World Bank Group’s Unified Guarantee Platform seek to address some of these barriers by simplifying and standardizing risk-mitigation tools. But ultimately, finance follows confidence. Without strong institutions, credible regulatory frameworks, and a pipeline of well-prepared projects, blended finance risks remaining a series of isolated successes rather than becoming a transformative source of capital for development and climate action.

²¹ World Bank Group, *Mission 300*

Blended finance as India's untapped climate engine

While the lack of a consolidated definition and robust transaction-tracking mechanisms makes it challenging to objectively assess the scale of blended finance in India, credible evidence suggests that the country's experience with this approach has been largely encouraging. Between 2010 and 2022, India saw \$5.6 billion in blended finance transactions, accounting for 3.4% of the global

Figure 2: India lags global averages in the share of climate-focused blended finance



*Source: The Blended Finance India Narrative (2010 to 2022)

^Source: Convergence's State of Blended Finance 2025 (2009 to 2024)

market²². Of this, only 17%, or less than \$1 billion, was catalytic capital. The market has nonetheless seen an average annual growth of 18.9% during this period—compared to 15.7% globally—with annual flows growing eightfold from \$140 million in 2010 to \$1.12 billion in 2022. These flows were concentrated in financial services, energy, and healthcare. Yet, climate-related sectors received less than one-third of these capital flows, far below the global average of 59%.

Nevertheless, the narrative that catalytic capital remains untested in India is only partly accurate. Over the years, several catalytic financing experiments in the country's climate sector have achieved notable success.

One of the most compelling illustrations of this comes from India's solar sector. The risk of payment delays or defaults by financially stressed power distribution companies (DISCOMs) discouraged investors and project developers from committing capital to solar projects. To address the sector's challenges, the Solar Energy Corporation of India (SECI) anchored a ₹1,500 crore payment security fund (PSF)²³ in 2017—jointly backed by the Government of India, state governments, and the Reserve Bank of India (RBI)—which guaranteed timely payments to solar power producers even

²² India Blended Finance Narrative Report

²³ Center for Strategic and International Studies, *Payment Security Mechanism for Solar Power in India*

Over its decade-long journey, TCCL disbursed \$3.9 billion across over 500 clean energy projects, supporting 22.4 GW of renewable capacity and mitigating approximately 25 million tonnes of emissions annually

if DISCOMs defaulted on their obligations. The result: commercial capital surged into solar infrastructure, scaling up capacity and driving down tariffs to record lows, positioning India as one of the fastest-growing solar markets in the world.

In the public sector, India's quasi-sovereign fund, the National Investment and Infrastructure Fund (NIIF), anchored the \$741 million Green Growth Equity Fund (GGEF) with contributions from international investors such as the UK Foreign, Commonwealth and Development Office (FCDO), the Dutch development bank FMO, and concessional equity from the Green Climate Fund. The fund remains to date among the largest single-country-focused funds on climate change in emerging markets. GGEF's portfolio has delivered significant environmental and social impact: 16 million tonnes of carbon emissions avoided, 14.2 billion kWh of renewable energy generated, 612 million kilometers powered across EVs, 7.7 million tonnes of waste treated, and nearly 15,000 direct green jobs created.²⁴

In the private sector, Tata Capital Limited partnered with the International Finance Corporation (IFC) to establish Tata Cleantech Capital Limited (TCCL)—a dedicated financier for clean energy projects.

From the outset, TCCL built robust assessment and underwriting frameworks purpose-built for emerging clean technologies. It also embedded global environmental, social and governance (ESG) standards into its operations—a discipline reinforced by the IFC partnership—which helped unlock access to global pools of capital and lowered its overall cost of funding. Over its decade-long journey, TCCL disbursed \$3.9 billion across over 500 clean energy projects, supporting 22.4 GW of renewable energy capacity—nearly 8% of India's installed renewable capacity—and mitigating approximately 25 million tonnes of emissions annually. This was achieved with net non-performing assets (NPA) of just 0.2%²⁵ and consistent above-average market returns over the period.

²⁴ Eversource Capital, Green Growth Equity Fund

²⁵ Tata Cleantech Capital Limited, Annual Report 2022-23

India will require a \$500 billion investment push across 20 critical technologies by 2030 to meet its climate goals in the areas of power, industry, and mobility

PART II

Quantifying the climate financing opportunity

To estimate the investment required for each technology, we multiply the additional capacity needed to meet India's 2030 climate targets with their respective costs.

For example, achieving India's grid-scale solar target of 292 GW by 2030 will require an additional 173 GW of capacity. A benchmark cost of \$528 million per GW represents an investment opportunity of approximately \$91 billion.

Extending this methodology across all 20 technologies in power, industry, and mobility yields a cumulative climate mitigation financing opportunity of **\$500 billion** by 2030. This includes:

- **\$198 billion, or 39.6% of the total financing opportunity**, in power and renewables to achieve the 500 GW non-fossil target by 2030. This spans 16 technologies including utility-scale renewable energy (RE), rooftop solar, battery storage and livelihood generating productive use of renewable energy (PURE) applications.
- **\$115 billion (23.0%)** in green hydrogen, which holds the potential to be a key industrial decarbonization technology.
- **\$187 billion (37.4%)** in electric mobility transition, comprising \$185 billion of consumer spending on purchase of EVs (including subsidies), and an additional \$2.5 billion investment opportunity in charging infrastructure.

