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The Regulatory and Market Landscape for Climate Finance into India's Renewable Energy Sector

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Executive Summary

India's clean energy landscape has developed rapidly over the last decade, enabled by an improving policy and regulatory architecture. Nevertheless, challenges remain that have impacted the scale and direction of climate finance flows to this sector, particularly from international sources. As India aims to further ramp up the pace of its RE deployment, both large- and small-scale, this brief analyzes these challenges from regulatory, institutional mandate, coordination and market development angles, and explores ways to address them.

Based on a literature review and 13 expert interviews in the large scale renewable energy, rooftop solar, and energy efficiency sectors, we find that regulatory challenges are relatively minor in the large scale RE sector, and that this may cause international funders to channel finance accordingly. In other words, the established governance structure facilitates a relatively easy flow of climate finance. On the other hand, the small scale renewables and energy efficiency sectors have received comparatively less policy support, and a lack of awareness and scale contributes to considerably less funding flowing to these sectors.

Overall, while the government has an important role to play in continuing to improve the policy and regulatory environment for clean energy finance – including international flows into the country – there is an equal role for funders to adapt their funding processes and scopes to the domestic context. Harmonizing these parallel efforts will require improved coordination between the various actors, including through more defined processes for consultations within the overall institutional architecture for climate action in India.

Introduction

As the window to limit global temperature rise to 1.5°C above pre-industrial levels closes, countries around the world are ramping up the scale of their climate ambitions, through rafts of policies, partnerships, instruments, and institutions. This ramping up is however uneven across countries, and its implementation hinges upon redirecting significant amounts of finance towards low-carbon pathways. Such redirection is determined by market signals as well as by government mandates and incentives. In particular, developing countries – under the principle of common but differentiated responsibilities and respective capabilities (CBDR-RC) – seek significant amounts of international public finance from developed countries to decarbonise their economies while pursuing multiple development objectives.

India is one prominent example, balancing two positions in the global climate negotiating space. On the one hand, it is a low-income country with 2022-23 per capita net incomes of INR 98,374 (USD 1190)(Ministry of Statistics and Programme Implementation 2023), and has contributed only 4% % to cumulative global emissions between 1850 and 2019, despite having more than 17% of the world's population (Ministry of Environment, Forest 2022). On the other hand, it is already the 3rd largest emitter (3.9 $GtCO_2e$ in 2022) (Crippa et.al 2023), and with its average annual GDP growth rate around 6-7%, it is projected by one study to emit around 6.3 **$GtCO_2e$** by 2050 under current pathways (Asia Society Policy Institute, 2022). The bulk of these emissions will come from the energy – and specifically electricity – sector. Electricity contributes to approximately 50% to India's CO_2 emissions (Rodrigues et. al, 2024) with a current generation of 1484 TWh (CEA, 2023a), and with demand projected to grow to nearly 5000 TWh by 2050 (Rodrigues et. al, 2024), it is critical to meet a large share of this through renewable sources. The future profile of India's electricity sector will tangibly impact the world's response to the climate crisis.

Decarbonising India's future electricity sector is a challenging task. Aside from regulatory, institutional, and political challenges, India will require large amounts of finance – including from international sources – to enable this transition. In particular, in 2009 developed countries had committed to annually mobilise USD 100 billion in climate finance by 2020 towards developing nations to help them mitigate greenhouse gas emissions and adapt to the negative impacts of climate change. Although the delivery of this commitment has been delayed and the amounts contested, international climate finance – particularly from public sources – can play a transformative role that can then catalyse further domestic and private finance.

The flows of climate finance have been mapped, and the methods and estimates are updated regularly, resulting in steady improvements in understanding the magnitude of flows, funders, and sectoral destinations. Such mapping efforts currently show that the volumes of climate finance flowing into India's energy sector are one quarter of estimated needs (Khanna, Purkayastha, and Jain 2022) This shortfall is on account of a number of reasons; various studies have explored the challenges facing the Indian energy sector and proposed policy and regulatory improvements as well as innovative mechanisms to channel more finance. However, the issue of how these flows are governed has been scantly explored, and initial studies propose exploring alternative approaches to governance, studying the roles of the public sector to steer international climate finance and a stronger role of recipient countries in such steering (Bracking & Leffel, 2021; Browne, 2022). This is an important aspect, because in a well-designed governance system, both direction and process of flows, appropriate use, as well as respective monitoring can contribute much to an effective use of climate finance.

This brief aims to better understand the institutional and regulatory landscape governing the flows of international public climate finance to India's power sector. In doing so, it aims to also highlight the different governance challenges faced by large-scale renewables against those faced by smaller scale rooftop solar and energy efficiency initiatives. A better understanding of these unique challenges is an important first step in improving the governance landscape to facilitate more efficient climate finance flows.

Methods and data

The findings and conclusions presented in this brief are based on two qualitative methods. First, we conducted a review of the global public climate finance governance system, with a specific focus on exploring governance arrangements in international public finance in India and comparable countries to understand and categorize common challenges. This review was primarily based on existing academic and grey literature. Second, the brief mapped the Indian regulatory and market landscape for renewable energy finance through a desk review, complemented by interviews with 13 energy finance experts representing think tanks, regulators, private banks, and bilateral aid agencies[1].

Although these interviews were initially focused on the overall clean energy sector, as it became evident that the landscape and challenges surrounding large-scale grid-integrated RE differed from those around smaller scale RE and efficiency initiatives, subsequent interviews were restructured to focus more individually on one or more of these areas.

Governance of international climate finance

Globally, investments in energy transition technologies reached USD 1.3 trillion in 2022 (IRENA and CPI 2023), largely concentrated in the renewable energy sector. India has a relatively less mature financial market compared with the global North, and huge low-carbon investment needs. In addition to investments needed in technologies and infrastructures (USD170 billion per year until 2030 to meet its climate goals according to the NDCs) (Khanna, Purkayastha, and Jain 2022), recent estimates suggest India needs USD 1 trillion over the next 30 years to manage a just energy transition (Chandra Bhushan, 2023). A brief snapshot of India's energy profile is provided in Box 1 below.

Such finance cannot easily be met domestically, or through private sources, particularly in areas that are not seen as commercially viable (such as in building technical capacity or in early-stage technologies). Mobilising concessional finance at scale, particularly where private finance needs additional incentives to participate, requires the support of international providers.

International climate finance providers – multilateral and bilateral – have engaged with India for several years, providing financial and technical support in a range of areas. More recently, they have increased their involvement in the renewable energy sector through greater quantities of finance, using a mix of instruments, working with a diversity of partners, to achieve a range of mutually reinforcing objectives (CPI 2023).

Despite this, in 2019, only 3.2% of global investment into renewable energy capacity (USD 9.3 billion) went to India, with solar energy accounting for 70% of this amount (UNEP, 2020) – the financial

[1] From Yes Bank, SECI, IREDA, GIZ, SIDBI, NTPC, IEEFA, Blackstone, CBI, JICA, ADB, and AFD

instruments that were used are typically based on risk appetites as well as on the gaps that funders are seeking to address (Table 1).

