INDIA–U.S. INVESTOR INITIATIVE

Challenges to Increasing U.S. Investment in India's Clean Energy Transition

Phase One: Risks and Barriers

Ananta Aspen Centre · Center for American Progress

June 9, 2026

CENTER FOR AMERICAN PROGRESS

Courtney Federico, Associate Director, International Climate Policy

Kalina Gibson, Research Associate, International Climate Policy

ANANTA ASPEN CENTRE

Ayan Barman, Former International Relations Consultant

Richa Kumaria, Programme Lead

About

India-U.S. Investor Initiative

INITIATIVE DESCRIPTION

The India-U.S. Investor Initiative sources expertise from the private sector, investment community leaders, and current and former finance ministry officials from the U.S. and India to discuss concrete reforms needed to address real and perceived risks of investing in the clean energy transition in India. As a deep dive exercise and outcome of the India-U.S. Track II Dialogue, this initiative will culminate in proposed reforms to build investor trust in India, looking towards 2028 as a deadline for making progress in lowering information barriers for investors and driving regulatory reforms that will decrease risk.

PROJECT OVERVIEW

This is a three-year endeavor and is led by the Ananta Aspen Centre and the Center for American Progress. This project has two main phases:

> **Phase 1: Identify risks and barriers to U.S. investment in India**
>
> During Phase 1, both the Ananta Centre and CAP have conducted stakeholder interviews with experts to understand risks and barriers to increasing U.S. investment in India's clean energy transition. These experts include market investors, former government officials, academics and think tank experts, and philanthropy leaders. Their perspectives were summarized and supplemented by research into a white paper, which will be circulated to key decision makers, including U.S. congressional offices, Indian government officials, and foreign policy leaders.

> **Phase 2: Develop policy solutions to ease challenges to investment**
>
> Phase 2 will focus on brainstorming solutions to the risks and barriers identified in Phase 1. To do so, staff will conduct additional stakeholder interviews, including revisiting experts identified in Phase 1, to understand how best to increase investor education, confidence, and engagement. This phase will similarly culminate in a white paper that will serve as the basis for engagement with government officials in the U.S. and India.

Executive Summary

India stands at a pivotal moment in its clean energy transition, one with profound implications for its domestic economic priorities, global climate goals and for the future of the U.S.-India economic and strategic partnership. This paper examines the current landscape of clean energy investment in India, with a focus on identifying the risks and barriers to U.S. investment in India's clean energy transition, including solar, wind, electric vehicles, energy storage, hydrogen, and nuclear. These findings lay the groundwork for a subsequent phase of work aimed at identifying policy solutions that can unlock capital, build institutional capacity, and deepen U.S.-India collaboration on the clean energy transition.

Risks and barriers from both U.S. and Indian perspectives included in this paper draw on stakeholder interviews with market investors, former government officials, academics and think tank experts, and philanthropy leaders. These interviews identify the following chokepoints in India’s clean energy transition:

U.S. PERSPECTIVE

- Operational risk stemming from the poor financial health of energy distributors, the reluctance of some local governments to honor offtake agreements, or attempts to revise or renegotiate existing power purchase agreements
- Physical infrastructure bottlenecks like a lack of reliable power grids, battery storage, or charging stations that prevent clean energy projects from operating at full capacity and limits financial returns for investors
- Insufficient risk mitigation instruments or appetites by U.S. financial institutions and other public financers that reduce investment in emerging-market clean energy projects

INDIA PERSPECTIVE

- An early-stage 'valley of death' where new clean energy technologies fail due to insufficient funding required for real-world deployment
- Insufficient diverse funding structures that combine different types of financing like high- and low-risk loans, private instruments, and public guarantees for large-scale projects
- Weak institutional capacity at the state/cluster level to absorb and deploy concessional finance

Political and Policy Background

Since returning to office in January 2025, the Trump administration has enacted a sweeping reversal of U.S. climate and clean energy policy that has dampened both domestic investment and public international climate finance flows. Domestically, the administration moved quickly to freeze and roll back funding for clean energy projects available under the Inflation Reduction Act and issued executive orders halting offshore wind leasing and EV charging infrastructure programs. On the international level, the Trump administration withdrew from the Paris Agreement for the second time and halted nearly all international climate finance, sending a clear global signal about the U.S. government's stance on climate. This policy inconsistency has eroded some of the regulatory predictability that underpins long-term clean energy investments and the effects have reverberated internationally. For India specifically, U.S. development

finance institutions and bilateral climate programs have historically served as catalytic anchors for private capital mobilization in India's clean energy sector. When the credibility and continuity of that public financing layer is called into question, private investors face a less favorable risk-return environment, making it harder to deploy capital into complex or early-stage clean energy projects at the scale India requires. Several stakeholders emphasized that barriers to investment do not arise solely from conditions within India. Constraints within the U.S. policy, financial, and institutional ecosystem also influence investment decisions and can limit capital flows even when opportunities in India are commercially attractive.