As shown in Table 1, debt financing is expected to account for the majority of this financing opportunity—reflecting the standard 70:30 debt-to-equity split common in large infrastructure projects—amounting to over \$350 billion. This comprises over \$259 billion in loan books for banks and NBFCs, directed towards technologies such as battery storage, rooftop solar, PURE applications, and EVs. It also comprises \$93 billion in corporate bond market issuances

for grid-scale solar PV and wind projects, which we assume are recycled back to banks and NBFCs to support primary debt issuance.

Table 1: Quantifying India's low-carbon financing requirements

Sector (share in GHG emissions)	Technology/ Sub-sector	Net target*	Benchmark costs [^]	Total investment	Debt component	Debt opportunity
		(A)	(B)	(A) * (B)	(C)	(A) * (B) * (C)
Power and renewables (~40%)	Solar PV	173 GW	\$528 million/ GW	\$91 billion	75%	\$69 billion
	Wind	44 GW	\$733 million/ GW	\$32 billion	75%	\$24 billion
	Battery storage	207 GWh	\$125/kWh	\$26 billion	70%	\$18 billion
	Distributed renewable energy (12 technologies)	Various targets	Various benchmarks	\$48 billion	40–84%	\$25 billion
	Rooftop solar [#]	0 GW	\$420 million/ GW	-	75%	-
Industry (~21%)	Green hydrogen (GH2)	60 GW (electrolyzer) 135 GW (RE)	\$500 million/GW (electrolyzer) \$631 million/ GW (RE)	\$115 billion	65%	\$75 billion
Electric mobility (~9%)	EVs	87.6 million units (E-2w) 0.6 million units (E-3w) 4.6 million units (E-4w) 40,300 units (E-buses)	\$1,341/unit (E-2w) \$2,705/unit (E-3w) \$13,443/unit (E-4w) \$104,182/unit (E-buses)	\$185 billion	75%	\$139 billion
	EV charging	Various estimates	Various estimates	\$2.5 billion	80%	\$2 billion
Total financing opportunity				\$500 billion	~70%	\$352 billion

* Net target refers to the difference between 2030 targets and 2025 penetration levels. Targets have been taken from various government policy target documents, including the Central Electricity Authority (CEA), the National Green Hydrogen Mission (NGHM), NITI Aayog, and PM Surya Ghar, among others. For details, see Annexure 1.

[^] Cost benchmarks and debt components are taken from various sources such as the Central Electricity Authority (CEA), Ministry of New and Renewable Energy (MNRE), Lazard, Bloomberg, Centre for Social and Economic Progress (CSEP), Lawrence Berkeley National Laboratory (LBNL), and stakeholder consultations among others. For details, see Annexure 2.

[#] As of March 2026, India has achieved the rooftop solar capacity target outlined in the PM Surya Ghar scheme.

Global examples show that blended finance has typically contributed 7–12% of total investment in large development and climate programs

Determining the scale of blended finance required

Unlike global flows, which are led by MDBs and DFIs, India's blended finance is driven by banks and NBFCs, which account for 43% of transactions. The market leans heavily on debt-based instruments like guarantees and insurance, followed by technical assistance and grants. This underscores the need to diversify India's climate finance architecture and mobilize capital in the form of grants, junior equity and/or guarantees from multilateral institutions and philanthropies—mechanisms that have proven more effective in catalyzing private investment at scale and closing systemic financing gaps.

Using technology-specific national targets and associated benchmark costs, we estimate that while India needs \$500 billion in climate financing, a fraction of it in the form of blended finance would suffice.

Global examples show that blended finance has typically contributed 7–12% of total investment in large development and climate programs. For instance, blended finance made up about 10% of planned investment in South Africa's Just Energy Transition Partnership (JETP)²⁶, 11.5% in Viet Nam's JETP²⁷, 10.2% through the European Union's External Investment Plan²⁸, and 7.1% in the Finland-IFC Blended Finance for Climate Program (BFCP)²⁹.

These examples suggest that blended finance is most effective when it plays a targeted role. This is consistent with guidance from the Blended Finance Taskforce³⁰, which notes that many blended finance programs use 10–20% concessional or development capital to reduce risks and attract larger amounts of private investment into infrastructure and development projects.

²⁶ South Africa's Just Energy Transition Implementation Plan, Government of South Africa

²⁷ Viet Nam's JETP Resource Mobilization Plan, Climate Policy Initiative

²⁸ EU External Investment Plan, European Commission

²⁹ Finland-IFC Blended Finance for Climate Program (BFCP), International Finance Corporation

³⁰ 'Better Finance. Better World', Consultation Paper of the Blended Finance Taskforce

As early projects supported through blended finance succeed, they demonstrate that technologies, business models, and policy frameworks can come together to deliver viable returns to private investors

Drawing on these international precedents and discussions with more than a dozen climate finance and sector experts, we assume that blended finance could potentially support 10% of the financing needed across each of the 20 low-carbon technologies. This would amount to \$50 billion, or 10% of the total \$500 billion financing requirement for India's climate transition.

Relatively small amounts of blended finance can have an outsize impact in mobilizing commercial investment. For instance, the BFCP—a partnership between the Government of Finland and the IFC—committed over \$130 million in blended finance to support 16 climate-focused investments worth \$2.4 billion across Africa, South and Southeast Asia between 2017 and 2023. BFCP's blended finance commitments played a pivotal role in establishing proof of concept, supporting first-of-a-kind and early-stage projects, and demonstrating commercial viability in underserved markets.

