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PARIS ALIGNMENT OF POWER SECTOR FINANCE FLOWS IN INDIA:

Challenges, Opportunities and Innovative Solutions

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SUSTAINABLE ENERGY FOR ALL

CLIMATE POLICY INITIATIVE

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PREFACE

In November 2021, a pivotal COP26 saw world leaders agreeing to the Glasgow Climate Pact in which 197 countries pledged to accelerate efforts on climate action, keeping the hope of capping global warming at 1.5 degrees alive with new and updated Nationally Determined Contribution (NDC) and net-zero commitments. The non-binding pact will set the global agenda on climate change for the next decade.

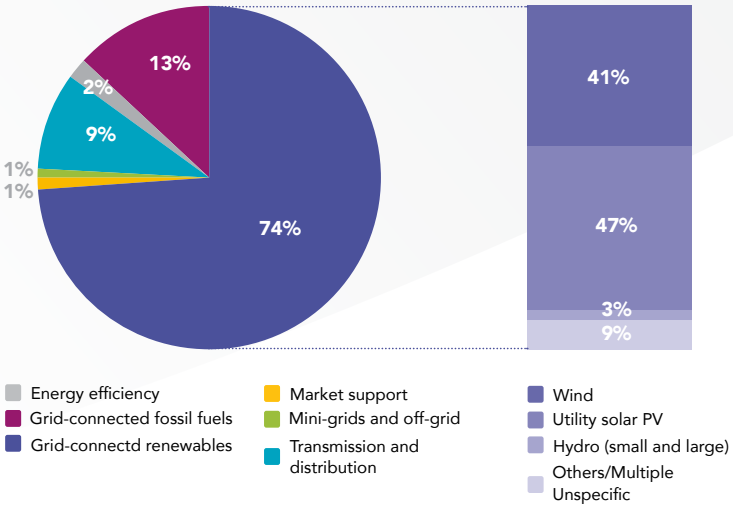
COP26 also saw the announcement of several significant commitments pertaining to international financing of fossil fuel projects. A group of 25 countries together with public financial institutions signed a UK-led joint statement committing to ending international public financing for the unabated fossil fuel energy sector by the end of 2022, prioritizing support for clean energy transition. These actions complement announcements made earlier in the year by China, Japan and South Korea to end overseas coal financing. Collectively, this could shift an estimated USD 17.8 billion a year in public support out of fossil fuels, functionally ending almost all concessional or public financing of international coal power projects (UNFCCC 2021). Additionally, major banks and financial institutions also made significant commitments to end the funding of unabated coal. While efforts to build consensus on ending fossil fuel subsidies and coal phase-out were unsuccessful, the countries agreed that advancing clean power generation and associated energy efficiency measures should involve "the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies".

At COP26, India announced a target of 500 GW of non-fossil energy capacity by 2030, reducing the carbon intensity of India's economy by less than 45 percent, and achieving net-zero emissions by 2070, demonstrating a concrete commitment on net-zero targets for the first time. India and the UK together led the launch of the Green Grids initiative. Backed by more than 80 countries, this initiative aims to build interconnected transnational grids to enable parts of the world with excess renewable energy capacity to transfer it to areas with deficits. India also supported other initiatives that were announced at COP26 included scaling up of the use of green hydrogen and mandating its use in industries like petroleum refineries and fertilizer.

This knowledge brief was developed in the lead-up to the COP26 summit in Glasgow and therefore is primarily based on stated policies of the Government of India. At the time of writing this brief, India has not yet submitted updated 2030 targets (in its NDC) to the UNFCCC as part of the five-yearly ratchet-up mechanism established in the Paris Agreement. The COP26 Glasgow Climate Pact allows for an annual review of more ambitious NDCs under which India will have the opportunity to present its updated NDC by COP27.

Catalysing India's Energy Transition

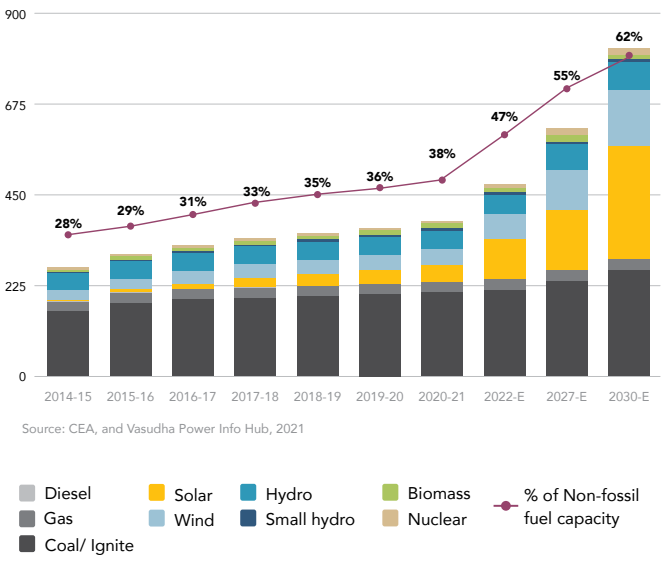
Key power sector financing trends



- Total tracked power sector finance commitments stood at USD 14.2 billion per annum between 2013-2019.
- Utility-scale renewable energy projects accounted for the largest portion (74 percent), followed by fossil fuel-based power plants (13 percent) and transmission and distribution (9 percent).
- Large domestic actors, especially public-sector enterprises and private developers, have been instrumental in driving renewable energy deployment in India, encouraged by policy incentives.

Paris Alignment of power sector finance

India's installed electricity capacity (GW) by source



Source: CEA, and Vasudha Power Info Hub, 2021

- India has made significant progress in achieving its Nationally Determined Contributions under the Paris Agreement and is expected to meet the targets set before 2030.
- However, fossil fuels, especially coal, continue to be the mainstay of India's electricity generation mix (74 percent) in the cost optimal capacity mix.
- Continued financing of coal-fired power projects is keeping India's carbon intensity well above the levels required to align with a global mean temperature rise of <1.8°C, consistent with the Paris Agreement-aligned IEA Sustainable Development Scenario (SDS).
- There is a need to not only continue to ramp up zero-carbon power investments, but also to act swiftly to accelerate the decommissioning and replacement of existing high-carbon capacity.

Key recommendations

Shift and align	• Expeditiously phase down coal financing and refinancing including upstream activities like coal mining, transport that use coal-fired power generation etc. • Support initiatives that accelerate decommissioning of coal-fired power plants whilst ensuring a just transition for coal-dependent communities.
Invest and explore	• Continue investments in renewables whilst scaling lending in inter-state and inter-region transmission infrastructures, energy storage, deployment of smart grids, etc. • Allocate a certain portion of investment portfolio towards low-carbon technologies and new business models (like green hydrogen etc.) through innovative financial mechanisms, blended financing, guarantees and credit enhancement. • Accelerate investments to various customer segments like micro, small and medium enterprises and residential for rooftop solar, solar PV-powered irrigation in agriculture, and ESCOs to finance energy-efficient technologies in new buildings and retrofits etc.
Assess and report	• Integrate climate risk into credit assessments; climate stress testing of own investment portfolio; measurable and transparent decarbonization targets; and report progress to regulators and investors. • Advise clients on strategies to build a climate-resilient portfolio and facilitate transition to low-carbon activities.

INTRODUCTION

India has shown significant success in progressing towards universal electricity access in recent years. Concerted efforts from public and private actors in enhancing power generation, strengthening transmission and distribution infrastructure, and ensuring last-mile connectivity to the grid have all contributed to India's rapid increase in the rate of electrification (Central Electricity Authority of India (CEA) 2020, IEA et al 2020). India's average number of hours of electricity supply across customer categories is around 17 hours per day (NITI Aayog et al 2020). There are, however, still an estimated 30 million people without electricity access and per capita electricity consumption is still only about a third of the global average (CEA 2021). Providing reliable, affordable and sustainable electricity access to all — a necessity for socio-economic development — is an ongoing and evolving challenge for India's power sector.

To maintain energy access, achieve energy security, and ensure a clean energy transition, there is a need to mobilize investments at an accelerated rate. To achieve universal access to reliable electricity, USD 35 billion needs to be spent annually between 2021 and 2030 on construction and refurbishment of transmission and distribution infrastructure (IEA et al 2021). According to Sustainable Energy for All (SEforALL) and Climate Policy Initiative (CPI) estimates, tracked investment in these sectors stood at USD 17.5 billion[1] in 2019. This clearly falls short of requirements. Even more expenditure is needed on electricity networks to overcome renewable energy integration challenges. At the recently concluded COP26, the Indian government announced a target of 500 GW of non-fossil energy capacity by 2030, achieving net zero by 2070, meeting 50 percent of its energy requirements from renewable energy by 2030, reducing its carbon intensity by less than 45 pecent over 2005 levels by 2030, and reducing total projected carbon emissions by one billion tons from now until 2030 (MEA 2021). India already has installed capacity from renewable sources at 38 percent in 2020-21 with current renewable capacity at 100GW[2]. Evaluations based on historical responsibility and current capability suggest that the scale and scope of India's climate action efforts exceeds its fair share of the global burden (MoEFCC 2021). However, achieving the aforementioned targets would require massive investment opportunities for both public and private financiers across technologies and sectors (including hard-to-abate energy intensive sectors).