Box 1: India Energy Profile

India's installed power capacity as of April 2024 was **442.8 GW**, of which 144.7 GW (CEA 2024) GW was based on renewable sources of generation (excluding large hydro). This is projected to grow to a total of **817.2 GW** by 2030 and **4000 GW** by 2050 (CEA 2023b). Of this, 53.2% (435 GW) is projected to be from RES excluding large hydropower in 2030, with RES accounting for nearly all generation by 2050 (ibid).

The Indian government is pursuing greater shares of renewables through various policies that have been developed over time. These include the JNNSM, RPOs, PLIs, PSL, NDC targets, domestic targets, and subsidies and net metering for RTS. In parallel, it is also promoting greater energy efficiency in industry through the PAT scheme.

Investments in India's electricity sector will have to reach **USD 35-40 billion** annually to 2030, largely in T&D improvements and in large-scale grid-connected capacity (World Economic Forum, 2024). This does not include additional investments beyond 2030 or the costs of managing a just transition, estimated at **USD 1 trillion** over the next three decades (Bhushan, 2023).

A table in the annex lists ten clean energy projects in India that received international support. This list is not representative, but is meant to illustratively indicate the range and type of interventions provided thus far towards growing and commercialising a market. The projects listed in the table were chosen in line with the entities interviewed for the study. Most of the domestic implementing agencies were organizations such as Indian Renewable Energy Development Agency (IREDA, Small Industries Development Bank of India (SIDBI), Solar Energy Corporation of India (SECI), and Bureau of Energy Efficiency (BEE). This data highlights that most international agencies typically collaborate with public-sector entities that are bolstered by sovereign backstops. Additionally, most of the funds were provided in the form of loans, and there was limited information available regarding the interest and repayment rates by domestic implementing agencies. The main observation from the table is the **provision of finance to larger, relatively risk-averse initiatives**, rather than towards smaller scale undertakings.

Beyond these headline numbers, there is limited understanding about how international climate finance is governed – and therefore directed – at the national and sectoral levels and the different modalities employed for it. Hence, a review of governance structures – at the global and country levels – becomes necessary to explore whether climate finance is being directed appropriately towards developing countries' needs and priorities, and to understand what changes might be required to overcome barriers.

Table 1: Risks and Appropriate Financial Interventions

		Type of Risk	Instruments and Mechanisms
Political Risks		Political Violence/Instability Expropriation Convertibility Breach of Contract	Political Risk Insurance and Guarantees
Macroeconomic Risks		Commodity/Economic Currency and Interest Rate Volatility Financing	Currency, Commodity, and Interest Rate Swaps and Facilities Local Currency Loans/Facilities and Guarantees
Low-Carbon Market Risk	**Policy-Related Risks**	Policy (Legislative or Regulatory) Changes Policy Inconsistency	Regulatory Risk Insurance and Guarantees
	Technology and Operational Risks	Technology: • Performance • Obsolescence • Finance-Related • Exit Operational: • Infrastructure	Concessional and Flexible Finance Lines of Credit Funds, Structures Products, and Aggregation Insurance/Guarantees

Source: Venugopal and Srivastava, 2012

Bracking and Leffel (2021) note that governance structures influence how climate finance is allocated and managed, and that studying these structures helps to assess whether current financial mechanisms are effective in mobilizing necessary resources. Browne (2022) further states that it is important to recognize nuances in governance (e.g. differences between formal institutional arrangement and informal power structures), since this offers the opportunity for more effective, equitable, and context-specific distribution of climate finance.

We review broad elements of the climate finance governance system, drawing on examples from Brazil, India, and Indonesia to understand and categorize common challenges. While noting that literature on the governance of climate finance is sparse, we categorise findings under the buckets of regulatory and market aspects, and institutional mandates and coordination aspects. Subsequently, we directed the interviews with Indian stakeholders to explore the contours of governance of financial flows in the Indian power sector along these categories.

Regulatory and market

Initial studies suggest that the global climate governance system is currently an ad-hoc, voluntary, and decentralized landscape, with a lack of concrete accountability measures (Roesch et al, 2021). In emerging economies such as Indonesia – which need international climate funding support (Basri and Riefky 2023) – limitations to the evolution of international climate finance (Suroso et al., 2022) include an unclear definition of climate finance and the lack of standardized indicators to measure achievement of the NDC targets, thereby making it difficult to assess the impacts of finance. Additionally, there is no periodic monitoring of international climate funding support. This has led to instances of funding being miscategorised as climate finance. Furthermore, such countries also face difficulties accessing climate finance, especially grants, which are usually prioritized for low-income countries or countries with special needs, and loan instruments dominate its climate change funding.

Further, on the international public finance landscape, Bertilsson and Thörn (2021) note that climate finance providers press recipients to accelerate financialization. This top-down financialization, led by

the principal historical contributors to the climate crisis, puts recipient countries in a position where they have to make themselves investable, i.e., the burden is on them to attract investment from private sources rather than relying mainly on concessional funding. Khan et al. (2020) add that funds might above all serve the interests of donors, rather than developing countries' actual needs. Relatedly, Bracking and Leffel (2021) find that while climate finance has expanded, positive developments associated with it are partially undermined by increasing market-oriented logic.

This may not be uniformly true for all emerging economies, however. Isah et al (2023) found that public financing of renewables is relatively more prevalent in Brazil as opposed to private investments, with the Brazilian Development Bank (BNDES) serving as the single largest financier of RE in Brazil. The experience of BNDES in Brazil may offer insights into the types of policy frameworks and dynamic public finance (ibid) required for accelerating RE investments.

However, Kruglianskas and Victor (2019) highlight that the greatest weaknesses regarding Brazil's climate finance governance are rooted in the absence of any formal systems for feedback from implementing entities. They suggest a focus on a better MRV structure.

Literature thus suggests that international public climate finance should reflect recipient country contexts and priorities, build in appropriate monitoring and accountability mechanisms, and provide for building capacity over time.

Mandates and coordination

Beyond regulatory challenges, coordination issues between the climate finance providers and recipients were found to be significant barriers in emerging economies like Indonesia (Brown and Peskett, 2011). (Climate Action Tracker, 2021) also found that the country needs to demonstrate improved stakeholder engagement and more effective coordination across the institutional framework. This applies to Brazil too, where low levels of mainstreamed climate-related policies between ministries, and sectoral/national strategies, have been additional challenges (Climate Action Tracker 2022).

Decisions on climate action and climate finance in emerging economies are usually driven by political considerations, rather than by country-specific technical evidence (For Indonesia, see Larasati and Mafira 2023, for Brazil, see Climate Action Tracker 2022). For instance, the previous Bolsonaro government of Brazil undermined or reversed many previous achievements for climate action, such as policies/institutional structures and laws. Climate finance decreased under that administration, particularly since Norway and Germany (who were principal donors to the Amazon fund) froze their contributions in response to the weakening of environmental policies (ibid).