As early projects supported through blended finance succeed, they demonstrate that technologies, business models, and policy frameworks can come together to deliver viable returns to private investors. A single successful pilot in green hydrogen or grid-scale battery storage, made possible by blended finance instruments such as grants or first-loss capital, can open the door for similar projects to raise commercial capital. As more successes emerge, perceived risks drop, financing costs fall, and new investors join in. In this way, backed by expert opinions, we consider a scenario where even a 10% penetration of the total financing opportunity in each technology met through blended finance could pave the way for the rest to be mobilized without additional support.

Quantifying what every dollar of catalytic capital unlocks ('leverage multiple')

We have identified 20 key technologies across the three sectors highlighted above with varying degrees of maturity—from nascency to commercial maturity. Every dollar of catalytic capital deployed mobilizes multiple dollars in blended finance. The resulting

‘leverage multiple’—the ratio of total blended finance (commercial and catalytic capital) mobilized per unit of catalytic capital deployed—varies widely depending on a technology’s maturity and perceived risk profile. Lower leverage multiples in blended finance structures indicate a higher requirement for catalytic capital to make a project viable.

To calculate these multiples, each technology is first assigned to one of the three Financial Readiness Levels (FRLs). Each level reflects not only a technology’s techno-commercial maturity but also the specific financing barrier it faces—whether capital is unavailable, prohibitively expensive, or insufficient at the required scale. The framework matches these barriers with appropriate financial instruments, ensuring that the right combination of grants, concessional finance, and guarantees is deployed to make the technology viable and mobilize commercial capital.

Table 2: Financing challenges faced based on varying levels of techno-commercial maturity and financial readiness

<i>Increasing leverage multiple</i> →			
Financial readiness	Low (FRL 1)	Moderate (FRL 2)	High (FRL 3)
Challenge	Access	Affordability	Abundance
Description	Finance not flowing at all—e.g. low loan approval rates	Finance flowing but at expensive terms—e.g. higher interest rates, shorter tenors etc.	Finance is readily flowing at attractive terms, but scale of finance is not enough
Technology	■ Green hydrogen	■ EVs and charging infrastructure ■ Battery storage ■ Distributed renewable energy (DRE) ■ Rooftop solar	■ Grid-scale renewable energy (solar and wind)
Intervention/instrument	■ Grants ■ Technical assistance ■ Concessional equity and/or debt	■ Concessional equity and/or debt ■ Guarantees	■ Credit guarantees to unlock larger pools of capital such as bond markets
← <i>Decreasing need for blended finance</i>			

Drawing on expert interviews and publicly available benchmark data on capital and operational costs, financial indicators and other metrics, we built customized financial models for each technology to assess the scale of intervention required to close financing or viability gaps against a reference point. Depending on the technology, these gaps broadly pertain to either cost or creditworthiness—such as differences in costs between a low-carbon technology and its conventional counterpart, or the difference in the current credit ratings of low-carbon technologies and the threshold rating required by investors. These gaps are addressed by incorporating one or more FRL-prescribed instruments and interventions into the model. This approach enables us to estimate the minimum amount of catalytic capital needed to unlock commercial capital and subsequently determine the leverage multiples for each technology. The multiples vary from a high of 35x for mature technologies like solar energy, to a low of 2x for green hydrogen³¹.

³¹ For details related to technology-specific inputs of the model, sources, proposed interventions, reference gaps chosen and general approach, see Annexure 3

Table 3: Estimating leverage multiples for low-carbon technologies

Sector	Technology	Proposed intervention	Leverage multiple*	Sources
Power and renewables	Solar PV	Partial credit guarantee (PCG) to unlock bond market	35x	CEEW-GFC estimates
Power and renewables	Wind	PCG to unlock bond market	29x	CEEW-GFC estimates
Power and renewables	Battery (BESS)	Concessional debt	13x	CEEW-GFC estimates
Power and renewables	Rooftop solar	Concessional debt and PCG	4x	Convergence
Power and renewables	Vertical fodder grow unit (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Higher capacity pump (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Solar-powered cold storage (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Solar micro pump (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Solar dryer (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Grain milling (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Solar loom (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Small solar refrigerator (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Small horticulture processors (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Solar charkha (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Solar milk chiller (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Power and renewables	Solar silk reeling machines (PURE)	Mix of grants, concessional debt and PCG	5x	CEEW-GFC estimates
Industry	Green hydrogen (GH2) production	Concessional debt/equity and grants	2x	CEEW-GFC estimates
Electric mobility	E-2w/E-3w/E-4w/E-buses	Concessional debt/equity and first-loss guarantee	7x	Green Climate Fund
Electric mobility	Charging infrastructure	Concessional debt/equity and first-loss guarantee	7x	Green Climate Fund

* For details, see Annexure 3

India's \$645 billion corporate bond market offers an opportunity to tap into new capital pools, but the current state of credit ratings of renewable energy projects remains a challenge

For instance:

- Grid-scale solar and wind projects are mature and commercially viable, but the speed and scale of their expansion is increasingly constrained by the lending capacity of banks and NBFCs. Without new financing mechanisms and deeper debt capital pools, renewable energy deployment risks slowing to a stall. India's \$645 billion corporate bond market offers an opportunity to tap into new capital pools, but the current state of credit ratings of renewable energy projects remains a challenge since most institutional investors seek AAA- or near AAA-rated instruments. Credit guarantees can help improve project credit ratings from the current BBB/A/AA to AAA, enabling access to bond markets at competitive costs. This could mobilize \$29 to \$35 in additional debt for every dollar of catalytic capital invested in credit enhancement—a leverage multiple of 29x and 35x for wind and solar, respectively.