Despite this, India has continued to press forward on its clean energy transition. The government has increased public investments in solar, wind, nuclear and green hydrogen, reinforced by the Union Budget 2026-27 allocations detailed below in this paper. This divergence in national trajectories can create a degree of strategic and policy uncertainty at the government-to-government level, adding another layer of complexity to an already challenging bilateral relationship. Differences in government priorities may make it more difficult to sustain or expand the policy, regulatory and institutional mechanisms that can facilitate cross-border clean energy investment.

For private investors, however, the implications are likely to vary by sector and commercial opportunity. Strong market fundamentals and the prospect of attractive returns can continue to drive investment even in the absence of closely aligned policy signals. At the same time, for projects that depend more heavily on long-term policy support, regulatory predictability or government-to-government cooperation, differences in national priorities may introduce additional uncertainty and affect investment decisions.

Clean Energy Investment in India

India’s transition to low-carbon energy is progressing rapidly on commercial solar and wind capacity but remains underfunded across the technologies and delivery channels needed to meet national medium-term climate and industrial goals. Deployment capital for utility-scale renewables and EV rollout is plentiful; the missing pieces are: applied research and development that moves lab results into field pilots, bankable capital stacks for first-of-a-kind technological ventures like green hydrogen plants and asset-heavy projects like grid transmission expansion and battery storage, and professionally

managed subnational delivery platforms that channel concessional finance, such as loans provided at below-market interest rates, to small businesses and medium-sized enterprises (MSMEs).

India's energy transition has attracted more private investment in recent years. Between 2017 and 2025, private market deal volumes in the energy transition sector rose from 134 to 230 total transactions, with total private deal value peaking at USD 13.6 billion in 2023. The bulk of investment in India's power generation capacity and transmission networks continues to come from domestic sources, but foreign capital has been playing an increasingly important complementary role. Importantly, stakeholders emphasized that while international dollar-denominated investors face more challenges with returns, India's domestic banking sector and local financial markets remain relatively liquid and competitive.

Foreign direct investment (FDI) in India's power sector has grown steadily, increasing from about 1% of India's renewable energy investment in FY21 to around 8% in FY25. In the first three quarters of FY25 alone, there was USD 3.4 billion worth of FDI in India's renewable energy sector. This growth has been facilitated by regulatory reforms permitting 100% FDI across electricity generation sources (with the exception of nuclear) and transmission infrastructure. Notably, the passage of the Sustainable Harnessing and Advancement of Nuclear Energy Act (SHANTI Act) in December 2025 created a pathway for cross-border investment in nuclear energy by allowing up to 49% of foreign equity in civilian nuclear power projects.

The total amount of private investment from the U.S. is opaque, yet some recent major U.S. investments in India's clean energy transition are known. Brookfield Asset Management, a private equity firm, announced in late 2025 an investment of USD 12 billion in renewable energy projects over three years in Andhra Pradesh, including financing for a clean energy powered data center. Private equity firm KKR announced a USD 450 million investment in Hero Future Energies in 2022. First Solar, a PV manufacturer from Arizona, opened a USD 700 million manufacturing plant in Tamil Nadu in 2024 financed through a mix of public and private capital.

India has emerged as the world's largest recipient of development finance institution (DFI) funding for clean energy. In 2024, India received approximately USD 2.4 billion in project-type interventions in clean energy generation from DFIs. Under the Biden administration, the U.S. DFC announced the creation of an up to USD 2 billion fund to help accelerate India's clean energy transition. Multilateral development banks (MDBs) have maintained substantial commitments to India's clean energy transition, though their role relative to the scale of need remains a subject of debate among respondents.

Between 2015 and 2020, total climate finance commitments by MDBs globally exceeded USD 308 billion, with India ranking among the top four developing and emerging recipient countries, receiving more than USD 10 billion.