This brief, by examining the current financing landscape of the Indian power sector, and its alignment with India's Nationally Determined Contributions (NDCs), aims to identify the challenges and opportunities in financing the country's ambitious renewable energy targets to facilitate a smooth energy transition. Analysing the key trends in power sector financing, such as the type of capital providers, technologies and instruments, is a key starting point to identify opportunities to scale up finance, as discussed in the next section. The subsequent section provides a novel approach to assessing the alignment of these investments with the goals of the Paris Agreement, following a methodology recently developed by CPI (CPI 2020). This is followed by examples of innovative financing mechanisms that are mobilizing private investments to the renewable energy sector (Case Study 1 and Case Study 2), and recommendations for financial actors to support India's energy transition in the coming years.

[1] This also includes tracked fossil fuels-based power investments of around USD 2.9 billion.
[2] As of August 2021.

UNDERSTANDING THE LANDSCAPE OF POWER SECTOR FINANCING

This section tracks financial commitments[3] to India's electricity sector between 2013 and 2019. It analyses key sources of capital, both public and private, the instruments used for mobilizing these investments and technologies and sectors it financed. For a more detailed methodology refer to SEforALL's *Energizing Finance: Understanding the Landscape* series (see Appendix 1). While significant data gaps persist, particularly in tracking fossil-fuel based investments and domestic budgets,[4] such an exercise can nevertheless offer critical insights into the current state of investments and help inform future direction.

Key Findings

Grid-connected utility-scale renewable energy projects continue to account for the largest portion of tracked electricity finance commitments, aligning with India's ambitious targets. Finance commitments to India's electricity sector averaged USD 13.9 billion annually between 2013 and 2019. Its ambitious policy targets of installing 175 GW of renewable energy capacity by the year 2022 and 500 GW by 2030, as well as achieving 40 percent installed capacity from non-fossil fuel-based energy resources by 2030 (India's NDC[5]), are the key policy drivers behind these trends. Other government initiatives include providing electricity connections to all non-electrified households by 2018 under Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA) and improving financial and operational performance of state distribution companies under Ujjwal DISCOM Assurance Yojana (UDAY).

Large domestic actors, especially public-sector enterprises and private developers with healthy balance sheets, have been instrumental in driving renewable energy deployment in India, encouraged by policy incentives. Domestic finance from public and private sources represented, on average, 74 percent of all finance tracked between 2013 and 2019, with international finance accounting for the remainder (Figure 1). Corporates alone accounted for 59 percent of total finance commitments, largely directed to utility-scale solar and wind energy projects. This can be attributed to favourable policy actions to attract private investments, including reverse auctions resulting in progressively falling prices; lower corporate tax rates for developers; renewable purchase obligations mandating utilities to procure a certain minimum amount of renewable power; investment in transmission infrastructure; and support for solar parks that help reduce project development and land acquisition risks (IEA 2021).

Now with higher rates of electrification, the Indian government is signaling a shift in its focus from merely extending access to improving the reliability and quality of supply. Finance commitments for transmission and distribution projects stood at USD 2 billion in 2019 (12 percent of the total tracked finance commitments). Government initiatives like the Green Energy Corridor and the National Smart Grid Mission aim to enhance the exchange of electricity between states, improve grid monitoring and balancing, and manage the risk of integrating renewable energy with the grid. Box 1 provides a brief analysis of government spending[6] on transmission and distribution projects in 2019. Recently, the government introduced the Electricity (Amendment) Bill, 2021 to de-license power distribution and facilitate the entry of private companies, allowing them to compete with state-owned

[3] Commitments may refer to firm obligations by means of Board decisions on investment programmes, closure of financing contracts or similar actions backed by the necessary funds to provide specified assistance/finance to a project, recipient country, or any other partner organization.
[4] This exercise does not track policy-induced revenue support mechanisms or other public subsidies. However, state energy budgets were analysed for the year 2019–20 (see Box 1).
[5] The NDCs India announced in 2015 remain its NDCs, at the time of writing this brief. Whether India upgrades its NDCs and includes the COP26 announcements remains to be seen. The new announcements are domestic goals for now.
[6] These are not included in the tracked investment due to a lack of granular information.

power distribution companies (Financial Express 2021). The Bill, if passed, will foster competition by allowing more than one service operator to supply power to a consumer in one distribution area, increasing private sector participation. It also proposes a new tariff policy, including the introduction of a direct benefit transfer for electricity subsidies, to ensure that state support for electricity access at reduced tariffs reaches the intended beneficiaries.

Domestic debt financing is driven by commercial banks and national public banks, which accounted for about 19 percent of total tracked finance between 2015 and 2019. This limited share can be attributed to the Reserve Bank of India's (RBI 2019) prescribed sector debt limits of 20–25 percent across infrastructure sectors, including power, to guard against concentration of credit risk. To address the credit issue, RBI doubled its loan limit (about USD 4 million) to renewable projects in 2020 though it may not completely address the limit issue for large-scale projects (RBI 2020; OECD 2021). Furthermore, low credit ratings due to sector-specific risks, including off-taker risk; high transaction costs partly due to lack of standardized project documentation (OECD 2021); high perceived risks due to limited historical performance data for some technologies; a mismatch between long-term lending and short-term deposits as sources of capital; currency risk; and under-developed domestic and offshore corporate bond markets (CMWG 2021) have all resulted in limited domestic lending by financial institutions to the Indian power sector. In recent years, several new instruments and mechanisms have been explored to alleviate these risks, but their full potential remains untapped. For instance, RBI has permitted Foreign Portfolio Investors to invest in debt securities issued by Infrastructure Investment Trusts (InvITs) and Real Estate Investment Trusts[7] (REITs). In its annual budget for 2022-23, the government has proposed to mobilize resources by issuing sovereign green bonds as part of its overall market borrowings. These bonds will be rupee-denominated papers and are expected to have a long tenure to suit the requirement of green infrastructure projects.

The Indian banking sector was saddled with burgeoning non-performing assets, especially in the infrastructure sector, which might have restricted credit to utility-scale renewable energy projects. Fossil fuel-based power industry remained a key asset class for banks. In fact, despite the potential stranded asset risk, tracked investments in coal power projects still accounted for 16.4 percent of the total tracked energy commitments in 2019 (Figure 1, and below section on challenges for details), of which commercial bank financing stood at 35 percent. Reduced lending to, and refinancing of, existing coal-fired power projects could create scope for increased lending to renewable energy projects.

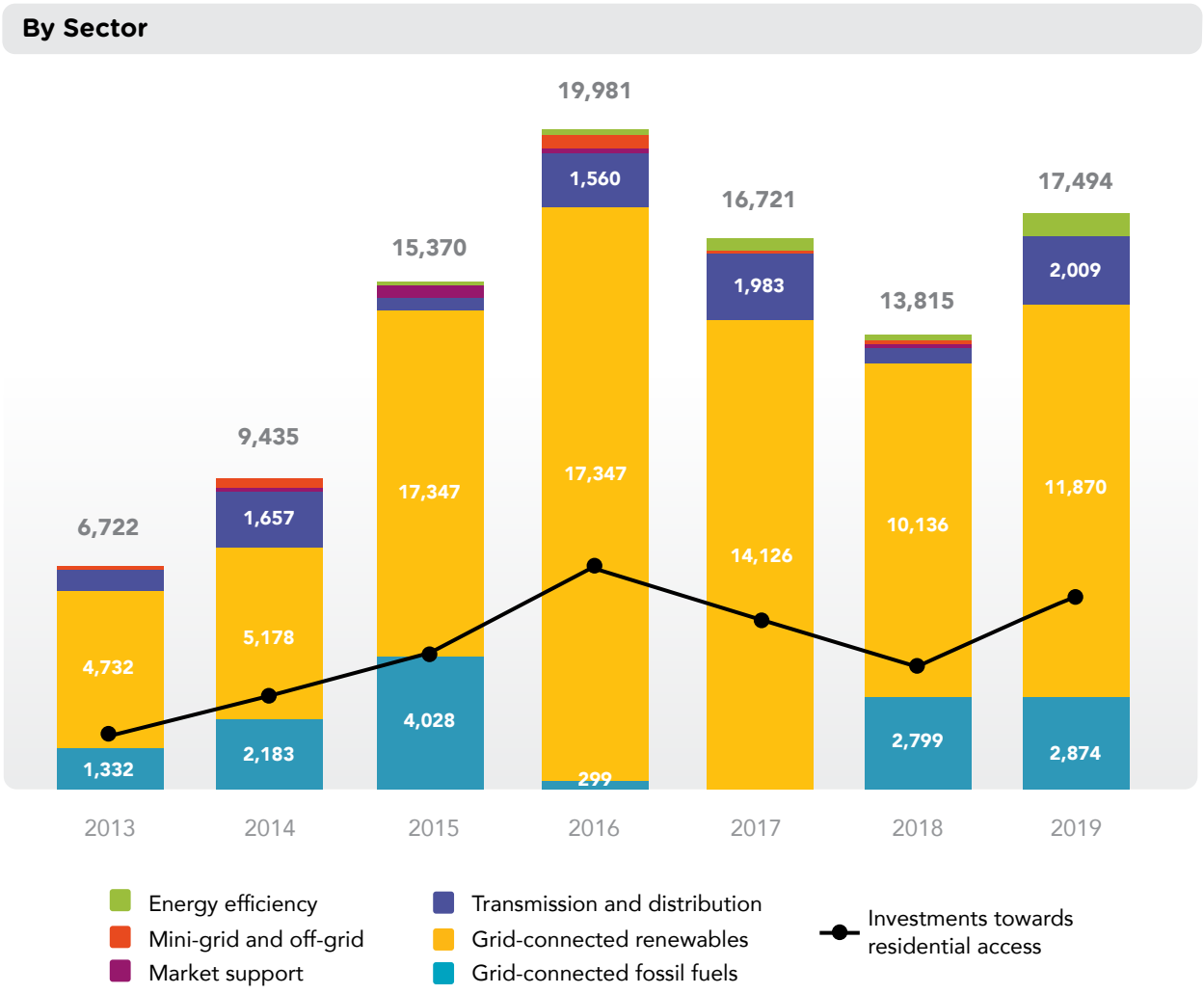
India's growing energy demand presents significant investment and lending opportunities across sectors and segments,[8] including energy efficiency. Tracked finance commitments for energy efficiency more than tripled in 2019 but accounted for only 4 percent of total commitments to the power sector. The volume of committed finance is likely to increase with government focusing on modernizing industrial facilities and mandating target-based reductions in energy consumption under the Perform, Achieve, Trade (PAT) Scheme[9] (IEA 2019) - flagship programme of Bureau of Energy Efficiency under the National Mission for Enhanced Energy Efficiency (NMEEE). Furthermore, India is also implementing other initiatives under NMEEE, such as Market Transformation for Energy Efficiency (MTEE) to accelerate a shift towards energy efficient appliances, Framework for Energy Efficient Economic Development (FEED) to develop fiscal instruments to promote energy efficiency, and Energy Efficiency Financing Platform (EEFP) to provide a stakeholder platform for implementing energy efficiency projects. To meet its expected electricity demand over the next two decades, India will require the addition of a power system of the current size of the European Union (IEA 2021). About two-thirds of Indian households are projected to own air-conditioners by 2040 (IEA 2018), making cooling systems a major driver of India's increasing residential electricity demand.