For utility-scale solar and wind, the leverage multiple is the ratio of debt raised to the catalytic capital required. Unlike other sectors where equity is also a hurdle, the additional capital for these technologies comes solely from debt—through bond issuance supported by credit enhancement.

Our current model assumes a conservative scenario where the guarantor absorbs complete loss in case of default. Under RBI's Expected Credit Loss (ECL) framework introduced in April 2026 (effective April 2027), secured loan defaults are benchmarked at 65% loss coverage. Applying this benchmark raises leverage multiples to 54x for solar projects and 44x for wind, reducing catalytic capital needs from \$374 million to \$243 million.

- For battery storage—where lenders remain cautious because of technology risk, cost competitiveness, and long payback periods—concessional debt and guarantees can help absorb early-stage risks. This enables commercial banks to lend at far greater scale, potentially unlocking commercial loans with a leverage multiple of up to 13x.

Despite strong demand, EVs face financing challenges due to technology risks and concerns around resale value; concessional debt/equity and portfolio guarantees can unlock commercial finance at a leverage multiple of 7x

- Productive use of renewable energy (PURE) devices for agriculture such as solar dryers and pumps struggle with limited access to credit due to the nascency of technology and lack of credit history of the clients it serves, leaving many viable initiatives underfunded despite strong demand. Several programs are currently in progress on this front. One of CEEW's flagship programs, Powering Livelihoods, implemented with Villgro (a social enterprise incubator), has demonstrated that a mix of grants, guarantees, and low-cost debt can de-risk the deployment of these devices and significantly reduce costs to mobilize commercial capital at a 5x leverage multiple, unlocking scale that traditional lending alone cannot achieve. Since this program reflects real-world outcomes, we adopt its indicative leverage multiple of 5x for the study.
- Green hydrogen remains commercially unviable, requiring a mix of subsidies, public grants and concessional debt/equity to demonstrate proof of concept. While leverage ratios are modest at 2x, targeted interventions are essential to de-risk early projects and build confidence among commercial investors.
- EVs and charging infrastructure face a financing gap: despite strong demand, commercial lenders remain cautious about technology risks and end-of-life/resale value. Concessional debt/equity and portfolio-level guarantees can help unlock commercial finance at leverage multiples of 7x, accelerating EV deployment and strengthening market confidence.

Quantifying the value of catalytic capital needed

For each technology, we estimate blended finance requirements by assuming it covers 10% of the total financing opportunity.

Dividing the blended finance requirement for each technology by the corresponding leverage multiple provides the catalytic capital required for that technology.

For example, in the case of grid-scale solar, \$9.1 billion of blended finance—at 10% of the \$91 billion financing opportunity—can be

unlocked with just \$0.3 billion in catalytic capital at the estimated leverage multiple of 35x.

Applying the same methodology across all 20 technologies yields an aggregate blended finance requirement of \$50 billion. Mobilizing this amount will require \$10 billion in catalytic capital. This implies a leverage multiple of 5x on an aggregate level—implying that every dollar of catalytic capital mobilizes five dollars of blended finance.

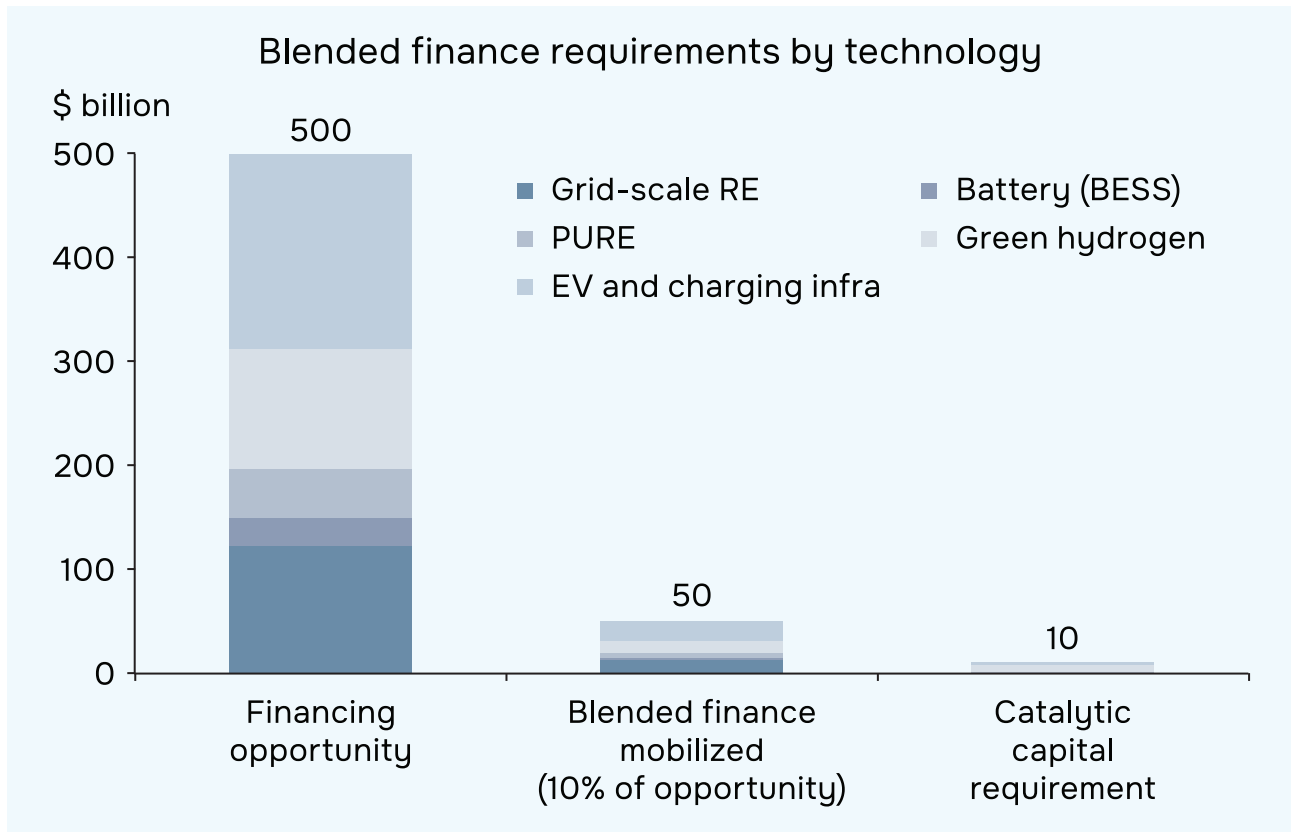
Put differently, each catalytic dollar attracts an additional four dollars from commercial investors.