India's clean energy transition goals are ambitious, but ambition alone does not mobilize capital. The persistent investment gap is not fundamentally caused by a global shortage of capital. Rather, it stems from a mismatch between the risk profiles of energy transition projects and the ability for projects to produce returns required by private investors. Many of the most important components of the transition, such as transmission expansion, storage, grid balancing, critical-mineral refining, industrial retrofits, and clean technologies in the pre-commercial/early market stage, are capital-intensive, high-risk, carry operational uncertainties and are often slow to generate returns, which makes private investors cautious without stronger policy certainty or de-risking support. Stakeholders emphasized that commercial solar and electric bus projects backed by sovereign or municipal payment security mechanisms have been more successful at generating predictable, timely returns, while utility-scale solar, and circular economy projects have struggled to demonstrate viable returns. In practice, public budgets can signal intent and create momentum, but it cannot by itself cover the multi-year investment required to move projects from announcement to implementation. Instead, public allocations must be deployed strategically as catalytic capital to de-risk investment-ready projects and crowd in available private capital.

The Union Budget's allocations therefore matter not just as sectoral line items, but as signals of where public capital is being directed to unlock larger flows of private and concessional finance. At the same time, these allocations also highlight the scale of the remaining financing challenge, which can only be addressed through coordinated policy, diversified finance, and public-private institutions that can convert concessional capital into bankable opportunities.

India has set ambitious targets across renewables (500 GW of non-fossil energy capacity by 2030), hydrogen (5 million metric tonnes (MMT) of green hydrogen per year by 2030, alongside about 125 GW of additional renewable capacity to support it), and energy-efficiency pathways (India's revised climate target is to reduce emissions intensity of GDP by 45% by 2030 from 2005 levels, with the Energy Conservation (Amendment) Act and BEE's programs providing the main policy framework). Delivering on those targets requires not only capacity additions but also large investments in: grid flexibility and storage, critical-materials processing, industrial decarbonisation (steel, cement, chemicals) and MSME retrofits.

Renewables Sector

The Ministry of New and Renewable Energy (MNRE) allocated USD 3.90 billion (Rs 32,915 crore), up 30% from 2025-26 revised estimates, driven by the national policy, 'PM Surya Ghar Muft Bijli Yojana' amounting to USD 2.61 billion (Rs 22,000 crore). In the solar sector, financing stood at USD 3.62 billion (Rs 30,539 crore) marking a 32% increase. Wind and other renewables, including grid/off-grid hydro, amounted to USD 65.3 million (Rs 5.51 billion) with bioenergy standing at USD 32.6 million (Rs 2.75 billion). Central green energy corridors were allocated USD 71 million (Rs 5.99 billion).

Critical Minerals

The Centre in the annual budget announced additional funding towards the 'National Critical Mineral Mission' with an outlay of USD 47.8 million (Rs 440 crore) under the Ministry of Mines. The total ministry funding dedicated to the sector sits at USD 4 million (Rs 34,300 crore). The budget exempts basic customs duty on capital goods for critical mineral processing. The central government is actively amending rationalized royalties for 24 critical minerals domestically to attract the private sector in auctions. Additionally the Union Budget announced the 'Rare Earth Strategy 2026-27' targeted at the development and production of rare earth permanent magnets with an outlay of USD 792 thousand (Rs. 7,280 crore).

Micro, Small, and Medium Sized Enterprises (MSMEs) and Startups

The Small and Medium-Sized Enterprises Growth Fund for future champions outlay was reported at USD 1.09 billion (Rs 10,000 crore). The 'MSE-GIFT Scheme' offers a 2% interest rate discount (subvention) for MSMEs adopting green/energy-efficient tech whereas the 'MSE-SPICE' scheme provides 25% direct cash (capital subsidy) for circular economy related projects. Public capital expenditure for energy infrastructure was at USD 135 billion (Rs 12.2 lakh crore) overall.

Nuclear Sector

In December 2025, India passed the Sustainable Harnessing and Advancement of Nuclear Energy Act (SHANTI Act), the most sweeping reform of India's nuclear regime, repealing the previously existing Atomic Energy Act from 1962 and the Civil Liability for Nuclear Damage Act from 2010. India aims to achieve 100GW of nuclear capacity by 2047. The SHANTI Act opens India's nuclear sector to regulated private and foreign participation. For the first time, non-state entities may hold up to 49% equity in civilian nuclear power projects, enabling joint ventures, international technology transfer, supply-chain partnerships, and new investment inflows. This shift repositions nuclear energy as a commercial opportunity.

U.S. PERSPECTIVE

Identified Risks to Clean Energy Investment in India

Against this backdrop, U.S. stakeholders have identified risks and barriers that continue to constrain investment at the scale required to meet India's clean energy goals. These risks include 1) operational, 2) regulatory, 3) political and geopolitical, 4) financial, 5) supply chain, and 6) systemic risk.