[7] India has three REITs: Embassy REIT (started in 2017), Brookfield REIT (commenced in 2019), and Mindspace REIT (began in 2020). The assets of Embassy Office Parks REIT include a 100 MW solar power set-up. The two publicly listed InvITs are: India Grid Trust, and IRB InvIT.
[8] Estimates using the World Bank Multi-Tier Framework (MTF) suggest that in 2019 50 percent of the total tracked electricity finance went towards the commercial and industrial sectors, while 25 percent.
[9] PAT scheme is a flagship programme of Bureau of Energy Efficiency under the National Mission for Enhanced Energy Efficiency (NMEEE). NMEEE is one of the eight national missions under the National Action Plan on Climate Change (NAPCC) launched by the Government of India in the year 2008.

Despite the huge market potential of mini-grids, they have not thrived due to several challenges. The market potential of renewable energy-based micro- and mini-grids in India is estimated to be at least USD 43 billion (Saur Energy 2019). However, financing in this sector has been limited by market conditions including government subsidies, regulatory hurdles, the nascent stage of the financial ecosystem for mini-grid projects in rural areas, and a lack of proven, sustainable business models. Furthermore, policymakers have shifted their focus on providing access to electricity to all households by extending the grid under the SAUBHAGYA scheme, which has disincentivized private sector participation in setting up mini-grids.

FIGURE 1

Snapshot of power sector financing in India (2013-2019, USD million)



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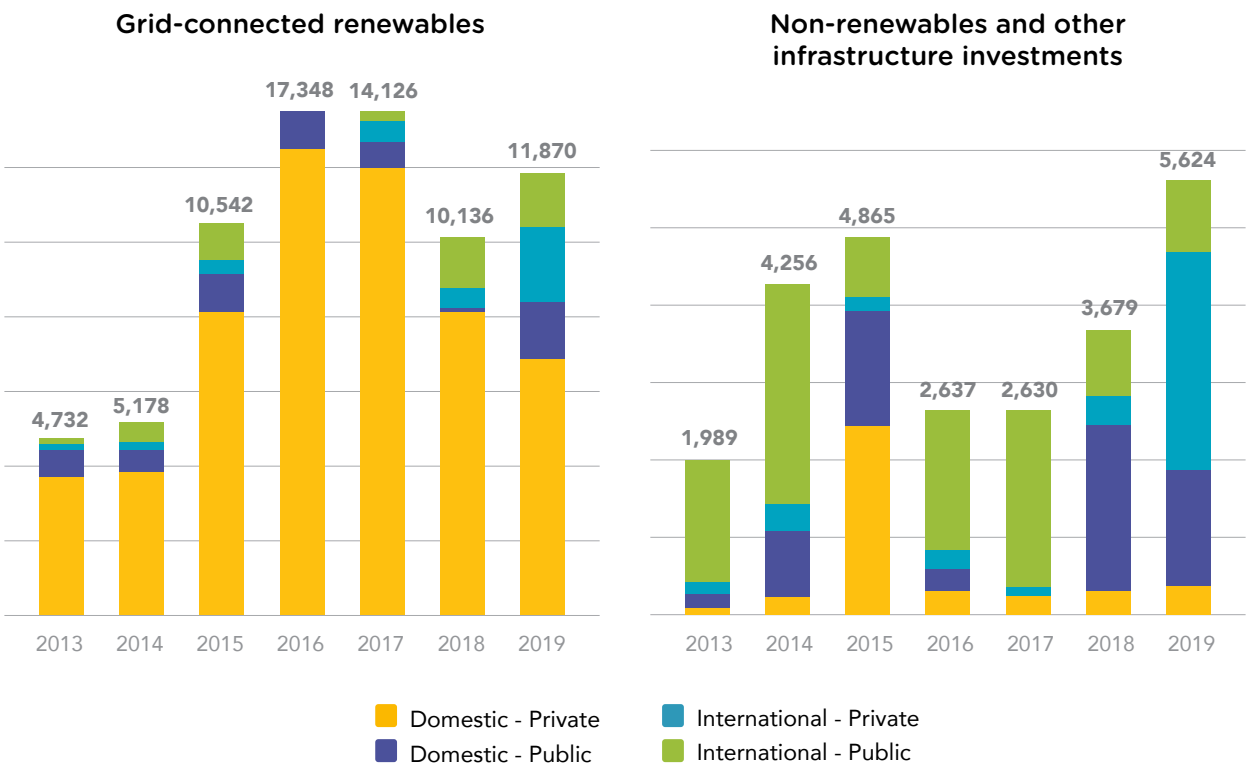

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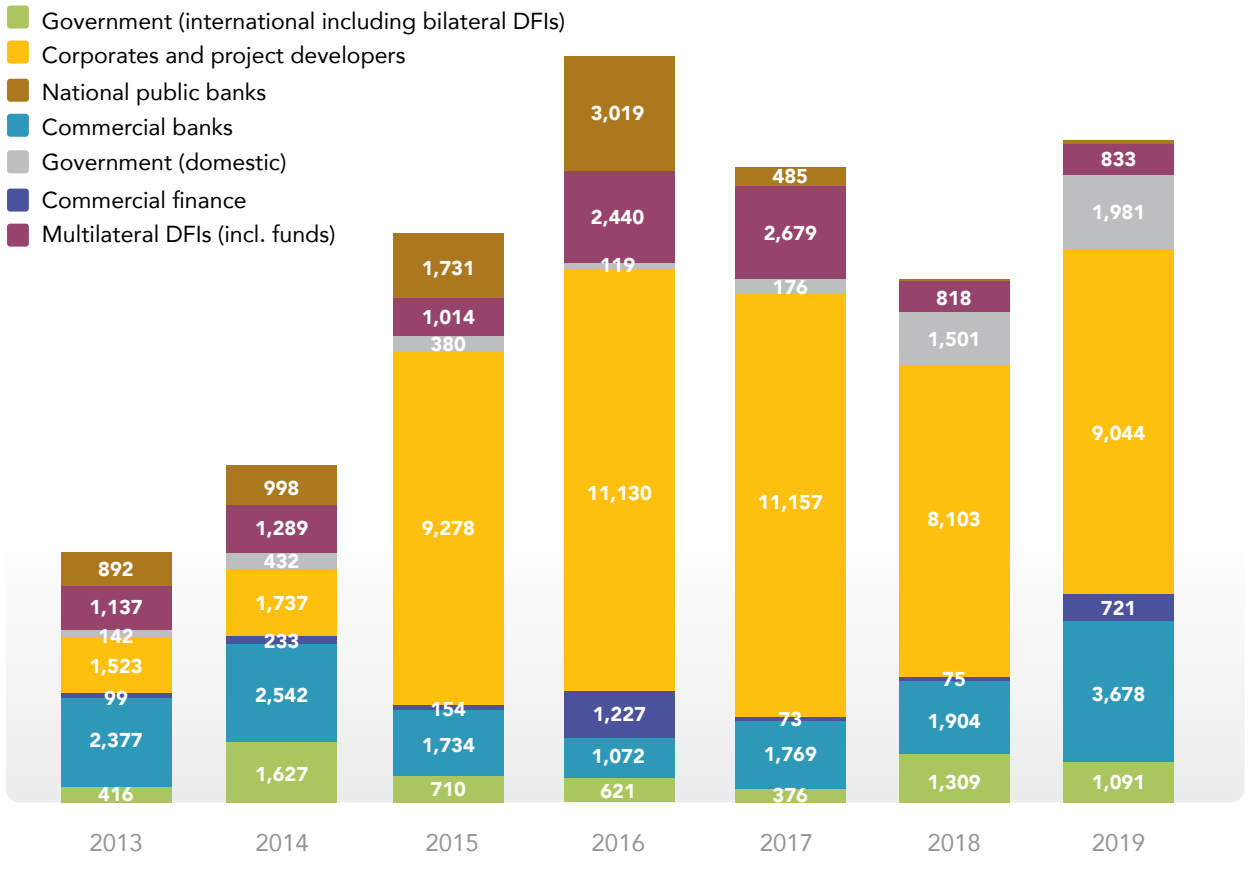
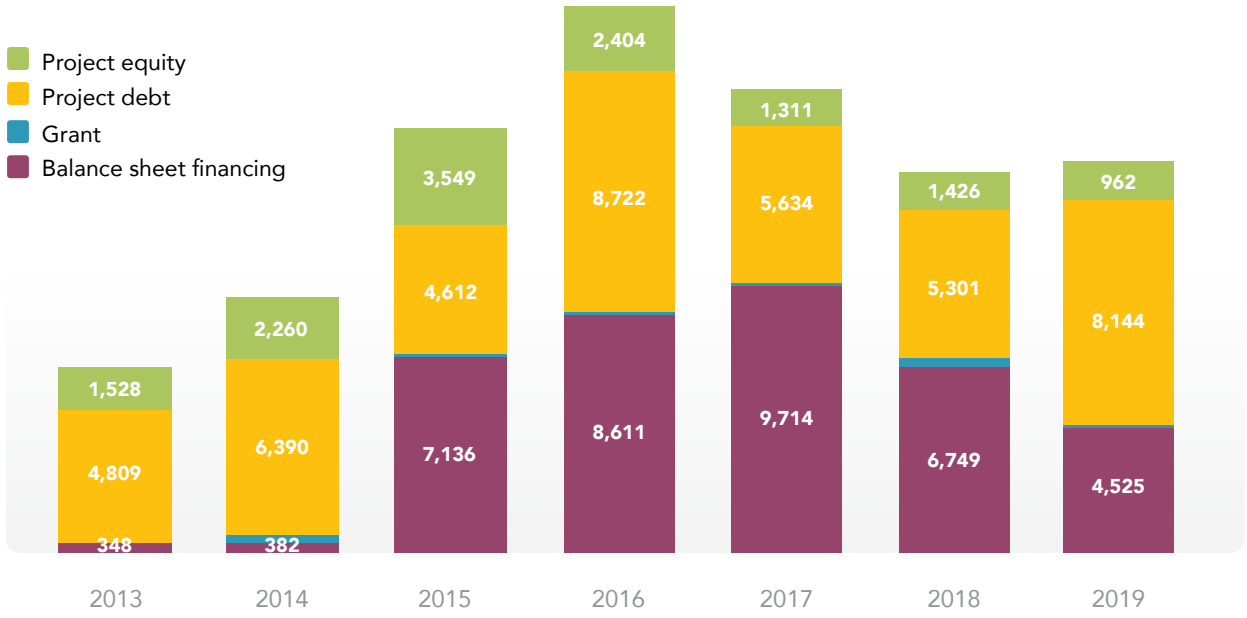