Table 4: Blended climate financing requirements for clean technologies

Sector	Technology	Intervention	Financing opportunity till 2030 (\$ billion)	Leverage multiple	Blended finance to be mobilized—10% of financing opportunity (\$ billion)	Catalytic capital required (\$ billion)
			(A)	(B)	(C) = 10% of (A)	(C) ÷ (B)
Power and renewables	Solar PV	Subsidized partial credit guarantee (PCG) to unlock the bond market	91	35x	9.1	0.3
	Wind	Subsidized partial credit guarantee (PCG) to unlock the bond market	32	29x	3.2	0.1
	BESS	Project-level concessional debt and PCG	26	13x	2.6	0.2
	PURE*	Mix of interventions that include grants, concessional debt, and PCG	48	5x	4.8	1.0
	Rooftop solar	Concessional debt and portfolio-level PCG	0	4x	0	0
Industry	Green hydrogen (GH2)	Project-level grants and concessional debt/equity	115	2x	11.5	5.9
Electric mobility	Electric vehicles -2w/3w/4w/ buses	Portfolio-level concessional debt/equity and PCG	185	7x	18.5	2.6
	Charging infrastructure	Portfolio-level concessional debt/equity and PCG	2.5	7x	0.3	0.04
Total			500	5x	50	10

*Refers to 12 productive use of renewable energy (PURE) technologies that boost income and improve livelihoods, including vertical fodder grow unit, higher capacity pump, solar powered cold storage, solar micro pump, solar dryer, grain milling, solar loom, small solar refrigerator/freezer, small horticulture processors, solar charkha, solar milk chiller and solar silk reeling machines.

Figure 3: \$10 billion in catalytic capital could mobilize \$50 billion in blended finance, helping bridge the \$500 billion climate financing opportunity



Source: CEEW-GFC, Tata Sons Research

Unlocking the next wave of climate capital in India

India's climate finance challenge is not about the absence of capital—it is about directing capital to where it matters most. In that context, deploying innovative blended finance instruments for technologies such as battery storage, green hydrogen, PURE, rooftop solar and EVs can reduce lenders' risk perception and expand loan books. Beyond lending, deepening the corporate bond market through credit enhancement could open a new channel of debt capital for grid-scale renewables. Green investment mandates for institutional investors such as pension funds and insurance companies ensures demand.

Blended finance can also reshape risk profiles for institutional investors. Creating diversified project pools with predictable returns could lower investment risks. Bundling renewable energy assets into portfolios or issuing green asset-backed securities can

At \$16 billion in 2023-24, domestic philanthropy—driven by family office-based philanthropy and corporate social responsibility (CSR) contributions—represents a growing pool of capital for climate investments

attract patient capital from institutional investors, while opening the door for retail investors. The success of instruments like Real Estate Investment Trusts (REITs) and Infrastructure Investment Trusts (InvITs), which have raised over \$21.8 billion (₹1.9 lakh crores) since 2020³², offers a proven model to build on.

Yet, the question remains: where will the catalytic capital for these instruments come from?

Today, catalytic capital largely flows from international sources, such as MDBs and DFIs, at the project level. Going forward, sector-specific country platforms—like those announced by a group of 13 developing countries, including India, at COP30 in November 2025—could channel international support. MDBs and DFIs can diversify away from debt into catalytic instruments like junior equity, guarantees and risk-sharing facilities to crowd in commercial capital more effectively. However, geopolitical realities cast doubt on whether such international flows can scale. The recent Fourth International Conference on Financing for Development (FfD4) at Seville³³ underscored the importance of domestically-led blended finance in developing countries.