Basri and Riefky (2023) suggest a twofold agenda for ensuring international financing flows towards the climate agenda in Indonesia. On one hand, a more specific and ambitious financial commitment by international investors to increase the flow of funds and secondly, an expansion on the demand side of financing through project preparation. This will require collaboration between provider organizations and domestic stakeholders in forms such as technical assistance, capacity building and improving institutional capacity.

Overall, the governance landscape of climate finance internationally indicates that an appropriate enabling architecture will rely on broader political support, regulatory frameworks, coordination among stakeholders, and country ownership with a clear coordinating and signalling role for the domestic public sector.

The rest of this brief explores the governance landscape of international energy finance in India in greater depth. Understanding this landscape is an important step in making international climate finance more fit for purpose, and in improving India's ability to streamline and properly direct international climate finance flows.

Interview findings

The findings in this section are derived from the literature review and expert interviews – with representatives of 13 institutions – conducted on the Indian clean energy finance landscape. Starting from the nature of climate finance flows and the major players in the Indian clean energy sector, the section speaks about various aspects of climate finance governance pertaining to RE overall, and to RTS and EE more specifically.

The landscape of climate finance in India is large and varied. Khanna, Purkayastha, and Jain (2022) found that within the Indian clean energy sector, international financial flows (public and private) accounted for only 18%. Of total green finance[2] flows into India in 2020, over half was from public sources. Public finance has come domestically and internationally – for instance India is the largest recipient of funds from the Green Climate Fund (GCF, 2019). International public finance has supported a range of activities in the RE space, as seen in in the annex.

Climate finance in India is however highly heterogeneous, fragmented and dispersed (Singh 2017). The presence of various finance providers and an absence of a central coordinating unit is compounded by the lack of a coherent domestic climate strategy (ibid). However, given that over 80% of mapped green finance flows went to clean energy and energy efficiency, (Khanna, Purkayastha, and Jain 2022) and given the investment needs and mitigation potentials in the two, this brief focuses on these sectors.

Some of the prominent actors in the clean energy finance space in India are listed below, for greater familiarity with the domestic landscape.

International providers

- Multilateral financing institutions: These include the World Bank Group, the Asian Development Bank, and increasingly the Asian Infrastructure Investment Bank

- Bilateral aid and finance agencies: These are the entities through which developed country governments directly provide ODA and climate finance to recipient countries. Prominent entities in India include GIZ and KfW (Germany), DFC (USA), AfD and Proparco (France), FCDO (sentence each on green growth equity fund, TCX fund, green guarantee company) and CDC (UK), JICA and JBIC (the bilateral agency and private sector entities of Japan), as well as various funds and mechanisms set up through them

Domestic providers and intermediaries

Domestic financing institutions serve as both, direct providers of finance, as well as (in case of public sector banks) intermediaries through which international climate finance is channelled onwards to final recipients. They include:

- Public banks such as the State Bank of India (SBI), including those with a specific development mandate, such as the National Bank for Agricultural and Rural Development

[2] Covering energy efficiency, clean energy, and clean transport

(NABARD), Indian Infrastructure Finance Company (IIFCL), and the Small Industries Development Bank of India (SIDBI)

- The Power Finance Corporation (PFC), a non-bank financial corporation that is mandated to provide funding and financial support to the power sector, and its subsidiary Rural Electrification Corporation (REC) that funds power sector projects with market borrowings, international borrowings, and financial assistance

- Private banks such as Yes Bank and IDFC

Regulators and facilitators

- Electricity regulators: The Central Electricity Regulatory Commission is the power market regulator, and it aims to promote competition, efficiency and economy in bulk power markets, improve the quality of supply, promote investments and advise government on the removal of institutional barriers to bridge the demand-supply gap. It is supported in these tasks at the subnational levels by the various State Electricity Regulatory Commissions.

- Financial regulators: The Reserve Bank of India (RBI) is pursuing efforts to tackle climate change risks. It has undertaken several measures to regulate energy finance, including monetary measures to prevail on the continued resources flow to **energy efficient sectors**. It has also suggested opening a window to offer low-cost funds to banks for their onward lending to help lower the borrowing costs of firms operating in the renewable energy space. In addition, it has articulated the need and reasoning for lower reserve requirements for lending to green projects (Reserve Bank of India 2023). In 2015, the RBI included loans for generation of renewable energy and public utilities run on non-conventional energy as part of its priority sector lending (PSL) policy to incentivise the development of green energy sources. Under this scheme, firms in renewable energy sector are eligible for loans up to INR 30 crore (USD 3.6 million) (PIB, 2023), while households are eligible for loans up to INR 10 lakh (USD 12 thousand) for investing in renewable energy. Analysis suggests that this approach was successful in channelling more resources to the renewable energy sector (Srivastava and Trivedi 2023). The RBI is also a member of the Network for Greening the Financial System (NGFS). It is aided in its efforts by the Ministry of Finance, which among other actions has developed a green taxonomy and offered production-linked incentives for RE components.

- Facilitators: The Solar Energy Corporation of India (SECI), under the Ministry of New and Renewable Energy, was established in 2011 to facilitate the implementation of India's renewable energy objectives. Among other roles, it is a nodal agency for implementing various MNRE schemes, and works as a single-window clearance mechanism for tendering and approving large RE projects. The Indian Renewable Energy Development Agency (IREDA), also under the MNRE, was set up in 1987 for promoting, developing and extending financial assistance for RE-related projects; it is registered as a non-banking financial company.

- Energy Efficiency Services Ltd (EESL) is a public sector energy service company (ESCO) which supports the development and adoption of energy efficient technologies across sectors, with its subsidiary CESL particularly focused on electric mobility.

Implementers

- Public: The National Thermal Power Corporation (NTPC) is the largest power producer, and contributes over 25% to India's overall power generation. It is increasingly diversifying its generation portfolio to include greater shares of RE.

- Private: Large scale (e.g., Adani, Renew), small scale (MSMEs), residential. In 2020, Azure Power (with a funded capacity of 800MW), SB Energy and ReNew Power Limited were among the top renewable energy sponsors (CFA 2021).

- States-level distribution companies (discoms) are the typical purchasers of power generated by project developers/independent power producers (IPPs). Lending is also concentrated in particular states, with two states – Rajasthan (43%) and Gujarat – (34%) accounting for 77% of all RE lending in 2020. Lending in these states has increased significantly over time. Wind energy financing was particularly concentrated in Gujarat, comprising 85% of the value of all wind deals across the country. The reason for this is that Gujarat has high wind speeds and a favourable policy environment. Rajasthan also witnessed a 77% increase in renewable energy project financing. This increase in the concentration of renewable energy lending has more to do with a significant rise in lending in Rajasthan and Gujarat than a plunge in lending in the other states (CFA, 2021).