By Instrument



Note: Limited granular information on financial commitments is publicly available for fossil fuel based power plants.

BOX 1

Transmission and Distribution– The Investment Potential

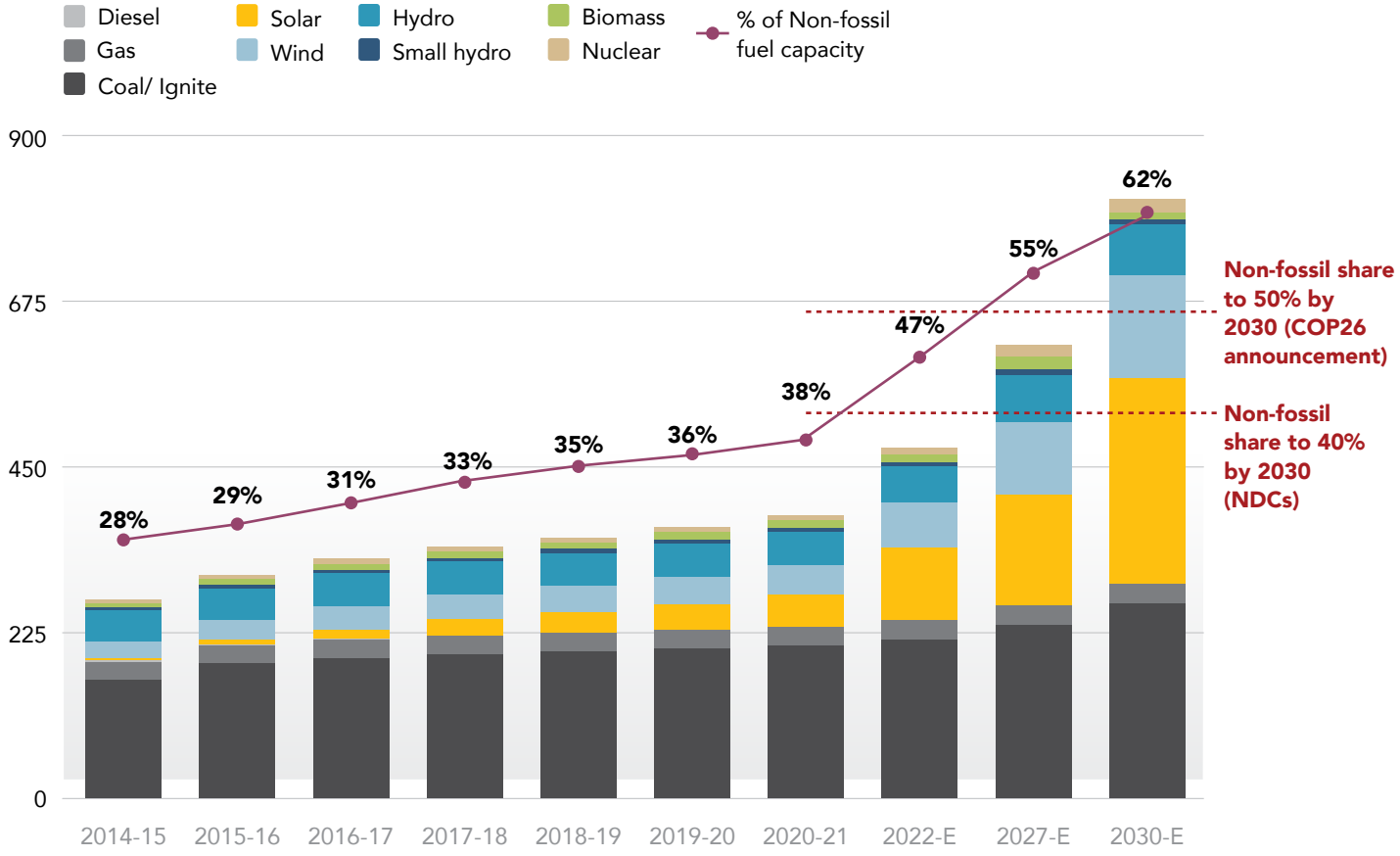
State energy budgets for the year 2019–20 reveal USD 12.2 billion in government expenditure allocated to transmission and distribution. Of this, state government investment accounted for 87 percent (USD 10.6 billion) while central government contributed the remaining 13 percent (USD 1.6 billion). However, these estimates are not included in the overall tracked finance due to difficulty in identifying whether the project is dedicated to the evacuate only renewable electricity or if the electricity system increases the share of renewable electricity use – an area of potential future research. **Estimates indicate that India needs to invest between USD 35 and 50 billion annually in transmission and distribution infrastructure between 2020 and 2030 to maintain reliable energy access and facilitate strong, sustainable economic growth** (IEEFA 2020). In fact, around 46 GW of installed power capacity in India is stranded because of poor last-mile connectivity and inadequate transmission and distribution infrastructure (CEA). Furthermore, the intermittent nature of renewable energy necessitates investments in grid monitoring and balancing and strengthens the case for intensive demand-side management interventions such as smart grids, and smart meters that remotely monitor and facilitate two-way electricity flows.

These needs are expected to drive substantial private investment in distribution, foremost being the investment needed to upgrade the distribution networks. India has a dedicated transmission infrastructure project for renewable energy, called the Green Energy Corridor Project. It aims at synchronizing electricity produced from renewable sources, such as solar and wind, with conventional power stations in the grid by constructing 9,700-circuit-kilometres transmission lines. Recently, the government launched a revamped distribution scheme costing approximately USD 40 billion (Ministry of Power 2021). The scheme aims to improve the quality and reliability of power supply to consumers through a financially sustainable and operationally efficient distribution sector.

PARIS ALIGNMENT OF POWER SECTOR FINANCING - CHALLENGES

India has made significant progress in achieving its Nationally Determined Contributions[10] (NDCs) under the Paris Agreement and is expected to meet the targets set before 2030. India has set three major goals as part of its NDCs: i) increase the share of power system generating capacity from non-fossil fuel sources[11] to 40 percent by 2030; ii) reduce the emissions intensity of GDP by 33 to 35 percent below 2005 levels by 2030; and iii) create a cumulative carbon sink of 2.5–3 billion tonnes of CO2 equivalent through forest and tree cover. At COP26, India announced a target of meeting 50 percent of its energy requirements from renewable energy and reducing the carbon intensity of its economy by more than 45 percent by 2030. In 2020-21, installed capacity from renewable sources was already 38 percent (Figure 2), and India had achieved carbon emission reductions of 28 percent in 2019 compared with 2005 levels (MoEFCC, 2021). This means India is likely to achieve its first two NDC targets by 2030.

FIGURE 2
India's installed electricity capacity (GW) by source



Source: CEA, and Vasudha Power Info Hub, 2021

[10] India's last submitted NDC was published in 2015. No updated NDCs were available at the time to reflect the COP26 announcements, therefore the analysis in the brief is focused on the last submitted NDC.
[11] This includes wind power, solar, hydropower, biomass, waste to energy and nuclear.