For India, this opens up a significant window for domestic philanthropy. At \$16 billion in 2023-24³⁴, domestic philanthropy—driven by family office-based philanthropy and corporate social responsibility (CSR) contributions—represents a growing pool of capital. However, allocations towards climate action have been limited, and experience with blended finance mechanisms even more so. Spending on low-carbon technologies aligns naturally with philanthropic priorities in health, agriculture, water, and livelihoods, offering valuable co-benefits. By adopting blended finance approaches, philanthropy can move beyond traditional grant-making to playing a catalytic role—absorbing risks, improving

³² Securities and Exchange Board of India

³³ Outcome Document of the Fourth International Conference on Financing for Development, Seville

³⁴ India Philanthropy Report 2025, Bain Capital and Dasra

A National Green Finance Institution (NGFI) could connect catalytic capital providers with India's domestic financing ecosystem, reinforcing rather than displacing lenders and bond investors

bankability, and crowding in commercial capital. India's laws generally do not prohibit the use of CSR funds in blended finance structures. However, CSR capital must retain its not-for-profit character, typically as grants or first-loss capital. Clearer policy guidance can facilitate more CSR in blended finance by recognizing returnable grants, first-loss default guarantees, or hybrid financial structures that target climate-mitigating projects rather than restricting spending strictly to non-profit donations. In turn, compliance frameworks can clarify how recycled capital, interest from returnable grants, or residual funds from blended pools can be redeployed for social impact.

Achieving all this in a way that meaningfully advances national priorities will require an enabling ecosystem, underpinned by a robust institutional architecture. Policymakers have begun to recognize this potential. The *Economic Survey of India 2025–2026*³⁵ highlights blended finance as a critical complement to robust domestic markets, strong development banks and credible regulation. NITI Aayog's *Scenarios Towards Viksit Bharat and Net Zero*³⁶ calls for blended finance mechanisms to bridge viability gaps in emerging clean technologies. It proposes a National Green Finance Institution (NGFI) to crowd in private capital and coordinate fragmented financial actors. Such an institution need not be built from scratch: an existing DFI could be repurposed, or a ring-fenced green subsidiary created, with GIFT International Financial Services Centre (GIFT IFSC) operations to channel international flows. At its core, the NGFI would connect catalytic capital providers with India's domestic financing ecosystem, reinforcing rather than displacing lenders and bond investors.

Ultimately, when it comes to decarbonization in India, the capital is there; the technology is there; the demand is there. What is missing is an orchestrated push to connect them in a catalytic manner—a gap that can be addressed by blended finance. ■

³⁵ Page 408, *Economic Survey 2025-26*, Ministry of Finance, Government of India

³⁶ Volume 9, *Financing Needs, Scenarios Towards Viksit Bharat and Net Zero*, NITI Aayog

Annexure I: Technology-wise targets till 2030

Sector	Technology	2030 target/ estimate	Source	2025 penetration	Source	Net target
Power and renewables	Solar PV	292 GW	CEA (2023)	119 GW	MNRE (2025)	173 GW
Power and renewables	Wind	100 GW	CEA (2023)	56 GW	MNRE (2025)	44 GW
Power and renewables	Battery (BESS)	208 GWh	CEA (2023)	1 GWh	CEEW compilation	207 GWh
Power and renewables	Rooftop solar	32 GW	PM Surya Ghar (2024)	32 GW	MNRE (2025)	0 GW
Power and renewables	Vertical fodder grow unit (PURE)	3,379,510 Nos.	CEEW (2023)	0 Nos.	Assumption	3,379,510 Nos.
Power and renewables	Higher capacity pump (PURE)	8,195,269 Nos.	CEEW (2023)	0 Nos.	Assumption	8,195,269 Nos.
Power and renewables	Solar-powered cold storage (PURE)	141,984 Nos.	CEEW (2023)	0 Nos.	Assumption	141,984 Nos.
Power and renewables	Solar micro pump (PURE)	3,425,032 Nos.	CEEW (2023)	0 Nos.	Assumption	3,425,032 Nos.
Power and renewables	Solar dryer (PURE)	1,680,316 Nos.	CEEW (2023)	0 Nos.	Assumption	1,680,316 Nos.
Power and renewables	Grain milling (PURE)	946,684 Nos.	CEEW (2023)	0 Nos.	Assumption	946,684 Nos.
Power and renewables	Solar loom (PURE)	620,915 Nos.	CEEW (2023)	0 Nos.	Assumption	620,915 Nos.
Power and renewables	Small solar refrigerator/freezer (PURE)	1,232,368 Nos.	CEEW (2023)	0 Nos.	Assumption	1,232,368 Nos.
Power and renewables	Small horticulture processors (PURE)	546,718 Nos.	CEEW (2023)	0 Nos.	Assumption	546,718 Nos.
Power and renewables	Solar charkha (PURE)	386,498 Nos.	CEEW (2023)	0 Nos.	Assumption	386,498 Nos.
Power and renewables	Solar milk chiller (PURE)	90,224 Nos.	CEEW (2023)	0 Nos.	Assumption	90,224 Nos.
Power and renewables	Solar silk reeling machines (PURE)	78,003 Nos.	CEEW (2023)	0 Nos.	Assumption	78,003 Nos.
Industry	Green hydrogen (GH2) production–RE	135 GW	NGHM (2023)	0 GW	CEEW (2024)	135 GW
Industry	Green hydrogen (GH2) production–Electrolyzer	60 GW	NGHM (2023)	0 GW	CEEW (2024)	60 GW
Electric mobility	E-2w	92 million units	CEEW GFC (2020)	4.4 million units	CEEW GFC Dashboard (2026)	87.6 million units
Electric mobility	E-3w	3.5 million units	CEEW GFC (2020)	2.9 million units	CEEW GFC Dashboard (2026)	0.6 million units
Electric mobility	E-4w	5 million units	CEEW GFC (2020)	0.4 million units	CEEW GFC Dashboard (2026)	4.6 million units
Electric mobility	E-buses	50,000 units	National Electric Bus Programme, MoRTH	9,700 units	CEEW (2025)	40,300 units
Electric mobility	Charging infrastructure	-	-	-	-	-