The section below summarizes key issues of the institutional and regulatory landscape governing the flows of clean energy finance that have both restrictive and facilitative effects, which are listed below. Some of these are general and particularly salient to large grid-scale RE, while others are specific to small rooftop solar (RTS) and/or energy efficiency (EE) in industries. The issues are clustered by topic.

Landscape for finance to RE and large-scale RE

The interviews conducted touched upon a range of topics relevant to the landscape of energy finance in India, and while there was broad agreement upon most of the challenges, in a few cases interviewees had divergent views. These divergences were based on the differing contexts of their operations, suggesting that policy and regulatory responses should be tailored to the specific types of actors. For instance, a number of interviewees stated that the amounts of finance aren't a barrier to RE development – though the amounts and types of finance cannot be met by domestic markets and require international support – and that project implementation is more of a challenge.

However, others maintained that the amounts of finance are also a barrier; that actual finance flows fall significantly short of needs, and that finance is only perceived as adequate for grid-scale tenders in some states, with the support of large developers[3]. It is unclear why there is such a divergence in perspectives about the adequacy of finance, although it may relate to different interviewees being familiar with different scales of RE projects and/or dependent on the type of off-taker.

[3] As a counter-example, projects in states like Rajasthan and Punjab do not have SECI's payment surety, explained further below In the text.

In either scenario, there is a need for greater international finance flows. To facilitate this at scale, Khanna, Purkayastha, and Jain (2022) highlight the need for a strong policy environment, including a) a well-defined green taxonomy, b) an integrated domestic measurement, reporting and verification (MRV) system and c) coordinated policy interventions to accelerate investments, above all in earlier-maturity sectors such as decentralized energy sources. These needs roughly mirror findings from international reviews in the previous section. These and other challenges and needs, as discussed with interviewees, are captured below.

Regulatory and policy architecture

It is understood that above all, the development of RE hinges on the combination of legislative frameworks, funding mechanisms, institutional arrangements, and coordination mechanisms (Krithika and Mahajan 2014). Despite the increased activity and investments in the large-scale RE sector in India, there remain gaps in the governance of RE in the country (ibid).

Among regulatory challenges, interviewees noted that issues pertaining to **land acquisition** – particularly the associated ecological and socio-economic considerations– can hamper project funding, although they did not give further details on these issues. They stated that different states also have different processes for land acquisition, and this lack of standardisation can be difficult for international investors to overcome. Further, until the land is transferred, developers can't mortgage it or create securities based on it, leading to project delays. Such land issues are among the primary challenges that need to be addressed for smoother project implementation, as also noted by (Krithika and Mahajan 2014).

A second issue relates to the health of India's distribution companies (**discoms**). Due to their poor financial health and they are poor **off-take risks**, power purchase agreements (PPAs) with most of the discoms in the country have low credit ratings from the power finance corporation of India; they are developed on a state-wise basis with limited transparency or standardisation of process. These regional variations make funding – particularly from international funders – more challenging. A related way in which India's grid structure translates to market risks for RE is that currently the government is extending the waiver on **inter-state transmission** charges every 2 years, but this does not provide long-term certainty for investors. Clarity and predictability around these charges could help draw in more investments, and improved reporting mechanisms and financial restructuring of discoms is also an important overarching precondition.

On regulatory support, the National Solar Mission (JNNSM) has central funding and government guarantees, so investors are perceived as being more ready to invest in large-scale RE. SECI also plays a role here, issuing tenders that can be bid upon by entities globally, and coordinating with RBI and state governments to jointly strengthen payment assurance by covering short-term liquidity risks, making investments safer and more attractive. In parallel, IREDA also provides short-term loans – the loan appraisal process also gives scheduled commercial banks (SCBs) greater confidence to lend to developers – and attempts to match repayments with project timelines. These loan amounts can't exceed 20% of the project's net worth, so IREDA and RBI also jointly underwrite to other lenders[4]. SCBs can then issue letters of credit to developers which also makes it easier for them to get loans.

Aside from these broader challenges around discoms, transmission charges, and land acquisition, the overall regulatory architecture of large-scale RE then seems relatively developed. One interviewee noted that the regulatory architecture appears to be leading the policy architecture; that regulators such as SEBI and RBI have been relatively progressive[5], while the policy apparatus has been slower

[4] Over time, rising net worths and falling RE costs have allowed IREDA to fund larger projects.

[5] SEBI updated the BRR into the BRSR, while the RBI was among the first regulators to speak about financial institutions being fit for purpose back in 2007

(albeit stable), more subject to political considerations, and more easily circumvented. A case in point may be a green taxonomy, which is perceived as very important to help better define finance flows and to help align the language between domestic and international entities. However, such a taxonomy still awaits issuance in 2024. On the regulatory side, interviewees also noted the need for a green bond framework, greater disclosure regulations, and CSR reporting. While these are more relevant for domestic policymakers, it is important for international providers of finance to be aware of these challenges, plan for them, and explore ways to mitigate their impacts.

Awareness

Capacity and awareness are the main hindrances to climate and finance reporting by banks and corporates. Even if a bank has a sustainability mandate, often that doesn't trickle down to corporate and retail investment advisors in the absence of internal nudges and consumer demand. Further, the lack of data availability and transparency, particularly in the **private sector**, makes it difficult for financing institutions to estimate emissions and make investment decisions. This latter point is less of a challenge with international public finance agencies that are mandated to work primarily with the public sector, although it is relevant for those – such as KfW, Proparco, JBIC – that engage with private entities. It also risks increasing the burden on public finance.

Mandates and scopes

International public finance providers noted that they typically reach out to Indian intermediaries such as IREDA or SIDBI – rather than vice versa – in order to establish funding agreements, and attempt to tailor their interventions to domestic priorities. Each of these international providers has a different mandate, scope of activities, and processes and timelines.[6]

Some large-scale funding, from institutions such as the WBG and ADB, has supported clean energy policy development objectives. Such institutions are perceived as financially more mature, better able to work on policy and programme support, and capacity building. Typically, upstream program/policy finance – as opposed to downstream project finance – supports capacity building and putting systems in place.

Entities such as JICA and AFD have provided financial support to IREDA, IIFCL, and SIDBI. They don't normally lend directly to independent power producers (IPPs), as they often require sovereign guarentees which restricts **private entities**. They thus support developers through credit lines via public financing intermediaries (like IREDA). Although they usually provide concessional finance, developers have attempted to pre-close their loans with IREDA, possibly because it charges them a higher interest rate that is closer to commercial lending.

Provider countries do have entities such as Proparco, KfW, and JBIC for supporting private sector development. However, the **counterparty** still has to be a government entity and not a commercial bank, which some interviewees noted can also present a regulatory hindrance, one which is caused by regulatory frameworks in the organisations' home countries.