However, fossil fuels, especially coal, continue to be the mainstay of India's electricity generation mix. Coal accounts for 74 percent of India's electricity generation (NITI Aayog 2021). In fact, India's likely cost optimal capacity mix will entail 267 GW of coal and lignite (or 33.5 percent of the total) by the end of 2029–30 (CEA, 2020b) (Figure 2). This translates to 58 GW of new capacity additions, net of retirements, or around 6.4 GW per annum (Institute of Energy Economics and Financial Analysis (IEEFA) 2021b) during this decade. While a perceived need for coal to hedge intermittency exists, these new coal-fired power plants would very likely be stranded on commissioning, given that India's coal-fired power plant load factor averaged 58 percent between 2017 and 2021 (CEA 2021b). This underutilization is also attributed to overestimation of power demand, which has resulted in more installed capacity than needed. Further, in 2018, 34 coal-fired power projects with a total capacity of 40 GW[12] were identified as 'stressed' or 'non-performing[13]' (Ministry of Power 2018). This was due to a variety of reasons including, but not limited to: non-availability of fuel (because of coal block cancellations); a lack of power purchase agreements; tariff disputes; aggressive bidding by developers; cost overruns due to implementation delays; and the inability of promoters to secure equity and working capital.

The continued operation of such carbon-intensive power plants, along with the commissioning of new coal capacity, is likely to expose investors to the financial risk of closures and potentially stranded assets. The Indian banking sector is estimated to be burdened with USD 40–60 billion in non-performing or stranded assets from the thermal generation sector (IEFFA 2019). While India has increased its installed capacity to meet growing energy demand, such newly commissioned carbon-intensive assets are likely to be "locked into" the system for years to come, further increasing the costs associated with decarbonizing India's power sector. Therefore, it is important to understand current investment practices in the power sector, and their adherence or otherwise to planned decarbonization pathways.

This brief follows a novel approach recently developed by the Climate Policy Initiative (CPI) to measure the alignment of primary investment in newly commissioned power generation assets with different global warming temperature trajectories (CPI 2020). A brief methodology, along with the key assumptions and limitations of this approach, is provided in Appendix III.

Key Findings

Despite substantial growth in finance for renewables in India in recent years, investment in coal-fired power plants continues. In the lower-bound case,[14] of USD 17.5 billion in total tracked power sector commitments, around 16 percent of this investment (or USD 2.8 billion) funded coal-fired power plant development in 2019 (Figure 1). In addition to the tracked commitments, secondary reports (Climate Trends and Global Energy Monitor) suggest a total 4.7 GW of funded coal-fired power plant capacity reaching financial close in 2019, with estimated commitments of USD 4.2 billion. Due to the lack of detailed publicly available data on coal-fired power plant financing, the tracked estimate of USD 2.8 billion reflects only a lower-bound estimate (see Appendix III). According to the International Energy Agency (IEA), spending on coal-fired power plants remained above USD 10 billion annually between 2015 and 2020 (IEA 2021). With decreasing appetite for new coal-fired power plants, existing and future projects involve either expansion or refinancing of existing coal generation, retrofits, and "clean coal" projects (Bloomberg 2021). This reveals that coal-fired power plants are still able to obtain finance despite the stranded asset risks that they carry. The majority of the 33 GW of coal-fired power plant capacity under construction in India, and the additional 29 GW in the preconstruction stage, will end up stranded. (IEFFA, 2021).

[12] Of this figure, 24.2 GW is commissioned capacity, and 15.7 GW is under-construction capacity.
[13] According to RBI, a non performing asset is one where interest and/or instalments of principal remain overdue for a period of more than 90 days.
[14] The lower-bound estimate is based on commitments of USD 4.2 billion (4.7 GW) for coal-fired projects in 2019 according to published reports (Climate Trends 2020), IJ Global database, and Global Energy Monitor. The upper-bound estimate is based on IEA's India Vision Outlook 2021 that reports spending on coal-fired power plants of USD 10 billion a year, which translates into 8.9 GW of coal-funded capacity.

Continued financing of coal-fired power projects may keep India's carbon intensity well above the carbon intensity required to align with a global mean temperature rise of <1.8°C[15], consistent with the Paris Agreement-aligned IEA Sustainable Development Scenario (SDS). Despite renewables accounting for 38 percent of India's installed capacity, fossil fuels continue to account for 75 percent of its domestic electricity generation. This has resulted in high baseline carbon intensity for India's existing generation fleet. Consequently, the carbon intensities required for new power sector investments to align with the goals of the Paris Agreement (as defined under IEA's SDS) are negative, as shown in Figure 3. This means that massive new investment is required not only to reduce emissions from new generation, but also to actively remove existing emissions to compensate for the carbon emissions from the existing fleet. In fact, the carbon intensity of 2019 investments are even higher than the levels estimated under the Current Policies Scenario (CPS) – a scenario that corresponds to temperature rise well above 3.2°C, making them "Extremely Misaligned" with the Paris Agreement (see Figure 3).

FIGURE 3

India's carbon intensities (CI) of power sector finance tracked in 2019 vs. future year alignment targets (tCO2/MWh)

Note:

- Dashed red line reflects the carbon intensity (CI) floor of zero i.e., the lowest possible CI for new generation.
- Sustainable Development Scenario (SDS) would be the only Paris Agreement-aligned scenario that corresponds to a temperature rise below 1.8°C.
- Stated Policies Scenario (SPS) even if aligned with National Determined Contributions (NDCs) would overshoot Paris Agreement targets and corresponds to a temperature rise below 3.2°C but above 1.8°C (<3.2°C).
- Current Policies Scenario (CPS), assuming that carbon intensity remains within thresholds estimated under the scenario, corresponds to a temperature rise above 3.2°C.

Such high-carbon intensity illustrates the need to not only continue to ramp up zero-carbon power investments, but also for swift action to accelerate the decommissioning and replacement of existing high-carbon capacity. In 2018, India's Central Electricity Authority (CEA) identified 22.7 GW of coal capacity for retirement by 2021–22, out of a total of 55 GW, which will exceed 25 years in operation by 2027 (Ministry of Power 2018). However, the Indian electricity sector has shown little progress toward this target, with only 5.7 GW being retired by February 2020 (DownToEarth 2020). Further undermining its own efforts, the Ministry of Environment, Forest, and Climate Change in April 2020 extended the timelines for coal-fired power plants

[15] A temperature rise below 1.8°C corresponds to the Sustainable Development Scenario (SDS) - the only Paris Agreement-aligned scenario.

to comply with emission regulation to 2024. This is the third extension to the 2015 notification — after the previous deadlines of 2017 and 2022 — with penalties for non-compliance as low as INR 0.20 (or USD 0.003) per unit of electricity, starting in 2025 (CSE 2021). Such policy delays indirectly support new investment in coal-fired power plants (ODI et al 2018) and increase stranded asset risk by delaying expenditure on required environmental compliance, thereby shielding funders from financial losses. In fact, distribution companies (DISCOMS) are estimated to save between USD 7 and 14 billion annually by exiting old coal power purchase agreements (PPAs) and accelerating the closure of old power plants (IEEFA 2021c).

Furthermore, it is estimated that the accelerated decommissioning of 35 GW in old coal capacity would result in annual savings of USD 1.03 billion over the next five years, or USD 5.2 billion over the plants' remaining life (CEEW 2021). While the decommissioning cost is estimated at USD 4.5 billion, which includes payouts to debt and equity holders and compensatory pay-outs to plant workforces. This means decommissioning would pay for itself in the next five to six years. This can offer some respite to the DISCOMS, which reported annual losses of USD 8.4 billion in 2019.

The financiers of coal-fired power plants — including state-owned enterprises (SOEs), development banks, and commercial banks — must account for the detrimental impact of potential stranded fossil fuel assets on their investment portfolios. Limited project-level information is available on the volume of debt and equity finance committed by various capital providers. However, analysis of projects under construction and commissioned provides some indication of the sources of finance for coal plants, enabling government and civil society to hold financiers and investors accountable for the environmental impacts of the carbon-emitting assets they fund.

Analysis based on asset-level data from S&P Global shows that 37.7 GW of coal generation capacity is currently under construction, with physical site work underway, and a further 13.7 GW is planned, still in development or in design. Around 70 percent of this capacity is in plants owned by government-owned utilities and enterprises, with the remaining 30 percent owned by private-sector entities. Furthermore, of the total coal-fired power plant capacity commissioned between 2018 and 2021, 90 percent was in plants owned by SOEs, with only 10 percent held by privately owned enterprises, compared to 2015–2017 when 53 percent of commissioned capacity was in privately owned plants (estimates based on Vasudha 2021 data). India's government-owned Power Finance Corporation (PFC[17]), a non-bank financial institution, lent USD 49 billion (or 54 percent of its total loan book) to various coal-fired projects as of December 2019 (IEFFA 2020b). PFC itself has borrowed from both foreign banks (17 percent) and Indian commercial banks (83 percent) mainly to finance its fossil fuel-based generation[18] projects, demonstrating that a wide variety of financial institutions are directly or indirectly financing coal-fired power plants.

While power sector actors are committing to a low-carbon energy transition, they need to transform their commitments into action – and quickly. A growing number of SOEs and utilities, independent power producers, corporates, and financial institutions — across the energy value chain — are positioning themselves for low-carbon transitions. These often manifest as either direct investments and/or through capital markets, integrating climate considerations into decision-making processes, or signalling intent through target setting, net-zero pledges, and coalitions. States and companies that cumulatively account for 50 percent of installed generation capacity in India have committed to not building new coal-fired power plants (Climate Trends 2021). Appendix IV provides a non-exhaustive list of such announcements. **However, many of the same actors are still adding coal-based assets to their portfolio.** For instance, nearly half of the 33 GW of capacity now under construction in India is sponsored by state-owned generation companies followed by the National Thermal Power Corporation (29 percent), Neyveli Lignite Corporation India Limited (6 percent), and private sponsors (16 percent) (IEEFA 2021b). Also, private actors such as the Adani Group, which has committed to a low-carbon transition, continue to plan more coal-fired power plants including a 1,600 MW plant under construction in India that would export power to Bangladesh (Adani 2021).