Annexure 2: Cost benchmarks for each technology

Sector	Technology	Unit	Cost	Source
Power and renewables	Solar PV	\$ million/GW	528	CEA (2025) [^]
Power and renewables	Wind	\$ million/GW	733	CEA (2025) [^]
Power and renewables	Battery (BESS)	\$/kWh	125	LBNL (2025) [@]
Power and renewables	Rooftop solar	\$ million/GW	420	CEA (2025) [^]
Power and renewables	Vertical fodder grow unit (PURE)	₹/unit	44,000	CEEW estimates (2025)
Power and renewables	Higher capacity pump (PURE)	₹/unit	87,360	CEEW estimates (2025)
Power and renewables	Solar-powered cold storage (PURE)	₹/unit	1,451,000	CEEW estimates (2025)
Power and renewables	Solar micro pump (PURE)	₹/unit	45,000	CEEW estimates (2025)
Power and renewables	Solar dryer (PURE)	₹/unit	178,240	CEEW estimates (2025)
Power and renewables	Grain milling (PURE)	₹/unit	2,070,305	CEEW estimates (2025)
Power and renewables	Solar loom (PURE)	₹/unit	156,000	CEEW estimates (2025)
Power and renewables	Small solar refrigerator/freezer (PURE)	₹/unit	112,500	CEEW estimates (2025)
Power and renewables	Small horticulture processors (PURE)	₹/unit	179,134	CEEW estimates (2025)
Power and renewables	Solar charkha (PURE)	₹/unit	75,000	CEEW estimates (2025)
Power and renewables	Solar milk chiller (PURE)	₹/unit	750,000	CEEW estimates (2025)
Power and renewables	Solar silk reeling machines (PURE)	₹/unit	28,350	CEEW estimates (2025)
Industry	Green hydrogen (GH2) production – RE	\$ million/GW	631	CEA (2025) [^]
Industry	Green hydrogen (GH2) production – Electrolyzer	\$ million/GW	500	CEEW-IGEF (2030) [#]
Electric mobility	E-2w	\$/unit	1,341	CEEW GFC estimates (2024)
Electric mobility	E-3w	\$/unit	2,705	CEEW GFC estimates (2024)
Electric mobility	E-4w	\$/unit	13,443	CEEW GFC estimates (2024)
Electric mobility	E-buses	\$/unit	104,182	CEEW GFC estimates (2024)
Electric mobility	Charging infrastructure	-	-	-

*Assumption: USD/INR = 88.0

[^]2025 cost estimates were derived by interpolating between 2020 actual costs and 2030 projected costs

[@]Assumes 2025 cost projections for co-located solar PV and BESS systems

[#]Projected 2030 costs of \$500 million per GW, down from \$750 million per GW in 2024

Annexure 3: Methodology for estimating leverage multiples

In March 2025, the Council on Energy, Environment and Water (CEEW) developed technology-specific financial models to assess how catalytic capital can mobilize commercial investment across a range of clean energy technologies. Catalytic capital—through instruments such as grants, guarantees, and concessional loans—can absorb investment risks and improve the attractiveness of emerging technologies for commercial investors. By reducing risk exposure for lenders and investors, these instruments can unlock significantly larger pools of private capital.

These models estimate the extent of catalytic capital required for each technology, and derive the corresponding ‘leverage multiple’—the amount of total investment that can be mobilized for every unit of catalytic capital deployed. For technologies where detailed financial modelling was not feasible, publicly available leverage multiples from blended finance vehicles were used. The approach used to calculate leverage multiples for each technology is summarized below:

- **Solar and wind:** Unlike other sectors where equity is the binding constraint, utility-scale solar and wind projects face a different challenge: access to large pools of debt at competitive costs. Despite being mature and commercially viable, their speed and scale of deployment is constrained by the lending capacity of banks and NBFCs. These projects often lack sufficiently strong credit ratings to raise debt through bond markets at competitive costs. To address this, CEEW’s model evaluates how subsidized credit enhancements—such as guarantees funded by catalytic capital from MDBs and philanthropies—can help improve project ratings from BBB/A/AA to AAA, thereby unlocking access to larger pools of debt at competitive costs.

The model estimates the total investment and debt required to meet 2030 targets by combining capacity gaps with project costs and conventional debt-to-equity ratios. Capex costs are assumed to remain broadly constant over time, with expected reductions in technology costs likely to be offset by rising land and labour expenses. Next, it assesses the distribution of credit ratings across 38 rated renewable energy entities, focusing exclusively on investment-grade projects. Default probabilities over a 10-year tenor are estimated using two models—hazard rate model and rating-transition matrix multiplication model. The financial model assumes that the guarantee facility will provide full coverage of bond amount and complete loss given default (LGD). Subsequently, the total amount of guarantee coverage is calculated by applying marginal default probabilities across each year, discounting losses to present value, and adjusting with statistical buffers at a 99% confidence level to account for extreme macroeconomic or sectoral stress events. Finally, the leverage multiple is derived by dividing the total debt mobilized by the total guarantee coverage required. For solar projects, every rupee of credit enhancement through guarantees mobilizes ₹35 of debt through bond issuances—a 35x leverage multiple. Similarly, for wind projects, the corresponding leverage multiple is found to be 29x.