Besides mandates, **cultural differences** also play a role in the operations of international funders. This includes their risk appetites, openness to change and novelty, speed and responsiveness, and procedural requirements. This situation might lead to a mismatch between provider preferences and recipient needs and may indicate a need for international funders to better adapt to local situations. Such differences can affect their ability to support newer, smaller projects, and their preferences for sovereign guarantees (which in turn can also impact costs). As an example, JICA has a longer timeline

[6] The Department of Economic Affairs (DEA) is a decision-making authority about where these interventions are directed.

of 12-18 months for loan approvals, but believes that the market has capacity to repay them, while other lenders might have shorter approval timelines but more stringent MRV criteria.

Lastly, domestic entities sometimes perceive that the guidelines and requirements of international funders – such as their **MRV criteria** – are often developed for global application, with limited adjustments for local contexts, which can create mismatches between the needs and the allocations of funds[7]. Conversely, international entities note that when they extend credit lines to local intermediaries like IREDA, project reporting also comes through IREDA, which is thereby a smooth and successful process. A greater role for intermediaries and aggregation entities may help address this challenge.

Commercial and market

Financial viability continues to be a hindrance to attracting investments. Financing institutions expect that the **cost of finance** will go up in coming years due to the snowball effects of a shifting geopolitical landscape. On the investment recovery side, the relatively **low plant load factors** (PLFs) of RE are a roadblock for banks, since that creates greater uncertainties and longer repayment cycles. This is compounded by the offtake risks stemming from poor discom health, discussed above. There are also concerns that the **costs of battery storage** systems – critical enablers for scaling up RE – are not coming down as rapidly as expected, compounding challenges for demand aggregation. Policies such as PLI schemes[8] may be required to strengthen domestic capacity to manufacture batteries.

International public finance in particular may find it easier to flow where the market is relatively well understood and where funders can invest in **singular large tranches**, such as grid-scale RE, which may risk a mismatch between funder objectives and local needs (for instance smaller scale, distributed projects). Recognising that this may also crowd out other willing finance, international funders expressed an interest in supporting less established markets – where they can have a more transformative impact, such as floating solar, pumped storage, or green hydrogen – and in grid improvements and providing technical assistance. However, they are not able to gauge the viability of/support for these less established markets in the domestic policy context, due to a lack of information, and are finding alternative avenues, such as greening industrial parks, through program support and investment support, to achieve their objectives. They also look to developers meeting criteria such as green certifications as a proxy for their due diligence into the viability and climate relevance of projects. Appropriate policy and regulatory signals may help direct more such international finance to these emerging areas.

A secondary loan market could help to address some of these limitations in sector lending, as has been the case in countries with robust clean energy markets. Yet, such a secondary market was only recently established in 2021 under a new self-regulatory body set up by ten lenders, including the State Bank of India, as per recommendations by an RBI taskforce (ETBFSI, 2021). A deeper and more liquid bond market in India would also help to recycle capital by offloading existing assets from banks and NBFCs to institutional and retail investors (Sandhu et al., 2018). In fact, foreign bond markets have already been used by a number of Indian renewable energy developers to refinance debt at more attractive terms, mainly for projects that have reached operational phase and therefore bear limited or no construction risks. Yet, use of these secondary markets for capital recycling remains limited, in part due to concentration of India's bond market in highly rated securities (i.e. AA and AAA ratings), which can be challenging for clean energy projects to achieve without an enhancement mechanism such as credit guarantee (Singh, Purkayastha and Shrimali, 2019).

[7] For Instance, directing loans to informal sector MSMEs

[8] Production Linked Incentive, or PLI, scheme of the Government of India is a form of performance-linked incentive to give companies incentives on incremental sales from products manufactured in domestic units

There is also limited appetite for any international finance, which is seen as costlier – for instance due to **exchange rate risks**, hedging for which significantly adds to the cost of capital – and riskier given comparatively more stringent disbursement requirements. Domestic entities noted that until 2020, nearly 60% of RE finance came from credit lines extended by international public sources, but now with liquidity risks and hedging risks, domestic borrowing is cheaper and more attractive. This points to a future where – assuming global macroeconomic conditions don't shift – increasing amounts of finance may have to be nationally sourced.

Coordination

At the domestic level, clashes between the **CERC and SERCs** on approving RE requirements could lead to funding complications, since PPAs are not valid until this approval. The institution of SECI as a nodal agency has helped address this by creating a single-window clearance mechanism and a transparent bidding process. One interviewee noted that India has made progress in developing the RE space and has set up effective institutions – such as SECI, IREDA, and PFC, which are playing concrete roles in developing the clean energy landscape – but an important remaining challenge is improved **centre-state coordination**.

There is also still a need to create **synergies across a multiplicity of national and international funds** and also a better targeting of both existing and additional funds. Greater transparency is required to increase coordination and cooperation among different sources of funds (Singh 2017).

Figure 1 below depicts the overview on regulatory and institutional landscape which governs the flow of international climate finance into large-scale RE.

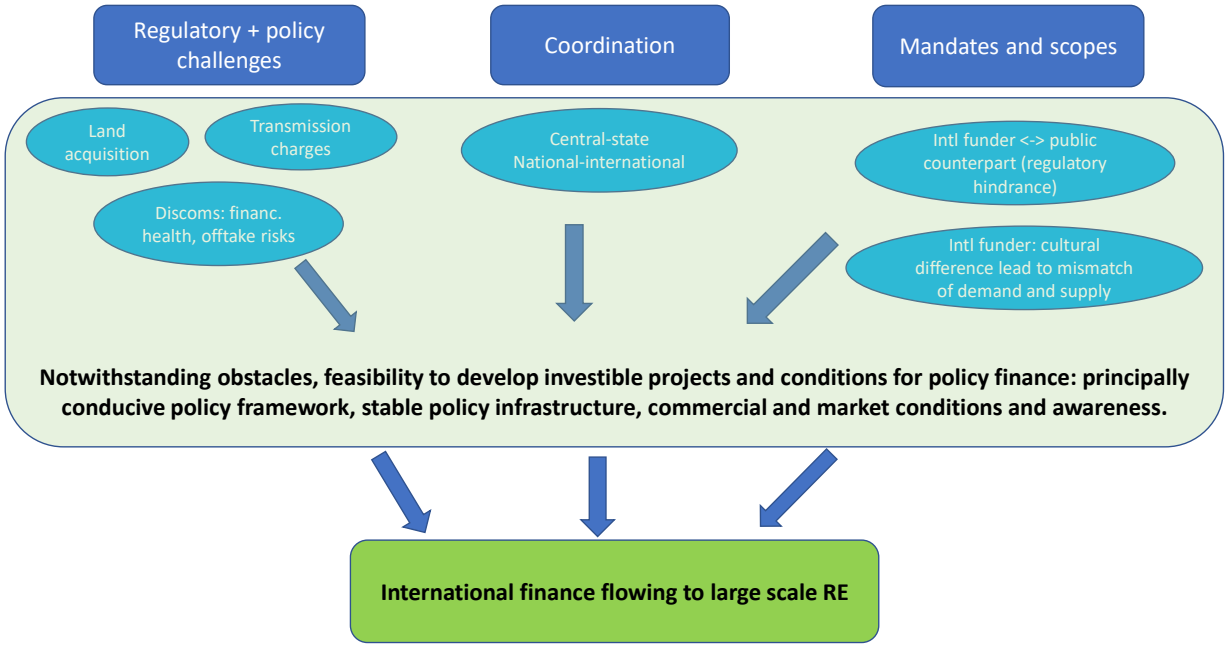

Figure 1: Institutional and regulatory landscape for finance to RE and large-scale RE in India: Despite some institutional-regulatory challenges, international climate finance flows to large-scale RE. Blue

figures indicate challenges, green shade favorable conditions, and arrows indicate directionality of conditions for finance flows.