[17] PFC acquired Rural Electrification Corporation Ltd. In 2019.
[18] Conventional generation accounted for 59 percent of PFC's total loan asset composition as of December 2019 followed by renewables including large hydro (11 percent) and transmission and distribution (29 percent).

INNOVATIVE FINANCING SOLUTIONS

The following case studies showcase examples of financial innovation in India that are helping mobilize private investments to the renewable energy sector.

CASE STUDY 1: GREEN BONDS FOR RENEWABLE ENERGY

Green bonds are becoming an increasingly popular instrument to fund Indian renewable energy projects. Green bonds are fixed-income instruments designed to support specific climate or environmental projects. Some notable examples of green bond innovation for raising capital for renewable energy projects in India are provided below.

- **IFC and HSBC's Real Economy Green Investment Opportunity:** This is a green bond fund focused on providing access to climate finance, primarily for renewable energy projects. The IFC has invested USD 100 million, and HSBC has invested USD 75 million, which is expected to raise between USD 500 and 700 million.
- **Masala Green Bonds:** This is an Indian rupee-denominated bond listed on the London Stock Exchange. The local currency associated with this bond has deemed it lower risk.
- **Azure Solar's Green Bond:** The bond's coupon rate of 3.575 percent is the lowest-ever rate for a borrower from India in the high-yield bond category. The bond reflects high demand for Indian green bonds and investor confidence in India's renewable sector.
- **Other entities** that have issued Indian green bonds for renewable energy projects include ACME Solar, Adani, CLP Wind, Greenko, Hero Future Energies, Indian Railway Finance Corporation, IREDA, NHPC, Power Finance Corporation, ReNew Power, Rural Electrification Corporation Limited, State Bank of India, Yes Bank, Tata Cleantech Capital, Urja Global Limited.

Key Takeaways

- **Innovation:** Financing renewable projects through green bonds is innovative in that green bonds are attracting mass markets to help fund the transition to clean energy. Investors will often pay a premium, also called a "greenium" for a green bond as opposed to a typical bond. Emerging market green bonds outperformed conventional emerging market bonds in 2020 and demonstrated lower volatility.
- **Impact:** The funds raised have been impactful and are helping India achieve its clean energy targets. Of the USD 14.4 billion worth of green bonds issued cumulatively since 2016, India could have abated an estimated 27.8 million tons of CO2 cumulatively over the last five years (authors' estimate). As fossil fuels become increasingly less appealing to investors, green bonds are gaining global support. Green bond issuances must take environmental, social and governance (ESG) considerations into account and should be based on transparent reporting and verification guidelines to drive confidence amongst investors keen on moving away from fossil-fuel based activities.
- **Scalability:** Corporate issuers including commercial banks have so far driven green bond issuances in India. From 2012 to 2020, corporates including commercial banks issued more than 80 percent of green bonds in India. As per the Institute for Energy Economics and Financial Analysis (IEEFA), corporates and financial institutions in India have raised more than USD 14.4 billion through green bond issuances since 2016. According to the International Finance Corporation (IFC), the cumulative issue of green bonds in emerging markets from 2012 to 2020 was estimated at USD 226 billion globally and the projected emerging market green bond issuance between 2021 and 2023 is estimated at an even larger figure of USD 260 billion globally. There has been a 21 percent increase in green bond issuances in emerging markets since 2019. Among emerging markets, India has the second greatest volume of outstanding green bonds.

CASE STUDY 2: FOREIGN EXCHANGE HEDGES FOR GREEN BONDS

Continuum's green bond framework

Hedging transactions to alleviate currency risk exposures has been traditionally employed by large commercial banks. With green bonds increasingly becoming mainstream in the bond market, foreign exchange hedges can be effectively used to support foreign bond issuances and adjust against underlying currency risks.

Continuum Green Energy Ltd (Continuum) is a renewable energy group based in India that focuses on large-scale wind projects that can be co-located with solar PV installations. Continuum raised USD 560 million through green bonds in February 2021 and has developed a framework to govern its bond issuances. In March 2021, a specially designed foreign exchange hedge solution for Continuum's green bond issuance was developed by Deutsche Bank.

The hedge transaction is for a six-year tenor, denominated in US dollars and Indian rupees on a notional value of USD 185 million, which is linked to Continuum's green bond USD primary issuance and is based on its green bond framework and a green hedge framework. The latter supports the implementation of Continuum's green bond framework by hedging against the currency risk related to projects funded via the green bonds. The company's underlying project revenues are generated in Indian rupees while the principal and interest are to be repaid in dollars.

Green hedge transactions like these can effectively help manage currency exposure and ensure that the underlying projects are financially sustainable, while ensuring investors receive their returns on the green bond.

Key Takeaways

- **Innovation:** The main innovation is the use of a hedge to manage currency risks typically associated with emerging market green bond issuances. It is a financial risk management solution for Continuum's USD green bonds and the proceeds are invested in greenfield renewable energy projects in India. Additionally, the instrument prioritizes ESG targets and promotes transparency among investors, particularly for emerging market green bond issuances.
- **Impact:** Average yields for Indian green bonds have dropped by more than 120 base points in USD terms in 2021 without any change in the issuer's credit rating (IEEFA). The falling yield rates combined with stable credit ratings suggest greater confidence by investors in the financial stability of Indian renewable energy borrowers. Tightening bond yield rates bodes well for renewable energy developers as they drive down the cost of capital. Given the increasing global demand for green/ESG-linked bonds, green hedge mechanisms will further help boost investor confidence and demand, mitigate currency risk and thereby drive down yield rates and cost of capital.
- **Scalability:** Continuum's green bond framework has the potential to be replicated by project developers and large commercial banks to minimize currency risks related to green bond issuances. Hedging instruments can be an effective tool to encourage more green bond issuances and attract greater levels of international commercial finance. Commercial banks could use green hedge frameworks to limit potential losses from green bond projects and manage currency rate fluctuations. Recognizing the underlying risks associated with hedging instruments, these derivative products can still be useful in driving down the cost of capital for renewable energy finance in developing markets such as India.

Source: See References.

WAY FORWARD

The following actions by financial institutions can support India's energy transition:

1

Commercial financers to align their financing activities, lending policies and practices with the Paris Agreement to reduce climate transition risk of their portfolio. A starting point is to expeditiously phase down coal financing and refinancing that is going directly or indirectly towards the construction of new plants or the renovation and expansion of existing plants. Given the cross-cutting nature of the energy sector, lending to upstream activities like coal mining or other sectors such as transport that use coal-fired power generation, should be progressively restricted by financers. This would lessen the exposure of their lending portfolios to climate transition risk while increasing their capacity to lend to other less carbon intensive sectors. The role of central bank and other financial regulators is crucial to this aspect. RBI has set up a Sustainable Finance Group in 2021 to spearhead its efforts and regulatory initiatives for sustainable finance - a step in the right direction.

Globally, there are also several initiatives and pilots in the pipeline, jointly led by development finance institutions (DFIs), asset managers and commercial banks, for the accelerated decommissioning of coal-fired power plants. For example, an innovative initiative called the Energy Transition Mechanism (ETM) led by the Asian Development Bank with Indonesia and the Philippines was announced at COP26. It will act as a funding vehicle to phase out coal while scaling up renewables in South and Southeast Asia. It consists of two facilities: coal retirement facility, which will buy out existing coal-fired power plants in Indonesia and Philippines, and the clean energy financing facility, which will invest in scaling up renewable sources of energy in the two countries (ADB 2021). Similar initiatives, with funding from international financers, could be replicated in India while providing adequate financial support to coal-dependent communities to ensure a just transition.

2

Commercial financiers should continue to expand their renewable energy portfolios whilst increasing investments to low-carbon and net-zero opportunities across the energy value chain. Commercial financers should allocate a certain portion of their investment portfolio towards clean energy projects, and new business models whose development and deployment will require substantial finance. If not financing high-risk research and development activity, institutions should extend their portfolios to ensure finance is made more widely available to small and medium enterprises (SMEs) and project developers, who typically lack access to long-term capital at affordable rates.

This includes, but is not limited to, the following low-carbon sectors:

- **Transmission and distribution:** The increasing share of renewables in the electricity generation mix has resulted in excess variable renewable energy (VRE) generation, leading to grid-integration challenges. This presents investment opportunities in projects targeted towards expanding inter-state and inter-region transmission infrastructure, integration of renewable energy management centres and deployment of smart grids (IEA and NITI Aayog 2021). To encourage local financial institution lending to transmission infrastructure, targeted risk mitigation measures such as guarantees and other credit enhancement tools need to be implemented (OECD 2021). Furthermore, India has launched a National Monetization Pipeline of brownfield infrastructure assets to attract much-needed capital from international and domestic institutional investors for new infrastructure creation. The total value of power transmission assets considered for monetization is estimated at USD 6 billion over financial years 2022 to 2025 and include the transmission infrastructure of the nodal central

transmission utility, Power Grid Corporation of India Ltd (PGCIL). These assets will be monetized through PGCL InvIT.