For utility-scale solar and wind, the leverage multiple is the ratio of debt raised to the catalytic capital required. Unlike other sectors where equity is also a hurdle, the additional capital mobilized for these technologies comes solely from debt—through bond issuance supported by credit enhancement.

- **Battery storage (BESS):** Battery storage systems continue to face high upfront capital costs as lenders remain cautious due to technology risks, uncertain revenue streams, and long payback periods. Concessional debt from MDBs can help absorb early-stage risks, paving the way for commercial lenders to provide loans at far greater scale.

CEEW's model evaluates how concessional loans can help reduce the Levelized Cost of Storage (LCOS)—the average cost per unit of electricity discharged from an energy storage system over its lifetime. The model considers a 100 MW/400 MWh battery storage project over a 25-year operational life, including battery replacements in Year 13 and annual operating costs at 2% of the initial project cost. The model draws on data from the Ministry of New and Renewable Energy (MNRE), Lawrence Berkeley National Laboratory (LBNL), Lazard, CARE Ratings, and recent SECI tenders for critical technical and cost assumptions—40% Viability Gap Funding (VGF) support for capex from the government, a standard 70:30 debt-equity financing structure, and 85% roundtrip efficiency for the storage system. Commercial debt is assumed at a 10% interest rate, supplemented by concessional loans ranging between 0% and 8% interest rates. By simulating scenarios with an increasing share of concessional debt, the model identifies that the most effective structure involves financing 40% of the project through interest-free concessional loans. This reduces the LCOS from ₹5.3/kWh to ₹4.1/kWh, and mobilizes nearly ₹13 in private investment for every rupee of catalytic capital provided—a leverage multiple of 13x.

- **Rooftop solar:** Rooftop solar projects struggle with limited access to credit, leaving many viable initiatives underfunded despite strong demand among smaller consumers and enterprises. A mix of grants, guarantees, and low-cost debt can help reduce financing risks and improve commercial lending flows into the sector. Due to limited data and the absence of reliable cost benchmarks, leverage multiples for rooftop solar projects are taken from Convergence's Blended Finance database, which reviews 72 funds worldwide and reports an average leverage multiple of 4x.
- **Productive use of renewable energy (PURE):** For PURE technologies like solar irrigation pumps, cold storage, and rural livelihood equipment—where limited access to credit has constrained adoption and market penetration—leverage estimates draw on the 'Powering Livelihoods' initiative led by CEEW and the Villgro Innovations Foundation. The program uses blended finance tools—grants, concessional loans, and credit guarantees—to ease financing barriers for rural entrepreneurs and small businesses, enabling commercial lending from NBFCs and microfinance institutions (MFIs). Based on program experience, every rupee of catalytic capital mobilizes about ₹5 in total investment, yielding a 5x leverage multiple. To date, the program has supported the deployment of over 24,000 clean energy systems.

- **Green hydrogen (GH2):** Green hydrogen projects continue to face significant financing barriers due to high upfront costs, technology risks, and uncertain revenue visibility. Consequently, commercial lenders remain cautious about lending exposure to such projects. Public grants and concessional debt/equity are essential to absorb early-stage risks, improving investor confidence, and accelerating scale-up.

CEEW's model evaluates how grants and concessional loans can reduce levelized cost of green hydrogen (LCOH)—the average cost of producing one kilogram of hydrogen over the lifetime of a project—by 2030. At present, green hydrogen costs are estimated at \$4/kg compared to grey hydrogen at \$2/kg, highlighting the need for targeted financial support to bridge this competitiveness gap. The analysis considers a 10 MW electrolyzer project over a 20-year operational life, including electrolyzer stack replacement in Year 11. Drawing on data from Lazard, Bloomberg, CSEP, and expert insights from Tata Capital, the model assumes that the project is financed using a 60:40 debt-equity structure, where debt is split equally between commercial loans at 10% interest and concessional loans ranging between 0% and 8%. It also factors in a direct production subsidy of \$0.4/kg from the government. The model projects key technological improvements between 2025 and 2030: a 33% fall in electrolyzer costs (from \$750/kW to \$500/kW), a 17% improvement in efficiency (lowering electricity use from 55 to 47 kWh/kg), and an increase in plant load factor from 70% to 75%. By analyzing scenarios where grants cover an increasing share of project costs, the model identifies that the most effective financing structure involves grants covering half the project cost and interest-free concessional loans. This blended structure lowers the cost of green hydrogen to match that of grey hydrogen by 2030, while mobilizing ₹2 of total investment for every rupee of catalytic capital—a 2x leverage multiple.

- **EVs and charging infrastructure:** Despite surging demand, EVs and charging infrastructure remain underfinanced as lenders remain cautious due to uncertainties around deployment scale, resale values, and long-term asset performance. Targeted concessional debt, low-cost or junior equity participation, and portfolio guarantees can help mitigate these risks, improve lender confidence, and accelerate commercial investment into the sector.

Due to lack of data around benchmark costs for EV financing and the wide variation in techno-commercial maturity across different vehicle types, we rely on publicly available leverage estimates from Vertelo, an India-focused EV financing and leasing platform supported by the Green Climate Fund (GCF) and the Macquarie Group. The platform targets a 7x leverage multiple, with \$200 million in initial equity capital expected to mobilize \$1.5 billion in total investments over ten years.

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