Landscape for finance to rooftop solar and energy efficiency

Interviewees highlighted that some challenges are specific to smaller RTS and EE initiatives, which are critical for decarbonising micro, small, and medium enterprises (MSMEs). MSMEs offer significant potential for deploying RTS and EE measures. They represented 29% of India's GDP in 2021-22 (Ministry of Micro, Small and Medium Enterprises, 2023) and play a crucial role in providing employment opportunities; per the 73rd round of NSS, the MSME sector created 11.1 crore (111 million) jobs (ibid). However, this sector is also one of the largest consumers of energy. The projected energy consumption of the sector is expected to be equivalent of 72 $mtCO_2e$ by 2030 (TERI 2022). It is imperative that the sector improve its energy efficiency and adopt renewable energy for its operations.

However, Sudmant et al. (2017) had found that although small-scale investment projects can offer the most significant decarbonisation opportunities, they are often overlooked in favour of large-scale projects. Pandey (2022) also found that in India large scale solar and wind parks are prioritized by the federal government over small-scale renewables like RTS , due to the belief that decentralized solar will inevitably grow at its own pace. As a result, the adoption of rooftop solar in India remains relatively low. In 2015, under the grid connected solar rooftop programme, the Indian government aimed to achieve a cumulative installed capacity of 40GW from grid connected RTS by the end of 2022 (Press Information Bureau 2019). However, the realized installations fell significantly short of the target, with only 8GW installed by December 2022 (Pandey, 2022). About 78% of the installed renewable capacity is due to large scale wind and solar power projects.

Dhingra et al. (2023) identified 35 barriers restricting industrial and commercial RTS growth in India, classified into five categories: financial, institutional & regulatory, location based, technical, and market based. Market-based and financial barriers were the most significant among these. A study also explored the top five barriers – operational, technical, financial, commercial, and awareness – to the adoption of RTS within the SME sector, with similar findings (Deloitte 2019).

The principal financial barriers are [1] low credit facilities and creditworthiness, [2] high upfront installation/capital cost, [3] insufficient market support, [4] long-term uncertainties and returns on investment, and [5] complex subsidy structures.

Market-based barriers include the poor financial health of discoms, low net-metering caps, and the unavailability of off-grid products from retail outlets. Additionally, MSMEs often lack the capacity and knowledge for equipment maintenance and are hesitant to invest in training or third-party maintenance services. Distribution utilities are also reluctant to promote rooftop solar, fearing revenue loss.

To address some of these issues, Gulia and Garg (2021) recommend credit enhancement schemes, favourable state-level policies with respect to the MSME segment, providing non-collateralised financing, long-term loans at lower interest rates, and hassle-free paperwork and faster loan approval processes. Other issues, raised by the interviewees, are clustered below.

Regulatory and policy architecture

Respondents believe that the overall regulatory landscape for RE – and in particular RTS and EE – has started improving after COP 26, although the market – which has the architecture for new financial structures to incentivise flows – needs more impetus. Notably, RTS incentives, and the **compensation for surplus energy** fed into the grid, aren't perceived as adequate. Upfront incentives like **accelerated depreciation** for RTS tax benefits are also not present. However, central financial assistance is available for RTS, and states have their individual subsidy schemes in addition.[9]

Awareness

Information and awareness are bigger challenges within the RTE and EE space. Respondents at SIDBI noted that **identifying MSMEs, and then contacting and sensitising them to the opportunities** for RTS and EE are considerable barriers. Respondents similarly noted that **public sector banks do sometimes have clear RE lending policies** (for instance, the State Bank of India has a Surya Shakti Cell to finance RTS undertakings in MSMEs), **but even internal staff such as relationship managers may not be aware of them**. This is heightened by the fact that currently, there is **no investor pressure** for banks to green their portfolios.

Mandates and scopes

A number of organisations have provided credit lines through intermediaries such as IREDA and SIDBI and EESL for MSMEs. These domestic financial institutions – which state that working with such international financiers is relatively straightforward given a long history of engagements – then reach out to MSMEs, and not the other way around, given MSMEs' limited awareness and incentives to decarbonise.

Public sector institutions such as SIDBI also refinance bank loans, which are then used to on-lend to MSMEs. Domestically however, a number of **banks also do not have provisions to offer grants for RTS undertakings**, limiting the amounts of finance available to such projects.

This lack of finance, coupled with **high management overheads**, has led to some large developers selling PPAs and tenders for RTS.

On the MRV side, impact analysis is still at a small scale. Reporting on international finance is a challenge due to data gaps and informal processes in small-scale businesses, and can rely on proxy metrics which can introduce margins of error.

Commercial and market

Currently, given that international funders find it easier to provide larger tranches of funding to relatively more understood markets, there is a perception that **smaller projects are more suited to domestic investors**, which can impact the amounts and types of finance flowing to them.

Even when international funders do provide credit lines for on-lending, **hedging risk** presents a significant challenge and limits the finance that can be dispersed from sanctioned amounts. High currency hedging costs inflate international borrowing costs. This is particularly true for JICA, which offers a greater degree of concessionality in its loans than other bilateral funders, but due to the greater exchange rate risks associated with JPY-denominated loans, takes sovereign guarantees at a cost of 0.4%-0.8%.

[9] It is also particularly important for international finance providers to be aware of the regulatory requirements for newer forms of RE, such as the need to consult with the Ministry of Defense for offshore wind farms.

One challenge for consumers/installers of RTS is that the **net metering policies** across states are generally perceived as unfavourable. Per (Jain et. al , 2019), 19 Indian states offered net metering in 2019. Despite some uniformity, states differed in the permitted system sizes and sanctioned loads, transformer capacity limits, voltage connectivity, billing arrangements, and compensation for surplus generation. A more recent restriction limiting net metering to installations under 10 kilowatts risks further hindering the growth of this sector (Gulia and Garg 2021)IEEFA, 2021). Further, MSMEs are not keen to take risk on their balance sheets, and thus do not have incentive to deviate from the status quo. Discoms are also not sufficiently incentivised to enable net metering.

Respondents perceive a **need for new financial products, such as greater insurance and guarantees for EE, as a way of building confidence** in the market by assuring repayment even in the case of regulatory and market headwinds.