Operational risk

Energy distributors are in poor financial health due to accumulated debt, high power procurement costs, transmission and commercial losses, and constraints on aligning tariffs with rising supply costs. In some cases, uncertainty surrounding the implementation of offtake agreements, including instances where state governments have revisited existing power purchase agreements, has also affected investor confidence. The majority of DISCOMS are rated as B, B-, C, or C- by the Indian Ministry of Power. To help improve payment discipline and strengthen the sector's financial health, the Ministry introduced the Electricity (Late Payment Surcharge and Related Matters) Rules in 2022, which permit power generators to curtail supply in the event of persistent payment delays.

Regulatory risk

Respondents indicated that there was a lack of clarity and certainty around regulations pertaining to foreign investment in clean energy projects of all scales. At the national level, there is uncertainty about the long-term climate and energy priorities for the government, including clean energy tariffs and incentives for foreign investors. Requirements around the inclusion of local content are perceived as costly. Also, regulations pertaining to power and transportation are set on the state level, not the national level, making it challenging for investors to understand regulatory differences from one state to the next or across states. India released a draft green taxonomy in May 2025; finalizing the taxonomy will likely help clarify standards and requirements around investment in clean energy projects.

Political and geopolitical risk

Since January 2025, the U.S.-India bilateral relationship has been tested. Uncertainty pertaining to the flow of goods and resources between the countries has stemmed from drawn out trade negotiations. Beyond the bilateral relationship, the U.S.

administration's stance toward clean energy has introduced an additional layer of risk to investors looking to support these types of projects in India.

Financial risk

Currency risk also remains a significant challenge for foreign investors. As clean energy investments are typically financed in U.S. dollars while project revenues are earned in Indian rupees, the depreciation of the rupee against the dollar can erode returns over time. This exchange rate risk makes it more difficult for investors to achieve target returns, such as 15% over a four-year investment horizon. Multilateral development banks and development finance institutions have limited capacity to absorb or hedge this risk at scale, and there is no straightforward policy solution to fully mitigate it.

Additionally, one respondent noted that the private debt markets in India were not deep enough to finance the magnitude of projects needed to reach India's renewable energy goals. The lack of debt in the market translates into a lack of liquidity available to finance projects, making it difficult for second and third tier renewable energy project developers to receive needed financing. Conversely, two other stakeholders argued that debt financing is readily accessible and that for most renewable energy projects in the infrastructure stack, 70% of financing can come from debt and the rest in equity. They argued that equity holders bear more of the risks from project execution, off-taker payment, and land acquisition, and without genuine equity protection mechanisms, project developers struggle to secure the risk capital to bring projects to market.

Another source of financial risk comes from bond issuers, most of which have a credit rating below investment grade, meaning they are rated as high-risk borrowers. This limits investment, because they are unable to commit to the long-term investment required to complete these projects. Furthermore, project developers face high capital costs.

It was noted that there is not enough risk capital available to derisk investments. Multilateral development banks are well structured to take on the role of derisking and are equipped with the tools, like guarantees, to help crowd in private capital. However, these institutions have traditionally been relatively risk-averse, given that public financing is scarce and heavily scrutinized. Yet, multiple respondents said that they thought the development finance institutions and international financial institutions could do more to take on risk for these projects.

Supply chain risk

Dependence on China for renewable energy technology presents risk for investors. Both the U.S. and India have a tenuous relationship with China, which could jeopardize access to raw materials, such as minerals, and technology. In 2025, China implemented export controls on certain rare earth elements, hurting manufacturers in the U.S., Europe, and elsewhere, illustrating their dominance in mineral supply and processing. In response to this risk, the Ministry of Power has instituted a 20% local content requirement for battery energy storage projects, which presents new challenges for these projects, since this requirement can cause short-term supply shortages and procurement bottlenecks for developers.

Systemic risk

Respondents noted that nascent markets, lack of grid infrastructure, lack of energy storage, limited EV charging infrastructure all contributed to a riskier environment.

U.S. PERSPECTIVE

Identified Barriers to Clean Energy Investment in India

While India has made significant progress in renewable energy deployment and possesses relatively mature local financial markets, stakeholders consistently identify structural barriers that prevent investment from flowing at the scale needed to meet the country's annual USD 400 billion financing requirement over the next five years. These barriers are not risk factors to be priced into returns, but rather constraints to capital deployment regardless of risk appetite. These barriers fall into two main categories: 1) infrastructure deficits that physically limit project deployment and grid integration; and 2) regulatory and institutional obstacles that create uncertainty, delays, and inconsistent frameworks across jurisdictions.