- **Rooftop solar:** India has a target of installing 40 GW of rooftop solar capacity by 2022. Despite rooftop solar being an attractive commercial proposition in most Indian states given the tax rebates, subsidies, priority sector loans, generation-based incentives, lower equipment costs, and high grid tariffs, it is yet to gain momentum. Lack of collateral, poor credit history, high perceived risk among financiers about its commercial and technical feasibility are some of the key issues hindering large-scale deployment of rooftop solar. Promoting distributed solar for residential, as well as commercial installations including micro, small and medium enterprises (MSMEs) can be an effective way to replace carbon intensive energy sources.

- **Battery storage and charging infrastructure:** India's energy storage market is in a nascent stage. Developing innovative financial mechanisms and leveraging blended financing structures will help crowd in private finance at scale. To facilitate credit availability for clean energy storage, the government in its budget for 2022-23 has proposed inclusion of 'Energy Storage Systems' including dense charging infrastructure and grid-scale battery systems in the harmonized list of infrastructure. It has also proposed a battery swapping policy in 2022 that will encourage the private sector to develop sustainable and innovative business models for 'Battery or Energy as a Service' and scale up the setting of charging infrastructure for electric vehicles.

- **Solarization of agriculture:** Agriculture, which accounts for 20 percent of electricity consumption, mostly from fossil-fuel based grid supply at subsidized rates, would benefit from receiving finance to transition to solar PV-powered irrigation. The government launched the Pradhan Mantri Kisan Urja Suraksha evem Utthan Mahabhiyan (PM KUSUM) Scheme, in 2019, for farmers to install solar pumps and grid-connected solar and other renewable power plants in the country. It aims to add solar and other renewable capacity of 25,750 MW by 2022.

- **Other distributed renewable energy technologies:** Financial institutions should consider collaborations with project preparation facilities (like the US-India Clean Energy Finance (USICEF)) to build a pipeline of commercially viable investible projects in the distributed energy sector. Such initiatives can help in leveraging grant capital to mobilize long-term debt to bridge the funding gaps in the energy sector. Similarly, funding mechanisms like viability gap funding can also be explored to facilitate setting up mini-grids in unserved and underserved areas. This will ensure that power supply, storage and demand are matched on a local level and consumers have access to reliable and uninterrupted supply of electricity.

- **Energy efficiency:** Despite progressive regulatory changes, introduction of schemes[19], and development of proven business models,[20] much of India's energy efficiency investment potential (USD 150 billion) remains untapped. Mainstream financiers, including banks and housing finance institutions, need to develop and expand financial services and products for energy-efficient technologies in new buildings, 'nearly zero-energy buildings', and retrofits in existing buildings to match the high upfront capital expenditure with long-term investment benefits. The World Bank's Partial Risk Sharing Facility (PRSF) for Energy Efficiency, which provides guarantees to commercial banks when lending to energy service companies (ESCOs), has demonstrated the commercial viability and market transforming potential of the ESCO-based business model. Several large financial institutions including public banks have supported more than 28 projects under the PRSF but need substantial scale-up to have a significant impact (World Bank 2020).

[19] This includes, but is not limited to, the Perform, Achieve, Trade (PAT) Scheme for industry, the large-scale efficient lighting programme for the residential sector, and agriculture demand-side management programmes.
[20] The Energy Efficiency Services Limited (EESL) deployment of over 366 million LED bulbs alone has helped to avoid building over 9.5 GW of new generation capacity — mainly from coal — that would have cost more than USD 10 billion (World Bank 2020).

- **Green hydrogen:** In 2022, India released a National Green Hydrogen Policy that aims to promote production of green hydrogen and green ammonia to enable meeting its climate targets while reducing its fossil fuel import bills. With a plan to manufacture a cumulative five million tons of green hydrogen by 2030, India is set to unlock large investment opportunities in this sector. In fact, several public and private actors have announced their commitments towards green hydrogen production. For instance, Reliance recently announced its plan to invest USD 75 billion in renewables infrastructure, including generation plants, solar panels and electrolysers, with green hydrogen as a priority.

3

Financial institutions to assess and report on the impact of climate-related risk on their operations and financing portfolios, and advise their clients on building climate-resilient portfolios. In the last two years, much progress has been made by financial institutions on forming net-zero and sustainable finance coalitions. For instance, the Glasgow Financial Alliance for Net Zero, a global coalition of more than 300 financial institutions with USD 90 trillion assets under management, has committed to decarbonization. However, a lot less focus is on integrating climate risk into credit assessments, setting specific, measurable and transparent decarbonization targets, and reporting progress to regulators and investors (CPI 2021; Deloitte 2021). Furthermore, financial institutions will increasingly face claims related to disclosures for green financial products, breach-of-contract and fiduciary duties if they continue to finance high-carbon projects.

The Task Force on Climate-related Financial Disclosures (TCFD) recommends financial institutions to conduct climate stress testing to understand the transition, physical, underwriting, reputational and liability risks of their lending portfolios as well the institutions to which they are exposed. This would help them to adequately price carbon risk when lending, advise their clients on strategies to build a climate-resilient portfolio, report to stakeholders on climate-related risks and opportunities based on forward-looking and scenario-based assessments, and increase transparency on reporting (voluntarily or mandatory) for climate-related disclosures. At present there is limited publicly available information on the magnitude of climate risk on the Indian financial system to develop appropriate mitigation strategies - an area of potential research for subsequent studies.

APPENDIX I:
Methodology for Power Sector Financing

Building on the methodology developed by SEforALL, CPI and the World Bank in the first edition of Energizing Finance: Understanding the Landscape and CPI's Global Landscape of Climate Finance 2019 methodology, the report begins by tracking public and private finance commitments , to any project that enhances energy access to electricity. These commitments include support for capacity-building measures as well as for the development and implementation of policies.

The report considers only collected information that was available at the project level, disregarding aggregate (regional or global), unverifiable figures, and top-down estimates, which may lead to underreporting of total finance. The report tracks commitments according to the following dimensions:

A. TECHNOLOGIES

Electricity technologies tracked in the report include electricity generation technologies and the transmission and distribution network. Specifically, the following technologies are included, as either electricity generating or facilitating the final consumption of electricity:

- Grid-connected electricity-generating assets, including renewable energy (solar PV, wind, small and large hydro, biomass and waste, biofuels, geothermal), and fossil fuels (coal, oil, gas).
- Transmission and distribution networks (including grid extensions and connections).
- Mini-grids including renewable energy assets, fossil fuel assets and hybrid solutions (a mix of renewable and fossil fuel energy).
- Off-grid assets including solar (solar home systems, solar lanterns) and non-solar technologies.
- Energy-efficiency investments that support energy conservation and demand reduction, including building and industry upgrades, smart grids, metering, tariffs, improvements in lighting, appliances and equipment that increase the quality of electricity grids and infrastructure.
- Market support activities, including capacity building, technical assistance and institutional support for energy reforms.

B. SOURCES

Public sector institutions include:

- Multilateral development finance institutions (DFIs) including climate funds and EU institutions, where the institution has multiple shareholder countries.
- Bilateral DFIs, where a single country owns the institution
- National DFIs, including public banks and local public sector providers of debt instruments
- Export credit/promotion agencies
- Government international, refers to bilateral Official Development Assistance (ODA) and Other Official Flows (OOF)
- Government domestic, domestic financing through public budgets carried out by central, state or local governments and their agencies

Private sector institutions include:

- Corporate actors and project developers designing, commissioning, operating and maintaining energy projects, such as private sector utilities and energy companies, independent power producers
- Commercial financial institutions providing private debt capital, such as commercial and investment banks and micro-financial institutions
- Commercial finance, including asset managers and early-stage investors (private equity, impact investors, venture capital and infrastructure funds
- Philanthropic foundations
- Households, i.e. family-level economic entities, high-net-worth individuals and their intermediaries (for example, family offices investing on their behalf)

C. FINANCIAL INSTRUMENTS

The report tracks:

- Grants
- Project-level debt (both concessional and commercial), where debt relies on a project's cash flow for repayment
- Project-level equity, equity investment relying on the project's cash flow for repayment
- Balance sheet financing (i.e. a direct debt or equity investment by a company or finance institution)
- Other instruments like crowdfunding

The report does not track disbursements and policy-induced revenue support mechanisms such as feed-in tariffs, secondary market transactions, or other public subsidies (except in the case studies). Feed-in tariffs, for example, pay back investment costs, so including them would constitute double counting. Similarly, guarantees are only exercised in particular circumstances, and there might never be any outflow from the guarantor. Secondary-market transactions, such as the reselling of stakes, are only tracked if they do not constitute double counting with other areas of the data collection.