Figure 2 below depicts the overview on regulatory and institutional landscape which governs the flow of international climate finance into small-scale RE and EE.

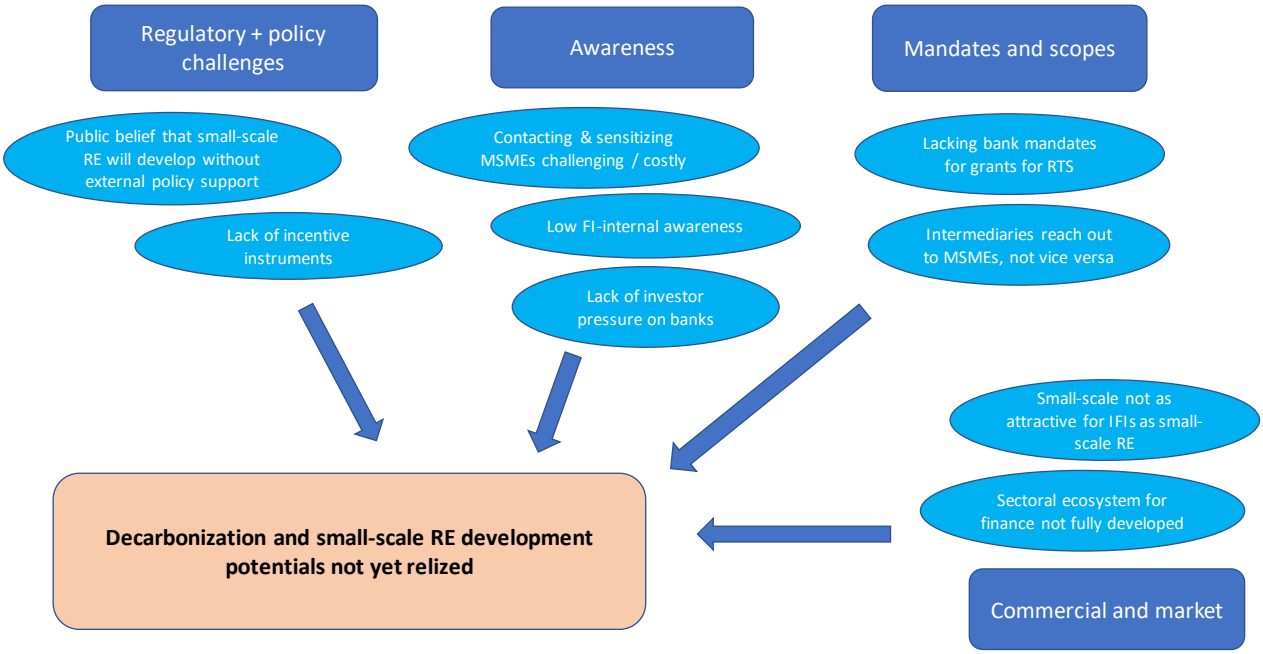

Figure 2: Institutional and regulatory landscape for finance to small-scale RE and EE in India: Small-scale RE and EE receives less policy support and awareness, and in its course, less finance. Blue figures represent types of challenges, which impact (arrows) the degree of funding for small-scale RE and EE (light red element).

Takeaways and conclusion

India's clean energy landscape has developed rapidly over the last decade, enabled by an improving policy and regulatory architecture. Nevertheless, challenges remain that have impacted the scale and direction of climate finance flows to this sector, including from international sources. As India aims to

further ramp up the pace of its RE development, particularly on the RTS side, it will be important to consider these challenges and explore ways to address them.

Some of these challenges relate to the structures and mandates of international public funders, particularly as they relative to their risk appetites, processing timelines, and MRV requirements (which are all especially challenging for smaller scale projects). The inclination of some international public finance providers may be to provide upstream finance, connected to policy and regulatory processes, which is also easier to facilitate in the area of large scale RE. This can lead to less finance flowing into smaller scale, distributed projects, or lesser developed areas such as floating solar. Policy signals by the Indian government could help to steer international funding towards these areas, coupled with more concerted efforts by funders to understand these areas.

On the regulatory side, definitions and disclosures will help with operations. Addressing land acquisition challenges and uncertainties around transmission charges will streamline processes. These can be further enabled by improving discom health and reducing offtake risks, which will also improve the bankability of PPAs and make raising finance easier, and by improving centre-state coordination on project implementation.

Facilitating greater private sector involvement can help scale up finance flows and increase the efficiency of disbursement processes. This can play a particularly important role in addressing market barriers such as the cost of storage technologies, which may require more R&D and PLIs for greater domestic manufacturing, as well as PSL and directed lending to smaller industries. Other market barriers, such as those relating to the cost of international finance, indicate a need for more hedging instruments and a deeper reliance on domestic finance, including more domestic issuances. Greater private involvement will depend not just on easing regulatory frameworks, but also on deepening financial markets and introducing more innovative instruments/models, such as hybrid annuity models through PPPs and recycled capital, as well as increasing awareness and capacity among domestic financial institutions for sustainable investing and reporting and strengthening such mandates.

Lastly, smaller RTS and EE projects face additional challenges of high upfront costs coupled with scale, unfavourable net metering policies, unappealing incentives, and a focus on large-scale projects, leading to limited financing into such ventures. It would help to provide clearer policy/regulatory signals for developing these areas, as well as for newer areas such as floating solar, while building awareness among MSMEs. There is a need for more uniform net-metering policies and for time-of-use pricing schemes. MDBs can also support these areas by taking on more risks and providing blended finance and smaller scale support.

An initial conclusion appears to be that international funders are drawn to comparably well-established governance systems in the large-scale RE sector because this provides these actors with the necessary readiness of project and policy-based finance. Institutional mandate and coordination issues are comparatively bigger challenges for international finance flows to large-scale RE. In turn, governance is less developed for the small scale RE and EE sector, and in its course, less international funding is flowing into that sector because it provides less favorable investment conditions. The recommendation is that international funders of climate finance increase efforts to cooperate with India on the improvement of the governance system in the small-scale RE and EE sector. This should be done in order to actively counteract tendencies to invest more in areas where already investment takes place but to work in situations where more risk appetites, openness to change and novelty, speed and responsiveness, and procedural requirements are required.

Overall, while the Indian government has an important role to play in continuing to improve the policy and regulatory environment for international clean energy finance flows into the country, there is an

equal role for funders to match their funding processes and scopes to the domestic context. Harmonizing these parallel efforts will require improved coordination between the various actors, potentially through more defined processes for consultations within the overall institutional architecture for climate action in India.

Annex: Selected clean energy projects in India with international financial support

Project	International implementing agency	Domestic implementing agency	Implementing year and period	Type of funding	Financial outlook	Objective
Promoting Renewable Energies	KfW	IREDA	1996- 2009 45 months	Composite Loan	Composite loan of EUR 61.36 million: Financing cooperation share of EUR 35.79 million + Market share of EUR 25.56 Million Other institutions/donors involved- Not listed Interest rate- 8.5-9.5% with credit periods of loans lasting 8-10 years Loan repayment rate for IREDA overall 85.7%	Mitigate climate change by promoting renewable energy sources and thus to support a decentralised energy supply. Composite loan for refinancing of 26 final loans for wind energy projects (94 MW), three bagasse-based cogeneration projects (CHP, 53 MW), and five solar photovoltaic plants (169 KWp).