INFRASTRUCTURE BARRIERS

Grid Connectivity and Transmission Infrastructure Deficits

India's electricity grid represents a fundamental constraint on renewable energy deployment, with approximately 40% of the required USD 400 billion five-year investment needed for transmission infrastructure and storage rather than generation

capacity. The grid's inability to efficiently absorb and transmit variable renewable energy creates curtailment risks – situations where power grids force renewable energy plants to intentionally waste generated power because the wires cannot handle it – in regions with high solar and wind potential, particularly along India's western corridor. This infrastructure deficit creates a situation where generation capacity cannot be effectively utilized even when built, making transmission and grid modernization a prerequisite for additional generation investment. The scale of required investment exceeds current state-level funding capacity, and financing structures for transmission differ significantly from generation projects, requiring distinct regulatory approaches and public-private models that have not been fully developed.

Energy Storage Bottlenecks

Stakeholders offered nuanced, and at times, competing perspectives regarding the exact nature of India's energy storage challenge. One expert emphasized that battery hardware costs have fallen significantly in India and globally, supported by enabling conditions created by the Ministry of Power and central regulator. From this perspective, high technology costs are no longer the main constraint, rather, declining prices have compressed profit margins for private investors seeking high yields. Conversely, another expert argued that energy storage has now surpassed physical grid transmission as India's single largest operational hurdle. In this view, rapid renewable capacity additions have led to overproduction that cannot be utilized without storage, and off-grid rural electrification remains bottlenecked. Under this second framing, India's paramount challenge is rapidly scaling domestic storage manufacturing capacity free from Chinese minerals and components.

Underdeveloped EV Charging Infrastructure

Electric vehicle adoption, particularly for four-wheelers (currently below 5% penetration), is severely constrained by the absence of adequate charging infrastructure. Infrastructure development is not economically viable for most private companies without additional support mechanisms, creating a circular problem where vehicle adoption is limited by charging availability while infrastructure investment is limited by vehicle penetration. Unlike two-wheelers and three-wheelers, which have achieved significantly higher adoption rates due to shorter range requirements, four-wheeler charging demands more extensive infrastructure networks. Battery swapping technology is currently impractical for larger vehicles due to battery size and weight constraints. The State Transmission Utilities responsible for this infrastructure lack the

bankability that the Solar Energy Cooperation of India (SECI) model provided for renewable energy PPAs, meaning there is no institutional structure to derisk transportation utility investments and enable private capital deployment at scale.

Land Acquisition Challenges

Securing land rights for renewable energy projects remains mired in bureaucratic processes, legal disputes, and inconsistent state-level procedures. While certain regions, particularly Gujarat's desert areas for solar development, offer more favorable conditions, developers face frequent litigation over land acquisition and transmission line right-of-way, creating project delays and cost overruns. The absence of comprehensive land banks, despite government advocacy for their creation, forces each developer to navigate complex acquisition processes independently. For transmission line development, the challenge compounds as continuous land rights must be secured across multiple jurisdictions. Single-window clearance mechanisms exist in some progressive states and have proven effective when implemented, but their absence in many states and lack of standardization at the federal level creates significant transaction costs and limits the ability to deploy capital efficiently across regions.

INSTITUTIONAL AND REGULATORY BARRIERS

Fragmented State-Level Regulatory Environments

Clean energy investment in India must navigate significant regulatory inconsistencies across states, with substantial variation in permitting processes, bond issuance structures, subsidy schemes, and cross-subsidization policies. Some progressive states offer streamlined single-window clearance mechanisms and supportive frameworks, while other states maintain cumbersome bureaucratic requirements that can delay projects by years. This state-by-state variation forces investors to develop customized strategies for each jurisdiction, increasing transaction costs and limiting scalability. The structuring of investment instruments changes based on the public-private capital mix and varies by state, making it difficult to develop standardized approaches or replicate successful models across regions. While bodies similar to the national Invest India initiative exist in some states to help navigate the investment environment, the absence of federal harmonization or minimum standards creates an uneven playing field that favors investors with extensive local knowledge and resources to navigate multiple regulatory regimes.