APPENDIX II:
List of Data Sources

Source name	Description	Sector relevance	International/ Domestic	Additional comments
Organisation for Economic Co-Operation and Development (OECD)	Data on international aid for project and market support from bilateral and multilateral donors, publicly available from the OECD DAC Creditor Reporting System (CRS)	Electricity	International	As information was not directly available, a "key words" search was performed to identify and separate off-grid, smart grid etc.
Bloomberg New Energy Finance (BNEF)	Asset finance database for grid-connected renewable energy Contains data on finance raised by solar companies	Electricity – grid- connected renewable generation (excluding large hydro) and off-grid solar	International and domestic	Main reference for finance for grid connected renewable energy
Climate Policy Initiative	Project-level data from DFIs (MDBs and IDFC members) collected during the Global Landscape of Climate Finance	Electricity	International	Additional data for bilateral and multilateral DFIs that include guarantees, risk mitigation instruments and non-concessional finance not reported in OECD DAC CRS
Climate Funds Update	Additional data on national and multilateral Climate Funds' commitments	Electricity – grid- connected and off-grid renewable generation	International	Complements data on international and domestic public finance for electricity projects
IJGlobal	Energy and infrastructure finance database	Electricity – grid- connected generation (fossil fuel, nuclear and large hydro) and transmission and distribution	International and domestic	Main reference for grid-connected fossil fuel and LNG distribution projects
S&P Global Market Intelligence	Tracks private equity investments in Asia-Pacific and Africa in the Energy and Utilities sectors	Electricity – mini-grids and grid- connected renewable generation	International	Complements mini-grid and grid- connected renewable finance data
Foundation Grant Self-Reporting	Tracks grant funding from philanthropies to energy access	Electricity – mini-grids, off-grid, market support and energy efficiency	International	Complements CPI tracking of foundation finance flows

APPENDIX III:
Methodology for analysis of Paris Alignment

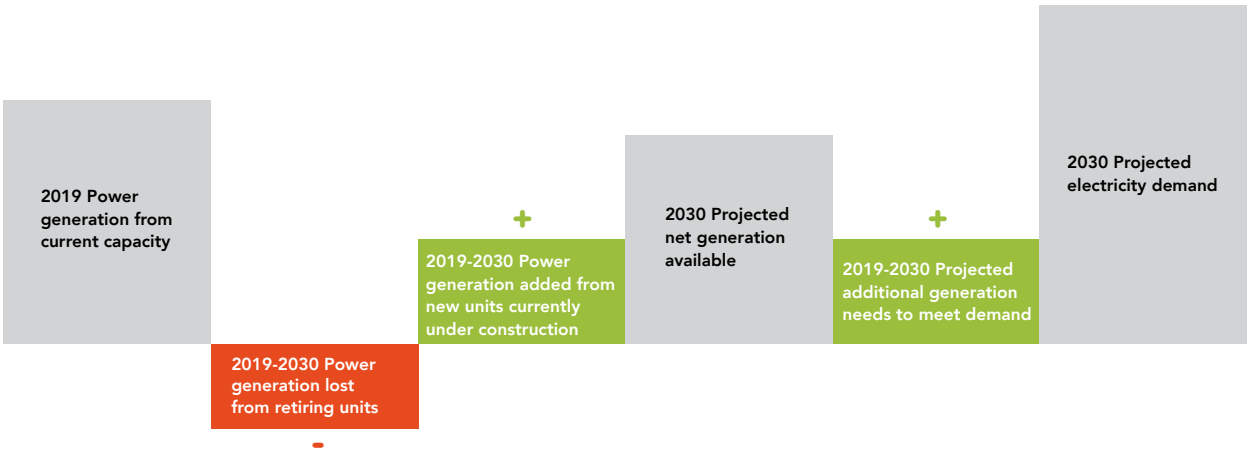
For a more detailed methodology please refer to the Climate Policy Initiative's (CPI's) Paris Misaligned? (CPI 2020).

Methodology:

1. Define the levels of carbon intensity associated with different temperature pathways based on pathway-specific carbon budgets for India's power sector.
    - Select GHG emission and activity-level scenarios corresponding to a range of global temperature rises for India's power sector.
    - Estimate the level of activity/output and the amount of GHG emissions for which assets currently in the system (net of retirement) are projected to be responsible at the time of a specific milestone (in this case 2030).
    - Calculate the level of extra activity/output required to meet future demand, which can be satisfied by financing additional assets in the future.
    - Estimate the carbon intensity of the new investment required to comply with the GHG emissions scenario used for comparison at the time of a specific milestone.
2. Compare the carbon intensity of investments, and underlying assets financed in 2019 with the target carbon intensity thresholds for additional future investments for different temperature scenarios, calculated in Step I. This leads us to four alignment statuses:
    - **"Aligned" (<1.8°C)** corresponding to a temperature rise below 1.8°C, based on the Sustainable Development Scenario (SDS); this would be the only Paris Agreement-aligned scenario.
    - **"Somewhat Misaligned" (<3.2°C)** corresponding to a temperature rise below 3.2°C but above 1.8°C (<3.2°C) based on the Stated Policies Scenario (SPS); even if aligned with National Determined Contributions (NDCs), this would overshoot Paris Agreement targets.
    - **"Very Misaligned" (>3.2°C)** corresponding to a temperature rise above 3.2°C based on the Current Policies Scenario (CPS), assuming that carbon intensity remains within thresholds estimated under the scenario.
    - **"Extremely Misaligned" (>>3.2°C)** corresponding to a temperature rise well above 3.2°C, assuming that carbon intensity would go beyond thresholds estimated under the scenario.

FIGURE 7

Determining the level of carbon intensity of additional power generation required to align country-specific carbon intensity with different temperature pathways



Data Sources: Data were obtained from CPI's Global Landscape of Climate Finance, SEforALL's Understanding the Landscape, IEA power sector scenarios, asset datasets such as S&P Global, and technology-specific assumptions in consultation with sector experts.

Assumptions and Limitations:

1. Despite the availability of scenarios for several milestones between 2025 and 2040, this brief assesses the alignment of current flows relative to 2030 targets. This is mainly because a) 2030 is the first pathway milestone set by the IPCC (2019); and b) it avoids the high uncertainties associated with longer-term scenarios, which are likely to change significantly to account for new policy adjustments and new investment decisions that lock in new capacity and associated emissions.

2. Due to the varying sources, natures, and levels of detail in the data collected, this brief presents figures for both total investment (tracked + estimated) and tracked investment using technology-level cost estimates. Given the limited granular data, estimates of some fossil fuel, and all nuclear investment are not included, which makes the presented estimates conservative (see Annex III).

3. The model needs to be considered as half dynamic and half static as this brief uses a static scenario year (2030) to assess the alignment of investments; what happens between now and 2030, or after 2030, is not currently assessed.

4. Unlike renewable energy investments, granular data on investments in fossil fuel plants are missing. To fill these gaps, the installed capacity data are combined with the average cost estimates, wherever needed. With no available clear estimates of tracked commitments and/or financial closure for coal-fired power plants, three commitment estimates were considered:
   - **Lower-Bound:** Data collected on the financial closure of coal-fired projects from published reports (Climate Trends 2020), IJ Global database and Global Energy Monitor. This leads this brief to capture 4.7 GW of funded capacity reaching financial closure in 2019 with estimated commitments of USD 4.2 billion.
   - **Upper-Bound:** According to IEA's India Vision Outlook 2021, spending on coal-fired power plants has remained above USD 10 billion a year; this translates into 8.9 GW of coal-funded capacity.
   - **Optimal Mix:** According to the Central Electricity Agency's (CEA's) 2021 report, by 2030 India's optimal capacity will require 58 GW of new capacity additions, net of retirement, or around 6.4 GW per annum (IEEFA 2021), which translates into USD 7.2 billion of investment.

5. Due to the lack of granular information available on coal-fired project financing, it is difficult to assess alignment status by capital provider type. Where it is required to fill in the missing data, a debt-to-equity ratio of 70:30 is applied, with equity assumed to be financed by the implementing project sponsor. The unknown debt could be financed by commercial banks, national public banks, non-banking financial institutions, and/or bonds raised in the capital market.

APPENDIX IV:
Non-Exhaustive List of Public and Private Stakeholders and their Green Energy Transition

Stakeholder Type	Institutions	Main Operations	Announcements/Datapoints	Financial Commitments, Targets, Integration
State-owned enterprises (SOES)	National Thermal Power Corporation (NTPC) 25% of total power generation	Power generation	Install 60GW of renewable energy by 2032 Target 10% reduction in net energy intensity	Targets
	Coal India Limited (CIL) World's largest coal producer	Coal mining	Invest USD 760 million by 2024 (or 3 GW) in rooftop and ground mounted solar power projects.	Financial commitments
	Indian railways	Railway	Achieve net-zero emissions by 2030 Install 20 GW of solar power plants Issued USD 500 million green bonds in 2017	Targets, Financial commitments
	NLC India Limited	Lignite mining and power generation	Formed of a joint venture with Coal India to develop 3 GW (USD 1.73 billion) of solar energy by 2024	Financial commitments
	Oil and Natural Gas Corporation (ONGC) 25% of market share in India	Oil and gas producer	MoU with NTPC to understand setting of RE projects in India and overseas Target acquisitions to achieve 10 GW of renewable capacity by 2040	Targets
	Singareni Collieries Company Limited (SCCL)	Coal mining	300 MW solar plant installation by 2021	Financial commitments

Stakeholder Type	Institutions	Main Operations	Announcements/Datapoints	Financial Commitments, Targets, Integration
Corporates	Adani	Power producer	Add 5 GW of renewable energy every year this decade Acquired SB Energy with 5GW renewable energy portfolio (USD 3.5 billion valuation) in 2021	Financial commitments, Targets
	Reliance Industries Limited (RIL)	Power producer	100 GW of solar power capacity by 2030 (USD 10 billion investment)	Financial commitments, Targets
	Tata Power	Power producer	15 GW of renewable energy over next few years Increase RE share to 80% by 2030 Achieve carbon neutrality by 2050	Targets
	JSW energy	Power producer	2.6 GW of RE by 2023 to increase RE share to 55% of the total portfolio	Targets
Commercial Banks	HSBC	Banking	Reduce financed emissions from customers' portfolio to net zero by 2050 Launched Green Deposit Programme in India to finance green initiatives including renewable energy	Targets
	HDFC Bank	Banking	Carbon neutrality by 2031–32	Targets

Note: In 2021, the Reserve Bank of India joined the Network of Central Banks and Supervisors for Greening the Financial System (NGFS). NGFS is a group of central banks and supervisors that aims to enhance the role of the financial system to manage risks while mobilizing capital for low-carbon investments.

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