REC Energy Efficiency Programme, phase I	KfW	Rural Electrification Corporation (REC) and Andhra Pradesh Southern Power Distribution Company (APSPDCL)	2008-2016	Credit line provided at a subsidized rate of interest	REC received a reduced-interest loan of EUR 70 million for setting up an energy efficiency credit line. REC passed the funds in their entirety on to APSPDCL, the sole borrower. 16 individual projects were financed in the state of Andhra Pradesh. Other institutions/donors involved- Not listed Interest rate- NA Loan repayment rate-100%	Raise energy efficiency of rural electricity distribution by issuing sub-loans to energy supply companies (ESCs) and by institutional strengthening at the REC and the supply companies
REC Energy Efficiency Programme, phase II	Commissioned by BMZ Germany and implemented by KfW	REC	2008-2016	Development loan	Loan of EUR 70 million to be financed by low interest loan. Other institutions/donors involved- Not listed Interest rate- 8.5-9.5%	To increase energy efficiency in electricity distribution (outcome objective) in rural Haryana This was the second credit line follow up phase in Haryana
PV solar plant Sakri in Maharashtra	Commissioned by BMZ Germany and implemented by KfW	Mahagenco	Starting 2009	Low interest rate loan	Total cost EUR 199 million (actual); 370 million (planned) This can be attributed mainly to the price decrease for PV modules between 2010 and 2012. Other institutions/donors involved- Not listed Interest rate- NA	Construction of a 125-MW large-scale photovoltaic power plant at the Shivajinagar site near Sakri in the Indian state of Maharashtra.
Credit line to SMIs and SIDBI to help curb industrial	Commissioned by BMZ Germany	SIDBI, funded with the FC	2003-2007 (Tranche I)	Direct loans to SMIs	EUR 15.2 million Other institutions/donors involved- Not	To award investment loans on a needs basis at positive interest rates in real terms to finance environmentally

pollution from SMIs	and implemented by KfW	credit facility SIDBI III		through SIDBI	listed Interest rate- The rates to be paid by the SMIs under the programme were negative in real terms in a number of cases. The reason for this was funding programmes by the Indian government for the purchase of new modern and environmentally friendly machines, which were also processed by the SIDBI and which were granted in addition to the FC programme. Loan repayment rate- negative in many instances	friendly production processes and green technologies.
First funding to IREDA, for implementing eleven RE projects led by IPPs	AFD	IREDA	2010 10 years	Green credit line	EUR 170 Million Other institutions/donors involved- Not listed Interest rate- NA	Diversification of the energy mix and reduction of greenhouse gas emissions through the development of 19 renewable energies projects (233 MW)
Energy savings and efficiency in street lightning	AFD	EESL	2015 5 years	Concessional sovereign loan	EUR 50 million Other institutions/donors involved- Not listed Interest rate- NA	As part of EESL's national programme for rolling out energy efficiency measures in street lighting systems, the municipality of Jodhpur benefitted from AFD funding to replace conventional street lights with 60,000 energy-efficient LED bulbs, slashing the energy consumption by 55%
Energy efficiency in SMEs	AFD	SIDBI	2010 3 years	Concessional non-sovereign loan	EUR 50 Million Other institutions/donors involved- Not listed Interest rate- NA	The loan allocated to SIDBI by AFD has allowed it to bring a technical and financial support to the sustainable growth of Indian SMEs, by financing investments in high energy performance equipment

Demand-Side Energy Efficiency Sector Project	ADB	EESL	2018-2023 6 years	Sovereign loan to EESL	Loan USD 200 million Grant USD 13 million (Global Environment Facility Grant) Other institutions/donors involved- Not listed Interest rate- NA	
Energy efficiency at MSMEs	World Bank	SIDBI, BEE, MoEFCC	2010-2019 9 years	Grant and loan	USD 59.30 million (loan) USD 11.3 million (grant) (non-additional to total) Other institutions/donors involved- Not listed Interest rate- NA	The objective of the Financing Energy Efficiency at Micro Small and Medium Enterprises (MSMEs) Project for India is to increase demand for energy efficiency investments in target micro, small and medium enterprise clusters and to build their capacity to access commercial finance

Glossary

Abbreviation	Full Form
AfD	Agence Française de Développement
BEE	Bureau of Energy Efficiency
BNDES	Brazilian Development Bank
CBDR-RC	Common but Differentiated Responsibilities and Respective Capabilities
CDC	Commonwealth Development Corporation
CERC	Central Electricity Regulatory Commission
CESL	Convergence Energy Services Limited
CO_2	Carbon Dioxide
CPI	Climate policy initiative
CSR	Corporate Social Responsibility
DFC	U.S. International Development Finance Corporation
EE	Energy efficiency
EESL	Energy Efficiency Services Ltd
ESCO	Energy Service Company
FCDO	Foreign, Commonwealth and Development Office
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
$GtCO_2e$	Gigatonn CO_2 equivalent
GW	Gigawatt
IDFC	Infrastructure Development Finance Company
IIFCL	India Infrastructure Finance Company
INR	Indian Rupee
IPPs	Independent Power Producers
IREDA	The Indian Renewable Energy Development Agency
IRENA	International renewable energy agency
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JNNSM	Jawaharlal Nehru National Solar Mission
JPY	Japanese Yen
KfW	Kreditanstalt für Wiederaufbau
MNRE	Ministry of New and Renewable Energy
MRV	Monitoring Reporting and Verification
MSMEs	Micro, Small and Medium Enterprises
NABARD	National Bank for Agriculture and Rural Development
NDCs	Nationally determined contributions
NGFS	Network for Greening the Financial System
NSS	National sample survey
NTPC	The National Thermal Power Corporation

ODA	Official Development Assistance
PAT Scheme	Perform, Achieve and Trade Scheme
PFC	Power Finance Corporation
PIB	Press Information Bureau
PLFs	Plant Load Factors
PLIs	Production Linked Incentive
PPAs	Power Purchase Agreements
PSL	Priority Sector Lending
RBI	The Reserve Bank of India
RE	Renewable Energy
REC	Rural Electrification Corporation
RES	Renewable Energy sources
RPOs	Renewable Purchase Obligation
RTS	Rooftop Solar
SBI	State Bank of India
SCBs	Scheduled Commercial Banks
SECI	Solar Energy Corporation of India
SERCs	State Electricity Regulatory Commission
SIDBI	Small Industries Development Bank of India
T&D	Transmission and Distribution
TCX fund	The currency Exchange Fund
TWh	Terawatt hours
UNEP	United nations environment program
USD	US Dollars

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