Permitting Delays and Bureaucratic Processes

The bureaucratic requirements for setting up clean energy projects—particularly manufacturing facilities—create substantial delays and uncertainty. While some states have made progress in streamlining approvals, the overall permitting environment remains challenging, with multiple agencies involved at both state and federal levels. These delays are particularly acute for projects requiring environmental clearances, grid connection approvals, and land-use permits. The absence of clear timelines for permit decisions and inconsistent application of regulations across jurisdictions creates planning uncertainty that deters investment. Even when single-window clearance systems exist, their effectiveness varies significantly based on state capacity and political will. For transmission projects and manufacturing facilities, the complexity multiplies as developers must coordinate approvals across multiple agencies and jurisdictions, with no guarantee of process completion within predictable timeframes.

Local Content Requirements

India's domestic manufacturing policies, particularly for solar components, create planning uncertainty and cost pressures for developers. While designed with industrial policy goals to build domestic capacity and reduce Chinese import dependence, local content requirements often lack predictable phase-in schedules that would allow investors to plan supply chain strategies effectively. The requirements vary by technology and component type, with specific timelines that may shift based on policy changes. This unpredictability prevents developers from optimizing global supply chains or making long-term procurement commitments. Although production linked incentive (PLI) schemes aim to encourage domestic manufacturing through subsidies, the interaction between PLIs and local content requirements creates complexity in project planning and cost estimation. The requirements serve legitimate industrial policy objectives but create a barrier to cost-competitive project development when implemented without sufficient clarity on future trajectories.

INDIAN PERSPECTIVE

Identified Risks to Clean Energy Investment in India

Indian stakeholders refer to mainly 1) regulatory and policy related challenges and 2) international supply-chain dependence in the critical minerals sector. These risks are not limited to one part of the value chain; they span regulatory and policy uncertainty, financial de-risking challenges, heavy supply-chain dependence, and operational constraints.. Together, they raise the cost of capital, slow project execution, and make it harder to mobilize long-term private investment.

Regulatory & Policy Risk

Sudden changes undermine finance. Recent retroactive tariff duties, such as the solar panel import duties which changed mid-shipment, and uncertain policies on storage and EV charging raise political risk premiums. Tariff uncertainty on batteries, steel, and photovoltaics makes investors demand higher returns. Inconsistent subsidies on renewables versus fossil fuels and a lack of a 'climate mandate' in the financial sector, such as priority-sector lending quotas, skew flows toward conventional assets. Indian stakeholders noted that many U.S. investors lack familiarity with India's state-level regulatory environments, local financing structures, and project-development ecosystem. While regulatory complexity exists, information asymmetries and limited on-the-ground engagement also contribute to investment hesitancy. Greater investor education, technical assistance, and market transparency could help bridge this gap and improve investor confidence.

Supply-Chain Dependence

India has virtually no domestic battery or rare-earth production. Almost all lithium-ion, magnets, etc. are imported with supply chains concentrated in China. This externalizes cost and risk. Interviewees note geostrategic danger. Without research and development on alternative battery chemistries or magnets, transition requires vulnerability management via stockpiles and joint ventures. India recognizes this vulnerability and is responding at the policy level through initiatives such as the National Critical Minerals Mission and the Production Linked Incentive (PLI) Scheme for Advanced Chemistry Cell Batteries. These are steps in the right direction, but they are still waiting for domestic demand to catch up and unlock their full potential.

Constrained Risk Appetite of Development Finance Institutions

Although U.S. and multilateral development finance institutions are intended to mobilize private capital into emerging markets, stakeholders observed that these institutions often operate under conservative risk parameters and extensive oversight requirements. As a result, financing is frequently directed toward mature, lower-risk projects rather than the first-of-a-kind technologies, early-stage infrastructure, and innovative business models where catalytic capital is most needed.

Yet India has demonstrated that targeted risk-sharing mechanisms can unlock private investment. The Solar Energy Corporation of India's (SECI) payment security mechanism has improved the bankability of renewable energy projects by reducing counterparty risk, while the National Investment and Infrastructure Fund (NIIF) and the Green Growth Equity Fund have used blended finance to crowd in institutional and private capital for climate investments. These examples show that concessional finance is most effective when it is deployed strategically to de-risk investment rather than replace private capital.

Institutional Investor Allocation Constraints

Large U.S. pension funds, insurance companies, and asset managers often face fiduciary, regulatory, and internal risk-management requirements that limit exposure to emerging-market infrastructure projects. Even where investment opportunities in India appear attractive, portfolio allocation rules, currency-risk considerations, and liquidity requirements can restrict participation at scale.

High Currency Hedging Costs

For many U.S. investors, managing exchange-rate exposure between the U.S. dollar and Indian rupee can significantly reduce project returns. Hedging instruments remain expensive for long-duration infrastructure investments, creating an additional cost that can make otherwise viable projects less competitive relative to domestic investment opportunities.

Financial Risk

A further challenge is that conventional credit-rating methodologies may not fully capture the long-term value and relatively stable cash flows associated with renewable energy projects. Many developers receive ratings below investment grade despite operating projects backed by long-term power purchase agreements, government support mechanisms, or predictable revenue streams. As a result, ratings may overstate risk and restrict access to affordable capital. This has led to calls for rating agencies and

financial institutions to refine their assessment frameworks so that they better reflect project fundamentals, climate-related opportunities, and the lower operational risks associated with mature renewable technologies. Improved credit assessment methodologies could help unlock investment without necessarily requiring a fundamental change in the underlying projects themselves.

INDIAN PERSPECTIVE

Identified Barriers to Clean Energy Investment in India

Beyond the policy and market risks discussed, India's clean energy transition is further constrained by lack of sufficient 1) translational research and development pipelines, 2) layered financing structures, 3) state-level platforms, 4) MSME credit channels, and 5) reliable data systems to make clean-energy opportunities bankable at scale.

Early R&D gap

India's lab-stage innovations struggle to reach pilots while public research and development is only at ~0.64% of GDP. From the perspective of private investors, 90% of climate finance goes to deployment, creating a fundamental tech risk. Investor's priorities require a shift towards innovation, lacking significant translational funding. Without translational funding, many promising ideas die in the laboratory before they can become a real-world pilot project.

Blended-finance misuse

Current public-private funding models often misuse public money by acting as a financial safety net for wealthy investors. Instead of driving new technology and demand, public money is being used to subsidize investors' returns through equity cushions, where public money absorbs the first wave of financial losses, or through guarantees with government-backed insurance against project failure. Interviewees flag that these subsidies need to be directed towards smaller players as well. While these safety nets may inflate returns for incumbent investors it often does little to build new solutions and spark actual innovation.

Capital-stack gaps

Large-scale projects like renewable manufacturing factories, hydrogen plants and material startups or for example, advanced startups dedicated to discovering advanced physical materials lack multi-tranche financing that offer flexible combinations of loans and investments. While Western markets offer complex capital stacks that mix different types of loans, grants, and investments to fund a single project, India currently lacks these diverse options. Specifically, there is a shortage of flexible funding designs, such as government-backed insurance or hybrid loan-and-investment structures.This makes it very difficult for small- and medium-sized startups to secure the funding they need to grow. While many climate ventures require and deserve large capital funding, the available financing is mostly limited to small amounts. Initial Series A venture capital financing is typically capped at USD 240,000–600,000 (Rs. 2–5 crore). This creates a Series B "funding valley" where companies are left starved of the capital they need to scale their operations. The challenge is particularly evident among IIT-incubated deep-tech ventures that develop promising technologies but struggle to progress beyond the seed stage, as well as green hydrogen electrolyzer startups that face difficulties securing the larger Series B investments required for commercial deployment and manufacturing scale-up.

State capacity and decentralized finance

Indian states and regional industrial clusters lack investment-ready platforms to absorb concessional funds or match private capital. Union ministries cannot allocate these specific funds on behalf of individual states. Practitioners propose bottom-up state climate funds. However, only a few states, including Tamil Nadu, Kerala, and Maharashtra, have set up their own government-backed investment funds for green projects. The general understanding stems from the notion that every federal state needs its own platform as central agencies can’t make any long-term commitments separately. Without state-level champions, multilateral flows (GCF, ADB, etc.) often stall in federal intermediaries like the Small Industries Development Bank of India (SIDBI), failing to reach MSMEs.

MSME credit gap

Over 80% of India’s MSMEs are micro/small and lack access to formal banking with only ~16% utilizing formal financing. Traditional banks see them as too high-risk due to informal financial accounting. Non-Banking Financial Companies (NBFCs) and fintech lenders are starting to use alternate data regarding Goods and Services Tax (GST) and other invoices such as solar and home loans. However, large Non-Performing Loans

(NPL) concerns, meaning unpaid, defaulting debts, and a lack of collateral hamper energy efficiency lending. While Energy Service Companies (ESCOs) want to finance efficiencies for MSMEs, traditional banks state that the current market is so big that we'll just focus on the regulated large factories. Lenders cite poor enforceability and a lack of standard contracts (ESCO paybacks, energy savings) as hurdles because it is difficult to guarantee they will be paid back out of a business' energy savings.

Adaptation and Resilience Financing Gap

Stakeholders noted that climate finance discussions often focus on mitigation technologies such as renewable energy generation, electric mobility, and green hydrogen, while adaptation and resilience investments receive comparatively less attention despite India's growing exposure to climate-related risks. Rising temperatures, water stress, extreme weather events, and disruptions to agricultural productivity are increasing the need for investments in climate resilience across rural and urban economies. However, adaptation projects often face greater financing challenges than mitigation projects because their benefits are dispersed, long-term, and difficult to monetize directly. As a result, adaptation and resilience remain underfunded relative to their economic and social importance, creating a significant gap in India's broader climate transition agenda.

End-User Financing Gap for Climate-Smart Technology Adoption

Within the above context, considerable attention is devoted to financing large-scale renewable energy projects and industrial decarbonization, stakeholders highlighted a parallel challenge: financing the adoption of climate-smart technologies by end users. Farmers, rural households, and small businesses often lack access to affordable credit needed to adopt technologies such as solar irrigation pumps, distributed renewable energy systems, efficient cooling technologies, micro-irrigation systems, precision agriculture tools, and climate-resilient agricultural equipment.

The challenge is distinct from technology development or project finance. Even when technologies are commercially available and technically proven, uptake remains constrained by limited access to affordable financing, high upfront costs, and insufficient mechanisms to aggregate demand at scale. As a result, the benefits of the clean energy transition and climate adaptation efforts may not reach many of the communities most vulnerable to climate impacts.

Expanding concessional lending, blended-finance structures, pay-as-you-save models, and innovative retail financing mechanisms for farmers and small enterprises could help accelerate technology adoption while improving resilience, productivity, energy

access, and climate adaptation outcomes.

Insufficient Pipeline of Investment-Ready Projects

Stakeholders consistently emphasize that one of the primary constraints on capital deployment in India is not a scarcity of global finance, but a shortage of bankable, investment-ready project pipelines.Capital will inevitably flow where data clarity and meaningful, predictable returns exist. However, many clean energy projects struggle to progress from concept to financing because they lack the technical preparation, commercial structuring, regulatory approvals, and revenue certainty required by investors.

The problem is particularly pronounced in emerging sectors such as green hydrogen, battery storage, industrial decarbonization, climate-smart agriculture, and distributed clean energy systems, where project models remain relatively new and institutional expertise is still developing. At the state and local levels, limited technical capacity can further delay project preparation and execution.

As a result, investors frequently encounter a disconnect between stated investment demand and the availability of bankable projects. Expanding project-preparation facilities, technical assistance programs, and state-level implementation platforms could help bridge this gap and improve the absorption of both private and concessional finance.

Data and information gaps

India has made significant progress in publishing energy and climate-related data through platforms such as NITI Aayog's India Energy Dashboard, the National Institute of Wind Energy's Solar Atlas, the Bureau of Energy Efficiency's Perform, Achieve and Trade (PAT) database, and renewable energy and transmission datasets maintained by MNRE and the Central Electricity Authority. However, these datasets remain fragmented across ministries and agencies, use different formats and geographic identifiers, are updated on different timelines, and are often not interoperable or machine-readable. As a result, investors must independently combine multiple sources including resource maps, transmission capacity, critical mineral data, industrial land availability, DISCOM financials, and state incentive policies, to assess the commercial viability of projects. Rather than a lack of data, the challenge is the absence of integrated, investment-grade information that links technical, financial, regulatory, and geographic datasets into a single decision-making platform, increasing transaction costs and due diligence requirements.

Limited Exit Opportunities

Indian stakeholders have heard from U.S. investors that clean energy investments often require clear exit pathways through secondary markets, refinancing opportunities, acquisitions, or public listings. While India's infrastructure investment ecosystem has matured significantly, secondary markets for certain clean energy asset classes remain relatively underdeveloped compared to more established markets. This can reduce liquidity and make investors hesitant to deploy capital into newer technologies or early-stage projects.

Conclusion

India remains one of the world's most important clean energy investment destinations, yet significant barriers continue to limit the flow of capital needed to achieve its climate and industrial ambitions. These challenges span both Indian and U.S. ecosystems, from project development and regulatory complexity to risk allocation and investor confidence. The findings of this paper provide a foundation for the next phase of work: identifying practical reforms and collaborative solutions that can unlock investment, build trust, and accelerate the clean energy transition.